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Presentation of Autumn Lecture by Professor Carol Jagger

Abstract of the Edinburgh Discussion

[Institute and Faculty of Actuaries, 1 October 2014]

The President (Mr N. Salter, F.I.A.): I would like to welcome Carol Jagger, the AXA Professor of Epidemiology of Ageing at Newcastle University. I am delighted that Carol has agreed to deliver our Autumn Lecture for 2014. The title of her lecture is “The age of uncertainty: what do we know about growing old?”.

Prof C. Jagger, H.F.I.A.: Thank you for inviting me to present the Autumn Lecture.

I want to tell you five things we know about becoming older. There is a lot of uncertainty about ageing, but there is a lot we know and which, perhaps, we are not fully utilising. I am going to tell you of five things we know, but which I feel we are not utilising properly or we are ignoring completely.

I will draw for that, mainly, on three longitudinal studies. Our Newcastle 85+ Study is a longitudinal study of over a thousand people born in 1921. It is not unlike your Lothian Birth Cohort study, and, in fact, is the same year for the first Lothian Birth Cohort.

Each of these studies, however, is unique in a particular aspect. The Newcastle 85+ Study is unique in that it is the largest and most comprehensive longitudinal study of this age group. This age group, the 85s and over, is the fastest-growing section of our population. It is a very comprehensive study. We covered the full spectrum of health from biological markers through disease and clinical measures to functional tests, psychosocial and socio-demographic measures. It included people in institutions. It is a total population study.

The second study is the Cognitive Function and Ageing Study (CFAS). In fact there are two studies. The first one started in 1991 in six centres in the United Kingdom of which three centres were carried through to CFAS II, which was about 20 years later. Those three were Newcastle, Nottingham and Cambridgeshire.

This is a study of people aged 65 and over. There are equal numbers in the 65–74 and 75+ age groups. Again it includes people in institutions.

The uniqueness of this study is that it comprises two cohorts about 20 years apart with identical design and identical measures. For the first time, we can see properly the extent to which the health of older people has changed, looking at the whole population including those in institutions.

The third study, DYNOPTA, is not really a study at all. It is an amalgamation of nine Australian longitudinal studies. To my knowledge, there is no other pooled data set like that in a single country, although there have been trials of those sorts of data sets within Europe. A lot of work went into pulling those data sets together and harmonising the measures. It includes over 50,000 people aged 45 and over.

Before I give you the five things that we know about ageing, I want to talk for a few minutes about uncertainty in measuring health. We are living longer. You all know that. Life expectancy at birth is increasing by about 2 years every decade. That means we are healthier, does it not?

Well, as I am in Scotland, I would say that such an assertion is not proven. But there are people who purport that, because life expectancy is increasing, we must be living longer and be healthier.

It might have been the case that life expectancy was a good surrogate measure of health in the past when infectious diseases were the main cause of mortality. But now we have a growing number of very old people, health and quality of life in their remaining years is very important.

Of course life expectancy is an easy option for measurement because death is a hard endpoint. There is no discussion about whether it occurs or not. I would say, when we are looking at mortality of different countries, that completeness of information might be an issue.

Health is a much more fuzzy measure. We need to think about the measures of health that we use. The World Health Organisation (WHO) defines health as "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity". I will come back to that when I talk a bit more about our 85-year-olds because I think that is a rather too stringent definition of health when we are looking at very old people.

Crucially, the measure of health depends on what sort of level of information you are trying to obtain. If you are looking at individual studies, you can use quite detailed measures. For instance, in our 85+ Study we did timed walks, we carried out spirometry tests and we took blood. The CFAS study had a detailed psychiatric assessment. One of the Australian studies was an eye study.

Because one of my big interests is disability, I will talk a bit more about instrumental activities of daily living (IADL) and activities of daily living (ADL). You can have a whole raft of those measures at an individual level and most studies would contain some.

If we are looking at a country level, and as we are still united we will think about the UK level, there is the Health Survey for England which has more detailed measures, and the English Longitudinal Study of Ageing. In addition there will shortly be an equivalent Scottish survey, and there is one for Northern Ireland.

Such surveys do not happen every year: we do not obtain regular information about the health of our population. At a UK level, the best that we can do is the limiting long-standing illness question for disability and, additionally, a self-rated health question. We obtain that information every year, but if we want information for people in institutions, all we have is census data, so every 10 years.

So we cannot obtain the depth of information that we might want at a country level. When we come to Europe, it is a totally different again. In fact, there are also translation and cultural differences in understanding the questions. The measure that we have across the whole of Europe is the Global Activity Limitation Indicator, which underpins Healthy Life Years. There is also a self-rated health measure and a global measure of morbidity: the amount of disease.

It has taken us 15 years to obtain even these measures. If you think about trying to develop measures for the OECD or an even broader spread of countries, then it is even harder.

The whole point of this is really to say that I firmly subscribe to a fellow statistician's view (Stephen Evans) that health is important to measure and therefore it is more important to measure it albeit inaccurately than not to measure it at all, or to measure something else accurately that is not very important. That has been one of my underlying principles with the European measures. If we can put the measures into surveys and show how they can be utilised, we will ultimately obtain better data.

Yes, health is hard to measure, but we need to do it. We can no longer just use life expectancy as a surrogate measure.

Now onto the five facts about ageing. The first fact is that the course of disability is predictable.

Figure 1 shows a typical model of the disablement process. It starts with disease or pathology, leading on to impairment at the body level, for example musculoskeletal or sensory/cognitive functional limitations. These come together to form restrictions in daily activities. The restriction in daily activities is the main way we measure independent living or the need for care and hence participation in society.

There are many and varied other external factors that can slow down or speed up this process, factors external to the individual at the top of Figure 1 or more internal to the individual at the bottom. Predisposing factors include socio-economic status, lifestyle factors – and I will say some more about those later – lifestyle changes, such as taking up exercise, and how we cope with increasing activity restriction and whether we compensate in some way by taking longer to do things or not doing them as often.

The main building blocks of the activity restriction are the ADL. In preparing this talk, I was rather shocked to see that Sidney Katz developed his index of ADL in 1963, when I was still at school; 50 years later they remain the main measures that go into most studies of ageing. He developed an index of the basic ADL as a measure of ageing. These were the sort of basic self-care activities including getting in and out of bed, getting to and from the toilet and feeding yourself. There were six of them. But he found with this index that they did not pick up milder levels of disability, which were still important.

In 1969, Powell Lawton and Elaine Brodie developed an IADL scale based more on household-type activities such as shopping, laundry and cooking a hot meal. There are issues with those activities because they are a bit more gender specific, perhaps. I will not say any more about that aspect.

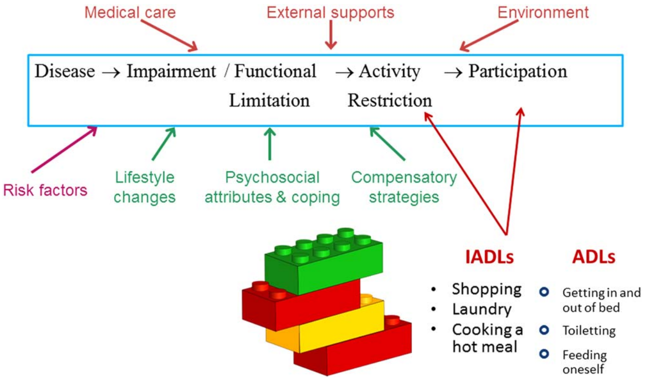


Figure 1. Disablement model

Together, these activities have been the basis of all studies of ageing are used to determine the need for care and as indicators of need for care.

The fact that Katz found that ADLs had a floor effect and did not pick up milder levels of disability tells you that IADLs happen before ADLs. There have been a few papers on this subject, but we also looked at it in the Newcastle 85+ Study.

Why do we bother doing that when other people have done it previously? Well no-one had done it in this age group, the very old, and no other study had as wide a range of activities. We had, in total, 17 ADLs.

From a factor analysis we found that 15 of the factors formed one dimension, as shown in Figure 2. Two formed a second dimension: “taking medication” and “dealing with your finances”. The second dimension includes a cognitive component. The first dimension covers more physical components.

What this shows is the level of difficulty and when you first encounter difficulty. There is a real hierarchy of order of loss. The first thing with which you have difficulty is cutting your toenails. The second is shopping. The third is using steps. They are represented separately for men, women and all people. They are similar for men and women except that women seem to have problems with heavy housework before men.

We can see, as you move down the chart, you are becoming very disabled. The ability to live independently when you are having such difficulties becomes very hard.

The other issue is that the order of loss of activities ties in balance, strength, lower limb or upper limb activity. First people lose lower limb activities, then upper limb activities. Some activities require balance and manual dexterity as well and these activities tend to be lost first.

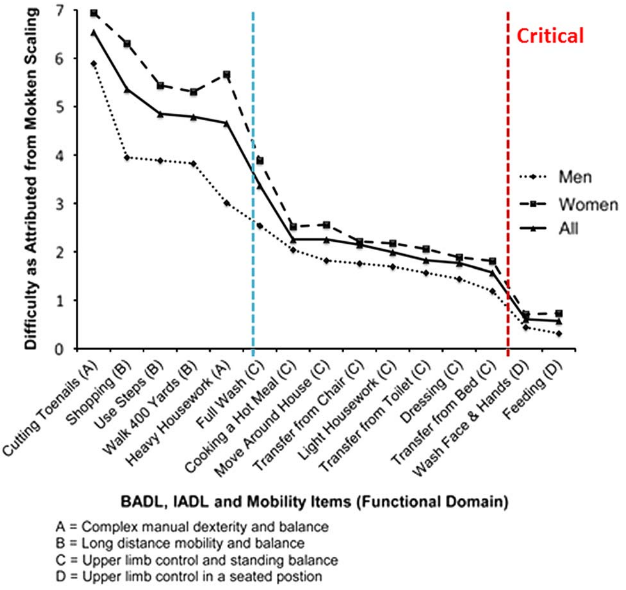


Figure 2. Order of activity loss (Source: Kingston *et al.*, 2012)

I also looked, some time ago, at another study based in Melton Mowbray in Leicestershire, where I used to live. That was a unique data set because it was data from the annual screens of over 75-year-olds. We looked longitudinally this time at the age at which people lost the ability to do, or had difficulty doing, the activity. Because this was an annual screening done by the general practice, we had fewer activities but the ordering is the same.

Bathing was the first activity lost. Mobility around the home was the second. The difference between the median ages at which you lost the ability to carry out these tasks was about 3 years.

The next activity lost was going to and from the toilet. That took about another 6 years. Then, as you can see in Figure 3, once you have reached this point you start to lose the ability to do the other activities fairly quickly. This is something that I will come back to later.

We know about this hierarchy, but I do not think that we are using it very well. People tend to take the index of ADLs or IADLs and say, “People have problems with one or more IADLs, but have not reached the ADL stage yet, or they have problems with one or more ADLs”.

If we look at the order and the time between, we have the possibility of informing people about how fast or slow they might be losing activities, which may help them to be thinking ahead at their circumstances such as where they live.

But also we are starting to look with local councils at how they are delivering their care. When you show them this curve, they say, “Yes, we are working with these people down at the right-hand side of the chart”. Actually that is a bit late. With the new Care Act coming in, it is going to be better if they are working more at the left-hand side of the chart and trying to keep people independent for longer.

Perhaps, we can use rapidity of loss as a marker for seeking healthcare since there might be something wrong. Also, designers of the environment, buildings and other products maybe need to understand the way that people lose ability and so be better able to design their products.

So this is an example of some information we know, but I am not totally convinced that we are using it properly.

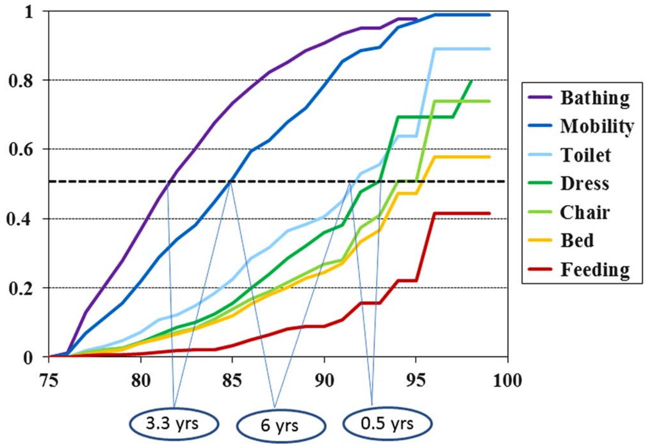


Figure 3. Age at onset of activity difficulty (Source: Jagger *et al.*, 2001)

The second thing we know is that most of old age is not spent dependent, so it is not quite as gloomy as we make it out to be.

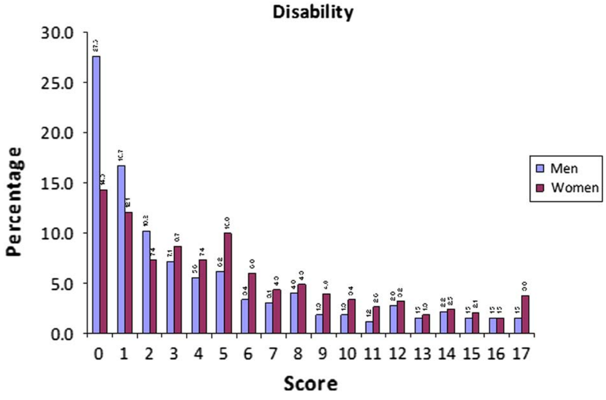
Figure 4 shows baseline data from our 85+ Study. Here we put together our 17 items into a disability scale. This shows the disability score: the number of activities with which people had difficulty. Zero is good and 17 is bad.

I do not think you would have expected a fifth of 85-year-olds to be able to do the whole range of activities without difficulty. In fact, it was 28% of men and 14% of women. All studies show women at the same age are more disabled than men. Men die, women hang on in there but are disabled, generally. On average, women had difficulty with four activities, men with two.

These were self-reported data so you might think the men were saying, “Yes, I can do all of these without difficulty”. But, in fact, we also did some objective measures, a timed walk. I took the activities which were mobility based and I checked their answers against their timed walk. They correlated very well so people were not just saying that they had no difficulties. Those who had no difficulties were the ones who were doing the timed walk faster. This was true at all of the time points as well.

You can see in Figure 5 some new work that a PhD student, Andrew Kingston, and I have been doing. He took the disability score and looked at how it changed between age 85 and 90. We had follow-ups at 18, 36 and 60 months. Here we found something really interesting. In fact, the disability profiles fell into four patterns for both men and women but these were a bit different for men and women. We found a group of men, 9% of men, who had no disability at age 85 and still had no disability at age 90 either. The only socio-economic status measure, out of education, social class and deprivation that seemed to be related to the trajectory was education. So people with lower education tended to be in the more disabled group and vice versa (people with better education tended to be in the less disabled trajectory). So the effect of education endures even to age 85.

Why is that interesting? Because years of education is one of the measures that has changed over time. The newer cohorts of 85-year-olds who will be coming through will have had greater access to education,



- 20% able to perform without difficulty all 17 activities of daily living

Figure 4. Physical functioning

particularly women, and will have had more years of schooling. If the cumulative disadvantage hypothesis is true, then it may be that education will result in less disability, rather than more, in future cohorts. This certainly seems to be true at the level of cognitive function, which I will show later.

ADLs and IADLs are great as building blocks, but they do not really tell us how much care someone might need. There was a geriatrician back in 1979, Bernard Isaacs, who was a Glaswegian by birth, although he did a lot of his work at the University of Birmingham. He developed an interval need measure, which has not really been used very much.

The interval need measure brings together the ADLs and IADLs, along with cognitive impairment and incontinence, which is another big marker of need for care, and assigns participants into one of four categories (Figure 6).

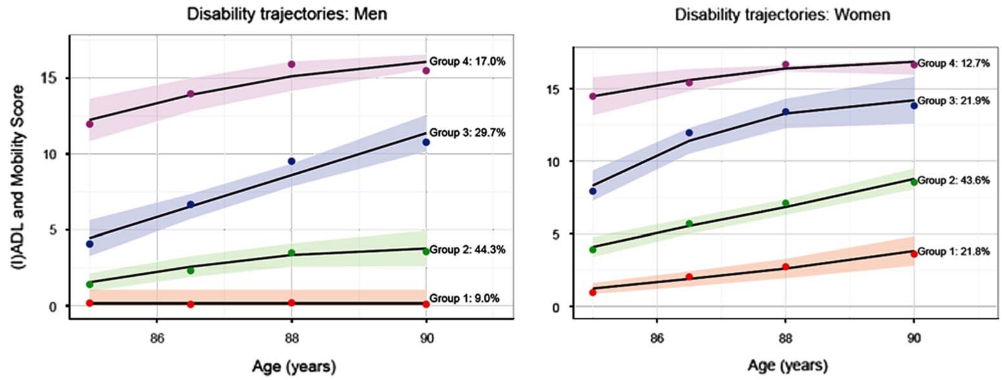
Critical interval need requires 24-hour care. Typically, these people were very cognitively impaired, had severe incontinence, could not dress themselves, could not get out of a chair without help and could not feed themselves without help. Only 8% of our population were in this group.

Short interval is needing someone to come in at regular times each day, every day. People with short interval need could not prepare a hot meal without help, or required help getting in and out of bed or dressing.

Long interval need was typically less than daily, such as help with shopping, finances and that sort of thing. The remainder were independent.

In total, only 8% of our population require 24-hour care. In fact, 80% of 85-year-olds need help less than daily: they are not all sitting in wheelchairs or in institutional care.

Applying multi-state life table techniques to the longitudinal data we have estimated the time people spend in these stages. You can see from Figure 7 that most of the years are spent needing help less than daily. This really shows that once you get to this stage of needing help at regular times each day,



- 9% of men remained fully able over the 5 years
- 12+ years of education associated with better trajectories

Figure 5. Disability trajectories (Source: Kingston *et al.*, 2015)

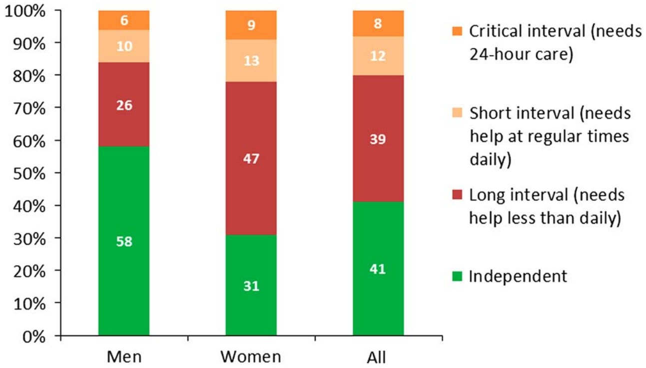


Figure 6. Need for care (Source: Jagger *et al.*, 2011)

you do not take very long before you need 24-hour care, which suggests that the dropping off on the right-hand side of the hierarchy curve is more rapid at that end.

When you are receiving help less than daily, it is probably a good time to be thinking about potential interventions to slow down progression because you have a bit more time to think about it or it is a time that people should be thinking, "Okay, if I am needing help less than daily, maybe I need to be thinking about where I am living, whether it is suitable, whether I need to move to something that I would be able to sustain when I need help dressing or I cannot get around quite as well. Maybe I need to be thinking at this stage about doing something about it".

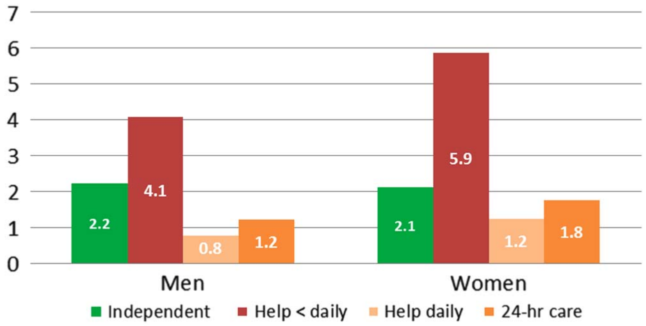
Again, women spend more years requiring care at every level than men. So, sorry, ladies, it is bad news.

When we published this paper on interval need, the reviewer asked us who was doing the caring? In fact, 75% – not all of them – of those who required help 24 hours a day were in residential care. What was interesting was that if they were not in care, the main carer was a child. For those who were in the short interval need, it was equal, spouse or child. But a child was the main carer in a lot of the instances. I began to think: who are these children? We tend to cut up age into little sections. We think about the very old, and we think about those about to retire, but we do not ever really join them together. I realised that, in fact, the children are around 60 years of age. Because the age at first birth for older people has not changed dramatically, and will not change dramatically, they will remain at around the age of 60 for some considerable time.

For people who are achieving the age of 85 in the next few decades, their first child at least will be around the age of 60. So the child who is caring is around the age of 60.

We know from a very good ONS publication from the census that carers are more likely to be women than men. There are as many in full-time employment as in part-time employment. Those who are in full-time employment and caring for 50 hours or more a week are between two and three times more likely to report being in not good health.

In terms of women, this is the group whom we are asking to work longer and for whom we are increasing the state pension age rapidly. These are the people who are also caring for the rapidly



- Most years spent needing help < daily
- Women spend more years requiring care at every level

Figure 7. Years with care needs from age 85

expanding group of 85-year-olds. We all need to consider the implications of this, but especially employers who may need to provide more flexible working patterns.

The third fact is that most of old age is not spent cognitively impaired. Dementia is probably the most feared condition of old age. But, in fact, of our 85-year-olds, 70% were not cognitively impaired, scoring 26–30 out of 30 on the Mini Mental State Examination, which is our cognitive function measure. Amazingly, 16% scored 30. I would be pushed to score 30 on a normal day, I think – certainly at the moment. Only 3% scored 10 or less, which we would say would be extremely cognitively impaired. The usual cut-off for dementia is 21.

The other good news from CFAS is that the prevalence of dementia has reduced. This has been a quite controversial finding in certain quarters. We applied the age- and sex-specific estimates in 1991–2011 from CFAS I, we would have expected 8.3% of the population to have dementia. In fact, the prevalence in CFAS II was 6.5%, a reduction of 1.8 percentage points.

You can see from Figure 8 that the big difference is in very old men. Most of the changes that have happened in the 20 years between CFAS I and CFAS II, might been considered to have increased the prevalence of dementia. We have reduced stroke mortality, there is a greater prevalence of diabetes. All of these you would expect to increase the prevalence of dementia. But, in fact, the other things that have changed, like levels of education and control of vascular morbidity, have overwhelmed the adverse factors and seem to have reduced the prevalence of dementia. That is good news for all of us.

However, because of the size of the ageing population, it means there are still going to be a lot of people with dementia. We have looked recently in the DYNOPTA study – and I will say a bit more about this later – at years with cognitive impairment, using health expectancies with cognitive impairment as the health measure. This shows total life expectancy and then years with cognitive impairment.

What is really striking in Figure 9, and this has been found in other studies too, is that the years spent with cognitive impairment is really flat with age. Women, on average, spend around 3 years with cognitive impairment, regardless of age, and men around 2 years.

When we did this earlier in CFAS I, there was a different cut-off point for the mini mental state: it was more severe, so the actual years are slightly different. But in Figure 10 you can see again that the black columns for those with moderate and severe cognitive impairment are relatively flat. The years spent with moderate to severe cognitive impairment seems to be pretty flat with age, which suggests it is a terminal event. If you are a 65-year-old man you can expect to spend 2 years, on average, with dementia, and it will be at the end of your life.

I have just put together the healthy life expectancy from CFAS I and CFAS II, however I cannot show you them because I have not yet submitted them. But I will say that the years with cognitive impairment have hardly changed. Despite the fact that the prevalence of dementia has gone down, the number of years with cognitive impairment has not changed. It is the years free of cognitive impairment that have gone up, luckily.

My fourth fact is: “Very old age is not for sissies”. This is an apology to Bette Davis. In our 85+ Study we found a high prevalence of disease; 58% had hypertension, over 50% had osteoarthritis. These diseases were ascertained from GP records rather than self-reported so there will be different biases since nothing is perfect, I would say.

It was not just single diseases that our 85-year-olds had. When we put together 18 diseases into a disease count, we found that, on average, men had four and women had five diseases. The disease count does not start at zero because nobody had nothing: everybody had one or more diseases.

Around 30% of our population had six or more diseases. Contrast that with the fact that 20% could do all the ADL. I would say the WHO definition of health as having absence of disease does not work for 85-year-olds. Many are functioning perfectly well, but they have all got a bit of something and are coping with it very well.

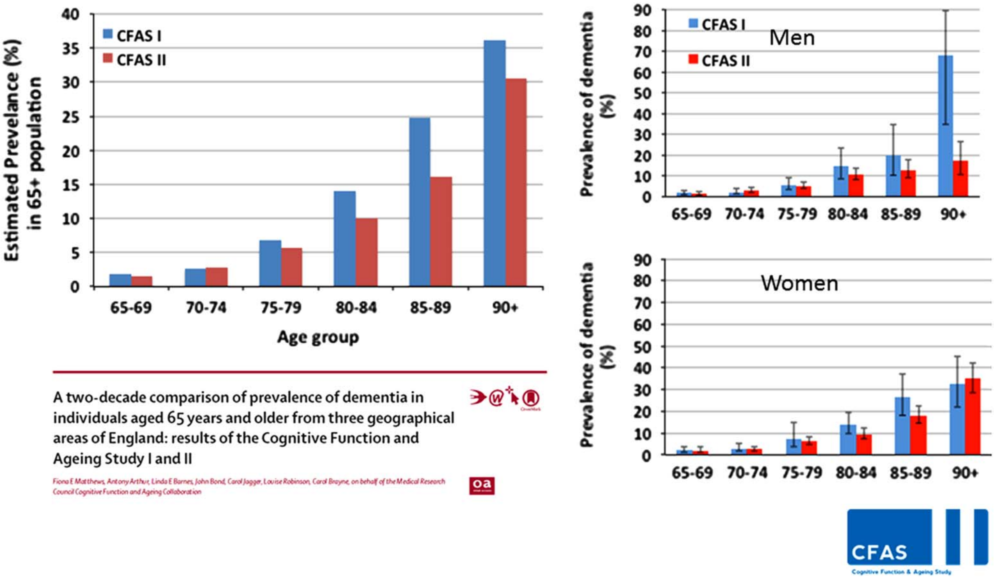
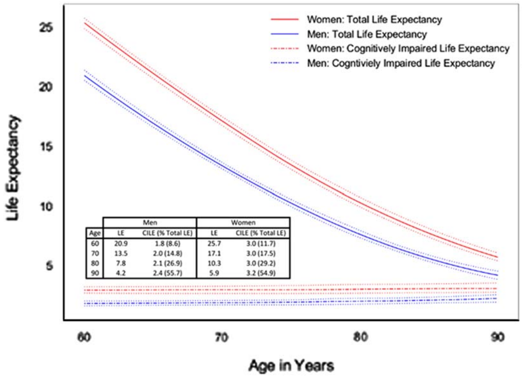


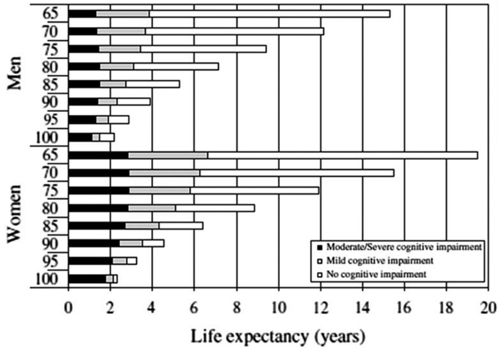
Figure 8. Prevalence of dementia has reduced (Source: Matthews *et al.*, 2013)



	Men		Women	
Age	LE	CILE (% Total LE)	LE	CILE (% Total LE)
60	20.9	1.8 (8.6)	25.7	3.0 (11.7)
70	13.5	2.0 (14.8)	17.1	3.0 (17.5)
80	7.8	2.1 (26.9)	10.3	3.0 (29.2)
90	4.2	2.4 (55.7)	5.9	3.2 (54.9)

Cognitive impairment = MMSE 0-23

Figure 9. Years with cognitive impairment (1) (Source: Anstey *et al.*, 2014)



Cognitive impairment: mild = MMSE 22-25
Mod/severe = 0-21

Figure 10. Years with cognitive impairment (2) (Source: Matthews *et al.*, 2009)

The trouble is that our health service is not set up for multi-morbidities, yet, multi-morbidity is the norm for very old people. Our NHS is set up for single diseases because, when it was set up, we did not have lots of 85-year-olds. We need to think a little bit more carefully about restructuring the NHS or finding some way to cope with the fact that people have to visit multiple outpatient clinics and some do that almost every week.

My fifth and last fact is that healthy ageing depends on where and how you live. I probably do not need to say this too loudly in Scotland.

These are the latest figures for disability-free life expectancy (DFLE) at birth from ONS for 2009–2011, with the changes from 2006–2008.

The things that I want you to note and about which I am starting to become quite vociferous, and boring, are these. First of all, inequalities in DFLE are much greater than inequalities in life expectancy. Figure 11 shows data excluding the outliers, and shows DFLE for the 10–90th percentile of the upper tier local authorities. Differences over the full range are much greater, over double the inequalities in life expectancy.

More importantly, although inequalities in life expectancy are going down, inequalities in DFLE are still going up. Yet, we still use life expectancy as a surrogate for health in the NHS resource allocation formula. We use the standardised mortality ratio and not DFLE. If we did use DFLE, the money would be allocated rather differently, I suspect (Figure 12).

These inequalities in DFLE have implications for extending working life. If you take those 2009–2011 figures and look at how many local authorities have a DFLE of <65 (state pension age) then about 50% of the upper tier local authorities have a DFLE under state pension age. However, if you look at this by region, then for the North East, all of them have a DFLE <65; in the North West, 74%; Yorkshire and the Humber, 73%; East of England, 18%.

It is not going to be as easy working longer in the North East as it is in the East of England because you will already have significant disability, possibly. So, employers and the government are going to have to think very carefully about that aspect, in terms of how it is to be managed.

I am glad to say that the ONS have started producing this as a measure. I hope that we are going to look at it more.

I hosted the International Network on Health Expectancy Conference here in Edinburgh in May. One of the papers (Minagawa & Saito, 2014) presented inequalities in DFLE at age 65 between the Japanese prefectures. Healthy life expectancy is becoming an important topic in Japan. They have joined our European project and now use the healthy life years measure with their goal being to increase healthy life expectancy and reduce regional inequalities. In Japan, regional inequalities in 2000 were about 3 years and by 2010 they were down to 2 years. So they have reduced the inequality by about one-third.

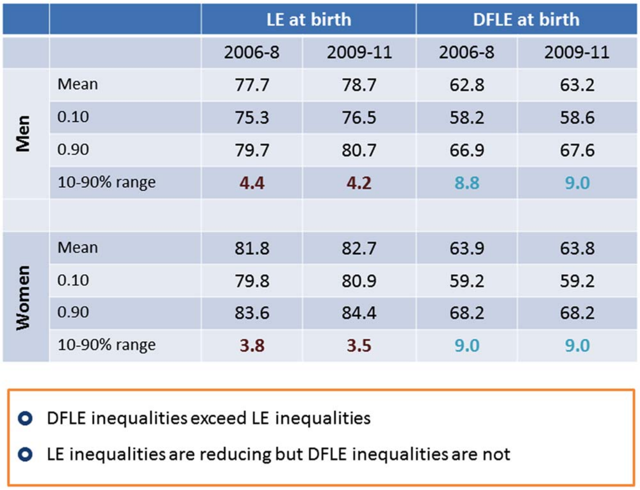
Our inequalities, on the other hand, are going up and are more like 8–9 years, so there is huge inequality in England compared to Japan.

How much of that is reflected in Japanese life expectancy is interesting. Tomorrow there is a meeting, in Newcastle, of Japanese funders to look at joint research. As far as I am concerned, Japan is a great place to do collaborative research: they have little inequality and we have much. Looking at differences between our two populations will be very informative.

I will now say a bit about lifestyle factors such as body mass index, obesity, smoking and alcohol. We have been looking at these in an Economic and Social Research Council-funded project into inequalities in healthy active life expectancy. This is just coming to an end.

We have been examining the relative contribution of socio-demographic, socio-economic and lifestyle factors to those inequalities in DFLE at birth. So far we have done this between 1991 and 2001, and we hope to do it with the new census when the mortality data is available (Figure 13).

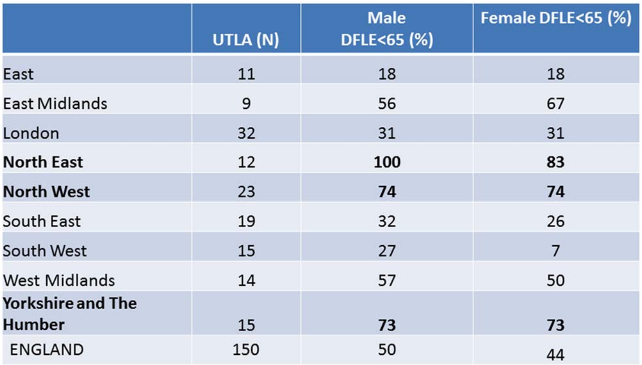
One of the factors that I want you to note is the proportion of the non-white population. That is a contributor to the variation in DFLE between upper tier local authorities. It was not quite significant in 1991, but it was very much so by 2001 and so had become more influential. This is something that is going to come through which we are not really thinking about. The ethnic minority population are a young population, but they are starting to enter the older age groups more now and will continue to do so.



		LE at birth		DFLE at birth	
		2006-8	2009-11	2006-8	2009-11
Men	Mean	77.7	78.7	62.8	63.2
	0.10	75.3	76.5	58.2	58.6
	0.90	79.7	80.7	66.9	67.6
	10-90% range	4.4	4.2	8.8	9.0
Women	Mean	81.8	82.7	63.9	63.8
	0.10	79.8	80.9	59.2	59.2
	0.90	83.6	84.4	68.2	68.2
	10-90% range	3.8	3.5	9.0	9.0

- DFLE inequalities exceed LE inequalities
- LE inequalities are reducing but DFLE inequalities are not

Figure 11. Inequalities at birth (2006–2011)



	UTLA (N)	Male DFLE<65 (%)	Female DFLE<65 (%)
East	11	18	18
East Midlands	9	56	67
London	32	31	31
North East	12	**100**	**83**
North West	23	**74**	**74**
South East	19	32	26
South West	15	27	7
West Midlands	14	57	50
Yorkshire and The Humber	15	**73**	**73**
ENGLAND	150	50	44

Figure 12. Extending working life

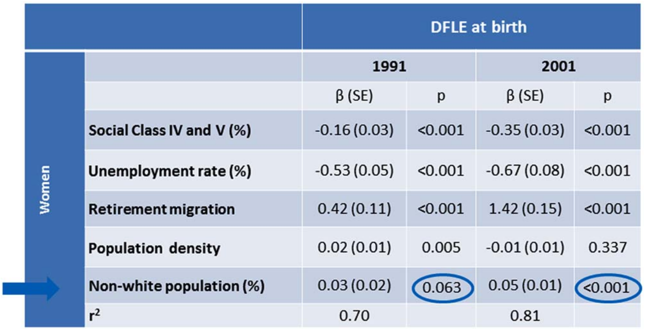
Why will this be an issue? It will be an issue because they have very different DFLE at birth.

For men and women, the group with longest life expectancy and longest DFLE is the Chinese. Indian women have life expectancies very similar to the white British group, but have many more years with disability, that is, shorter DFLE. This will affect inequalities between local authorities because the ethnic population is also grouped geographically.

The Bangladeshi and Pakistani populations have lower life expectancy and much lower DFLE for both men and women, too.

An other contributor – a really strong contributor – is social class.

For lifestyle factors we have to work at government office region level because that is the only level where we can obtain health behaviours. At the upper tier local authority level, we can obtain other measures, but drinking and smoking measures are only available at the government office region



		DFLE at birth			
		1991		2001	
		β (SE)	p	β (SE)	p
Women	Social Class IV and V (%)	-0.16 (0.03)	<0.001	-0.35 (0.03)	<0.001
	Unemployment rate (%)	-0.53 (0.05)	<0.001	-0.67 (0.08)	<0.001
	Retirement migration	0.42 (0.11)	<0.001	1.42 (0.15)	<0.001
	Population density	0.02 (0.01)	0.005	-0.01 (0.01)	0.337
	Non-white population (%)	0.03 (0.02)	0.063	0.05 (0.01)	<0.001
	r^2	0.70		0.81	

Figure 13. Contributors to inequalities in DFLE at birth (Source: Wohland *et al.*, 2014)

level from the Health Surveys for England. Our analysis shows that a strong contender for men is heavy drinking and binge drinking. So where are we with minimum pricing? Good question!

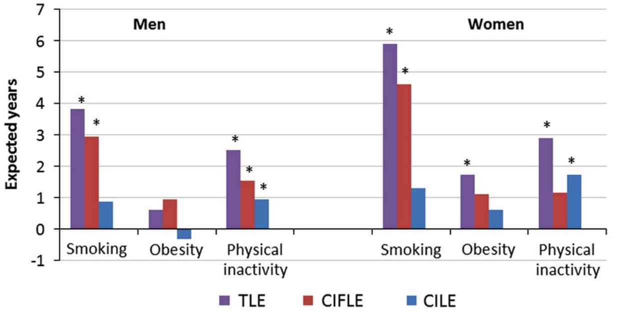
However the gain is not all in good years. If we do not examine health expectancy alongside mortality, we obtain a rather distorted picture. This can be seen in Figure 14 where we look at the effects on cognitive impairment-free life expectancy. From the central bars you can see that if you stop smoking then you would gain almost 3 years in cognitive impairment-free life expectancy, and you would gain if you stopped being physically inactive if you are man, and if you are woman you gain if you stop smoking.

If you are a man and you become physically active, you also gain years without cognitive impairment. But it is not all win because, of course, most of these lifestyle factors also have an effect on mortality. Smoking and physical activity increase your total life years, and if you are looking at a measure like cognitive impairment, which is very, very strongly related to age, then if you live longer, you have more of a chance of becoming cognitively impaired.

I believe that you need to look at health and mortality together and an increase in healthy life years should exceed the increase in life expectancy or unhealthy years will increase. I do not really subscribe to the fact that health expectancy is more important than life expectancy. It is as important. The aim of the game is to push these two curves in Figure 15 closer to the mortality curve. But if the mortality one is still moving as it is, it is not that easy.

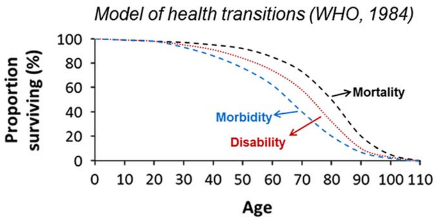
In conclusion, there is a lot we know about growing older. But our knowledge is based on the current cohorts and we do not really know what the future is going to bring. That is where the uncertainty lies. There has been a huge growth recently in micro-simulation. That might provide a way of exploring uncertainty in the future, using the data that we know about, and playing about with scenarios to see what may or may not happen in the future.

Before finishing I wanted to mention a new project that has started this year led at LSE by Martin Knapp. It is called MODEM – Modelling the Outcome and Cost Impacts of Interventions for Dementia. Within this, I will be developing a micro-simulation model, which will feed into another model for the costs of care for older people using the interval need measure and will include their disease status, particularly cognitive impairment. The care packages will be dependent on what other diseases they have as well as dementia. It will also be able to calculate the duration in these different care states and DFLE.



Years gained (*= significantly>0) in total life expectancy (TLE), cognitive impairment free life expectancy (CIFLE) and life expectancy with cognitive impairment (CILE) without risk factor (high educated)

Figure 14. But it's not all gain in good years… (Source: Anstey *et al.*, 2014)



" Increased longevity without quality of life is an empty prize. Health expectancy is more important than life expectancy."

Dr Hiroshi Nakajima, Director-General WHO 1997

Increase in healthy years should exceed increase in life expectancy or unhealthy years will increase

Figure 15. Healthy life expectancy

A Speaker: The Dilnot report called for common assessment criteria for long-term care across all local authorities. How likely is that to happen?

Prof Jagger: That is a good question. One of the worries I have about devolving down to local authorities is that I feel no one has an overview. That is true in terms of health expectancy, because the ONS have had to abandon most small area and socio-economic monitoring of health expectancy due to budget cuts. I do not feel that anyone will be monitoring inequalities.

I feel the same thing is true of assessment. Unless someone in authority and with evidence says "this is how it should be done", or local authorities have a will to get together and jointly decide on tools, I do not think that it will happen.

You may remember that back in 1991 the government told GPs they had to give each of their over 75s an annual health check. But GPs were not told what areas this should cover or what the most appropriate instruments were. Some GPs gave a cursory check when the older person came to the surgery, as most over 75s visit their GP at least once a year.

Whereas, in Melton, in the practice with which we were involved, practice nurses went out systematically to the person's home and used an assessment that we, as age researchers, had designed.

So overall these health checks were very variable across the country. But it could have been a great opportunity to get some really good routine data to monitor ageing. We do have some routine primary care data, for example, the General Practice Research Database, but none have disability or functioning or need for care collected systematically across practices.

Mr W. D. B. Anderson, F.I.A.: I was particularly taken by one of your earlier charts where you were showing the decline of capability of people as they progressed. I think it was cutting toenails (on the left-hand side of the slide), which seemed to be the most predictive factor of what was going to come further on.

This is potentially really useful in our world of financial services because of the budget changes that have been brought forward to give people free choice of either having an annuity for their pension, if they are in a defined contribution pension scheme, or doing drawdown.

For many people, they would probably be quite attracted to just drawing down their funds until such point as they see their cognitive or physical capability is declining.

Is there a further series of predictive variables that appear before cutting your toenails? People would have to decide that they bought an annuity before they got to that stage in life. My question is: can it be extrapolated off to the left?

Prof Jagger: I would say we had the fullest list of activities of any study. It will be easy to check whether people had different ones from us and where these activities sat in the hierarchy and specifically whether they occur before difficulty with toenails.

Indeed, we do know that physical limitations – individual functions like reaching or stretching, which together make up activities – do occur before IADLs.

What I am particularly interested in now is whether the speed of loss is changed for different groups. I think the ordering is probably going to remain the same, but, for example, if a person has early signs of cognitive impairment, they may still might be able to carry out activities, but do they encounter difficulty with activities faster? The thought would be they probably would.

The President: One of your graphs shows a difference of 3.3 years, I think it was, between two different events. How variable is that? That is obviously the average. Are there some people for whom that period is a very long or is it quite tightly drawn around that middle number?

Prof Jagger: I did not really look at that in the Melton data. You can get a sense of it from the graph, but there would need to be many shorter follow-ups to be able to get a good idea of the variability. In the Newcastle 85+ Study, we had four assessments only, over a 5-year period and, as yet, we have not reproduced the analysis I did in Melton with the wider range of activities.

A Speaker: One thing that struck me was that once someone becomes ill, they could become better. For example, someone who cannot go shopping because of hip arthritis could have their hip repaired and start shopping again. How do you take into account medical improvements or cures to some illnesses?

Prof Jagger: The first graph I showed was cross-sectional, with the prevalence of difficulty for each activity. Prevalence will reflect incidence and recovery but it is not explicit. We have not looked at the activities yet in terms of recovery, but recovery is likely to be greater for those activities where difficulty is encountered early, which are those at the left-hand side of the graph.

And yes, some of them will be people who have had hip replacements, and some may be people who have had a fall but not broken a hip, but who have stopped doing activities for a time.

The important thing to note is that there is recovery in this age group. It is not all downhill.

The President: Are you finding that the government and the health service are interested in the analysis that you are doing? Are they listening? Do you think they are doing something?

Prof Jagger: "Yes and no" is probably the safe answer. I think that there is an understanding that inequalities are there, but I do not feel that they are yet being properly addressed.

In terms of multi-morbidity then this is starting to be addressed, partly through the increasing recognition of frailty, but also through other initiatives. In Newcastle, we have CRESTA Clinics, where people with particular configurations of conditions come and are seen by all the consultants at one visit.

These conditions do occur in distinct patterns, so there are not an infinite number of possibilities. It seems rather obvious to move towards combined clinics for particular conditions or specialties that often co-occur to enable case conferences and so that the older person can be viewed holistically rather than as a collection of organs. However, the latter is how the NHS was, and mostly still is, configured.

Prof D. Bell: I am thinking about the problems that you are going to confront with your micro-simulation.

One of the things that you talked about a lot was child care for those at the top end of the needs spectrum. We are going to move into a situation where family structure is going to change around a lot. These kinds of relationships, and indeed the number of women who have had no children at all, is going to change a lot. That is going to change the nature of the supply of care, it seems to me. I am wondering what your thinking is about that.

Prof Jagger: Fortunately, that is not my bit of the micro-simulation, but it is an important issue.

In a previous project with which I was involved, I developed a macro-simulation model. The project was called MAP 2030 – modelling ageing population to 2030. There was another element looking at family structure and informal care. MAP 2030 took our separate models and linked them together. But yes, you are correct. Family sizes are smaller and families are more dispersed because of moves for employment as well as divorce. Also, since men's life expectancy is increasing faster than women's, there will be more very old couples. I feel that these may be quite vulnerable units as sometimes it is unclear who is doing the caring and who is being cared for. Older people living alone are much more visible to services as potentially vulnerable.

A Speaker: One of your comments relating to morbidity was that men just die and women just live with it. Why is that?

Prof Jagger: I wish we knew. We have a chance of exploring that further in the 85+ Study because everybody is the same age, and often in studies women tend to be older than men, so you have age as a confounder.

To some extent it is the sort of diseases that men have, but I do not think that is the whole answer. The prevalence of arthritis is much higher in women: women tend to have the non-fatal diseases and men have the fatal ones. I do not know whether that is a good thing or a bad thing. Maybe the quicker the better. I would go for the fatal, I think.

Mr D. Gray, F.F.A.: My understanding is that dementia would be quite significant. You are not saying anything to the contrary. But how comfortable are you in drawing any conclusions on the basis of a comparison of two studies, CFAS I and II, and are there any plans for a CFAS III?

Prof Jagger: You need to speak to the MRC about that! There are no plans for a CFAS III at present.

I am comfortable in what we found because the studies are identical in design. We can say with some degree of certainty that the level of dementia that we are picking up are identical. The ascertainment was identical between the two studies.

But of course you are quite right, we do not know whether that will continue in the future and obviously we need to revisit that analysis. However, it is probably not worth doing that too early since we found the prevalence of dementia had fallen 1.8 percentage points over about a 20-year period. Revisiting it in 10 years might be a good idea or unless there were particular cohorts starting to come through, which were perceived to have higher or lower risk.

The President: With that, I will draw the evening to a close. I should like to thank Carol Jagger for a very interesting talk.

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