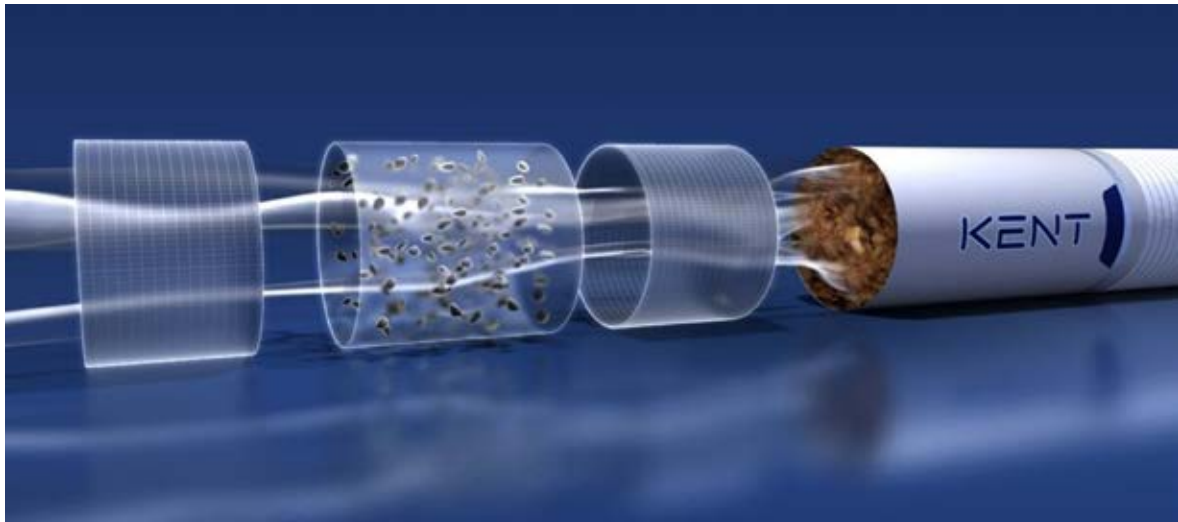


this week



BAT puts tobacco in new e-cigarette

British American Tobacco (BAT) has announced plans for a hybrid product that combines electronic cigarette technology with tobacco.

Like a standard e-cigarette, the iFuse will heat nicotine infused liquid into a vapour, but this will then be passed through tobacco before being inhaled. BAT said that iFuse, a so called “heat not burn” product, will incorporate elements of its Kent brand of cigarettes and will be sold where that brand is popular.¹

This latest example of rapid innovation outpacing regulation and understanding of the effects on public health has reinforced fears that the industry is using such products to “renormalise” smoking, bypassing laws aimed at controlling tobacco promotion and branding.

BAT has said that it is “committed to developing a range of next generation tobacco and nicotine products across the risk continuum,” but many public health figures are sceptical of the company’s attempts to reposition itself as the solution to a catastrophic global public health problem it has helped to create.²

Martin McKee, president of the European Public Health Association, said that the latest news “adds to the evidence that the

tobacco industry is really in the business of selling nicotine, in any form, for which it needs a continuing supply of addicts.” How it recruited them was “immaterial” to the industry, he said.

John Britton, director of the UK Centre for Tobacco Control Studies at the University of Nottingham, said that if iFuse turns out to be “an effective nicotine delivery device that proves acceptable as a smoking substitute to smokers, then it could be an effective harm reduction option.”

But he added that “the devil is in the detail. How clean is the vapour, how do any likely hazards stack up against existing options, and how do regulators allow the product to be positioned?”

From May 2016 all tobacco products must be sold in identically coloured, standardised packs, stripped of all branding bar the name and dominated by graphically illustrated health warnings.³

The cigarette companies have challenged the new regulations under international trade and intellectual property laws in a case due to be heard in the High Court in December.⁴

Jonathan Gornall, London

Cite this as: *BMJ* 2015;351:h6314

BAT’s decision to produce a hybrid cigarette showed that the tobacco industry was keen to recruit nicotine addicts, public health expert Martin McKee said

NEWS ONLINE

- CCG advises patients to pay privately for treatments it plans to stop funding on the NHS
- Progesterone supplements fail to reduce risk of recurrent miscarriage, study shows

MEDICINE

needed in a third of hospitals, it added. Nearly half (45%) of patients with sepsis admitted to hospital with no other obvious problem either died or were left with a disability, the audit found. (Full *BMJ* story doi:10.1136/bmj.h6237.)

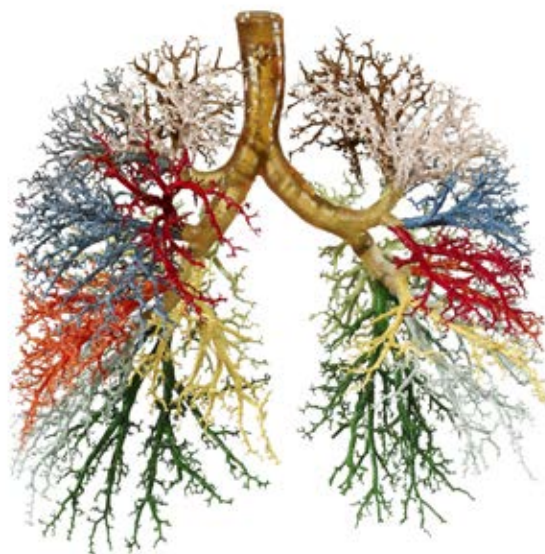
Anatomical waxworks

This model of the blood vessels in the lungs (right) features in an exhibition called *Designing Bodies: Models of Human Anatomy from 1945 to Now* at the Hunterian Museum, London. Martyn Cooke, head of the conservation unit at the Royal College of Surgeons, pioneered the wax, resin, and gelatin replicas after the college was asked to develop a model of the brain and skull for surgeons to train in treating head trauma injuries. The exhibition runs until 20 February 2016.

Wednesday 25th "Angelina effect" sees demand for double mastectomies rise

The number of preventive double mastectomies performed at a clinic in Manchester have

increased dramatically since May 2013, when the actor Angelina Jolie announced that she had had the procedure, researchers reported in *Breast Cancer Research*. Some 83 double mastectomies were performed at the Genesis Prevention Centre Family History clinic from January 2014 to June 2015, compared with 29 from January 2011 to June 2012.



Gareth Evans, professor of clinical genetics at the clinic, said that the increased uptake of double mastectomies may be attributed to "the Angelina effect."

Thursday 26th MRI after mammography detects extra cancers

Magnetic resonance imaging of the breast in 2021 women with newly diagnosed breast cancer found additional cancer in 14% (285 women) that was not seen on mammography, a study in *Radiology* showed. Cancer detected only by MRI was invasive in 76% of women, larger than 1 cm in 25%, and larger than the known index cancer in 23%. (Full *BMJ* story doi:10.1136/bmj.h6319.)

Friday 27th TTIP negotiations held in Brussels

The European Union's Foreign Affairs Council was due to meet in Brussels to discuss negotiations on the Transatlantic Trade and Investment Partnership (TTIP) with the United States, which many commentators believe will undermine public health services and lower consumer safety standards.

Cite this as: *BMJ* 2015;351:h6335

SIXTY SECONDS ON... ADHD



ATTENTION-DEFICIT/HYPERACTIVITY DISORDER? THAT'S A DIAGNOSIS IN SEARCH OF A DISEASE, ISN'T IT?

Not according to most child psychiatrists, who say that there is plenty of evidence that it's a real condition.

BUT THERE'S NO BIOLOGICAL TEST, AND LOTS OF CHILDREN ARE HYPERACTIVE, INATTENTIVE, AND IMPULSIVE.

True enough. So it's only the extreme end of the spectrum that warrants the diagnosis, and when the symptoms cause "significant impairment," says the National Institute for Health and Care Excellence (NICE). But defining a threshold for impairment is contentious in itself.

DEEP WATERS . . .

And not getting any shallower. ADHD has been around as a diagnosis for decades, but evidence on the best ways to treat it is still contested. Methylphenidate (Ritalin) is prescribed to many children, but a new Cochrane systematic review in this issue of *The BMJ* (p 21) concludes there isn't enough good quality evidence to justify its use.



IS THAT A SURPRISE?

Parents worried about their children being given a central nervous system stimulant may well be surprised that the evidence is so poor.

DOES NICE RECOMMEND THIS POORLY EVIDENCED DRUG?

Yes. In a 2009 guideline that runs to 664 pages (don't attempt it if you suffer any degree of inattention) it recommends drugs such as methylphenidate as a first line treatment for school age children with severe ADHD. A review of the guidance is ongoing.

Nigel Hawkes, London

Cite this as: *BMJ* 2015;351:h6294

Pay in the NHS: who earns what?

Healthcare workers have all had a pay squeeze over the past few years, but **John Appleby** finds some have done better than others

Healthcare has always been a labour intensive industry and is likely to remain so. In a study of the probability of computerisation of different occupations, along with choreographers, computer systems analysts, and the clergy, healthcare jobs rank among the least susceptible to replacement by computers and robots.¹ Good news for employment of NHS workers. But it also means that their pay—in aggregate around £50bn—38% of the total NHS spend and the single largest cost in providing healthcare—is hard to ignore in times of austerity.

Squeezing growth in the pay bill over the past five years² has been a key policy to make the NHS money go further. The impact of five years of capping pay growth is clear (fig 2 overleaf). Across all directly employed NHS staff in England (that is, excluding general practitioners and dentists) mean total gross earnings fell by 2.6% in real terms between 2009 and 2015. Compared with the 7.1% fall in real median gross earnings across all occupations in the entire economy this doesn't look too bad perhaps. But the burden of the reduction in the NHS has not been

14%
the percentage
reduction in the mean
gross earnings of
registrars
since 2009

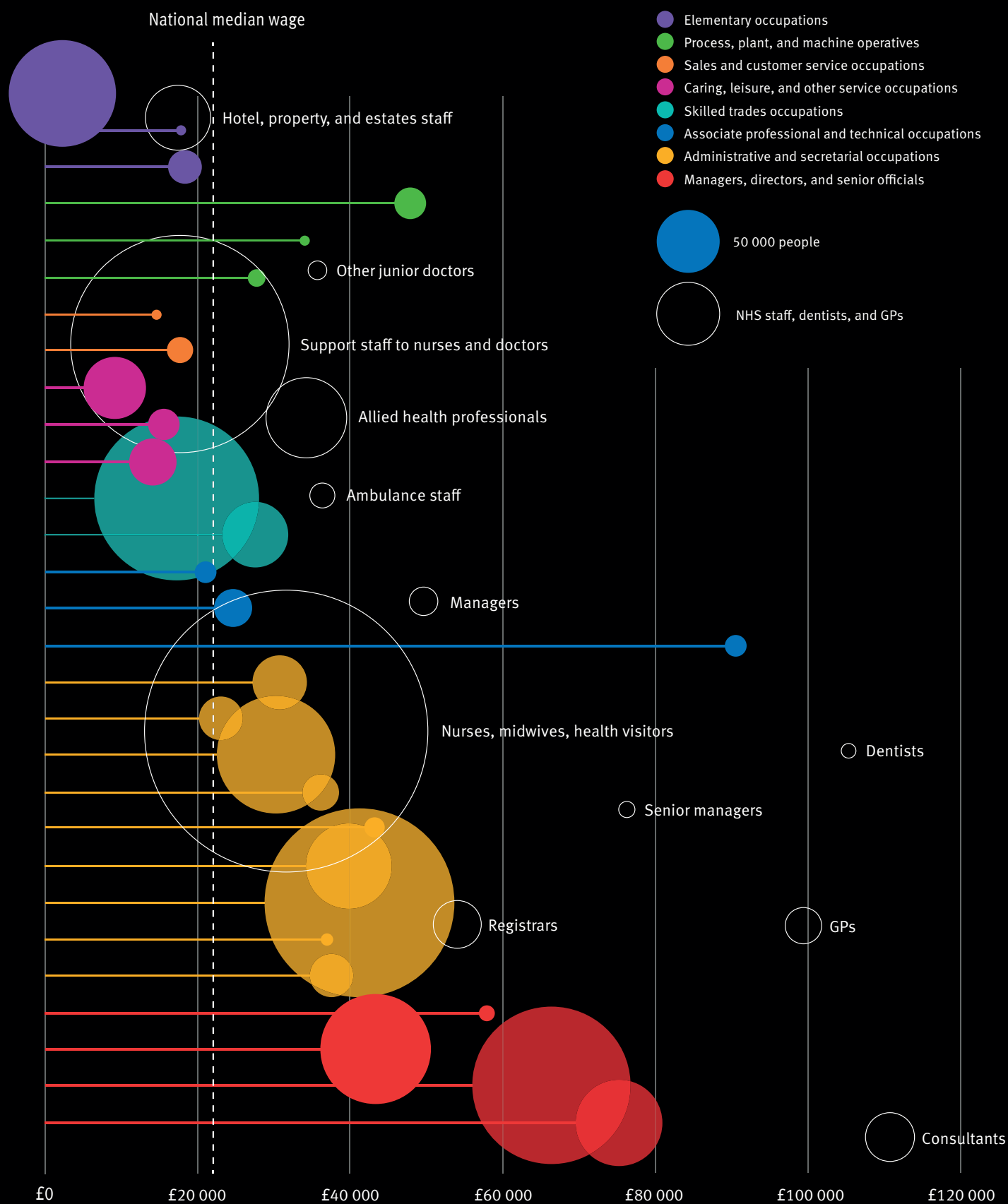
spread evenly. While NHS managers (on average) have seen their pay increase in real terms by 3.1%, nurses have had a real cut of 3.1%. Strikingly, registrars—the largest group of junior doctors—have seen their mean gross earning reduce by 14.3%; a loss of nearly £9000 on average.

Consultants, GPs, and dentists contracting to the NHS have experienced the largest falls (10.7%, 14.8%, and 20.2% respectively) in average real incomes before tax; this equates to a loss in cash ranging from £13 000 for consultants to £17 000 for GPs and £27 000 for dentists.

Of course, all these changes are about averages of totals, and part (though unlikely all) of the changes in earnings may be due to variations in the composition of the workforce in different groups. As pay tends to increase with age for example, a shift to older workers over time will increase the mean or median earnings regardless of any actual changes in pay.

Fig 1 | Gross annual median earnings for selected occupations, 2014 (Lollipop personnel includes school break and road crossing monitors; NHS staff figures are mean not median earnings but these approximate well to medians)^{3 5-7}





In 2014, doctors earnt around **five times** the national median gross wage of **£22 000**

Compared with other non-healthcare occupations, doctors are top earners. In 2014, they earnt around five times the national median gross wage of £22 000 and more than one of the highest paid non-healthcare occupations, aircraft pilots and flight engineers (fig 1). Around one in five consultants earns more than the prime minister's official salary of £142 000 (for what that statistic is worth⁶).

Before leaving what some may see as the politics of envy, the median or mean wage (both similar in the NHS) conceals large variations in earnings. As a result of hours worked and other contractual details, the mean gross wage for doctors on the same grades varies (fig 3). For the sake of clarity the figure's x axis is truncated, but at the extreme, in the year to June 2015 one consultant's gross earnings amounted to £578 000. And a couple of registrars earnt £160 000.

But, to mangle the old music hall joke, the question is not, "What's a Greek earn?" but rather, "What's a Greek worth?" In theory, from an employer's point of view, the economic answer is: fractionally less than the increase in "value" (revenue) a worker generates from being employed. But, in practice, quantifying (let alone agreeing) the value of the marginal product of labour is not easy (as Jeremy Hunt and junior doctors know all too well.)

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Cite this as: *BMJ* 2015;351:h6250

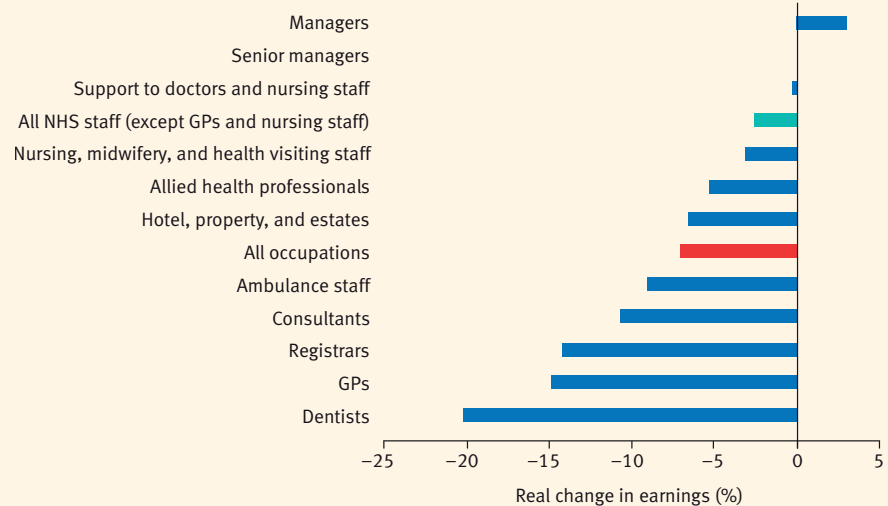


Fig 2 | Percentage change in mean of total gross earnings: English NHS staff, GPs, and dentists, 2009-15 (figures for "all occupations" across the whole economy are based on medians; GP and dentist figures are changes from 2009 to 2014)³⁻⁷

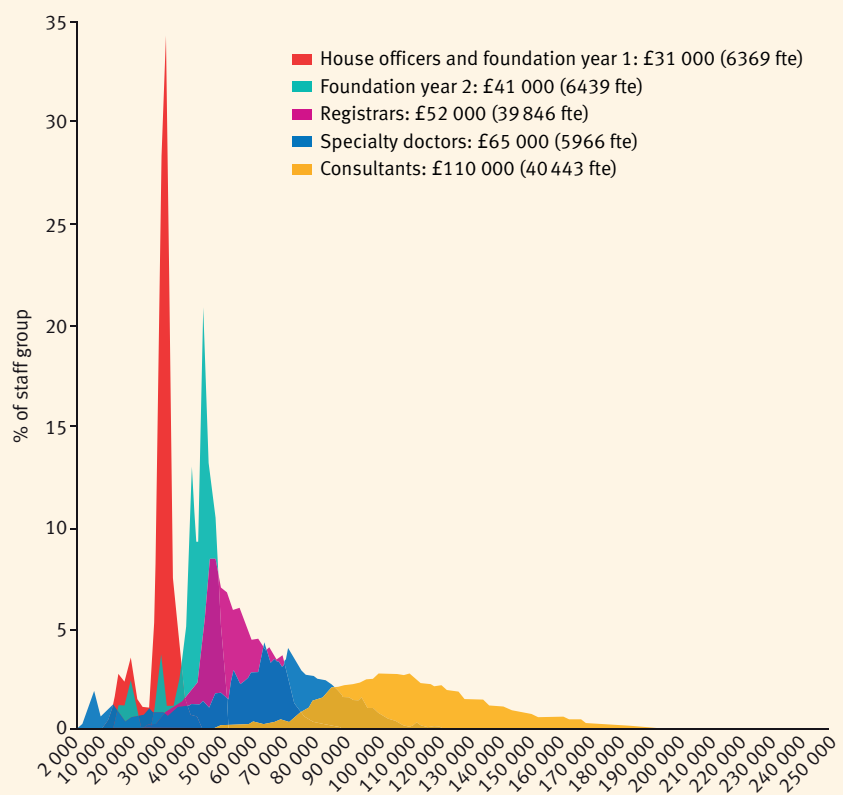


Fig 3 | Distribution and median total earnings, selected medical staff, year to June 2015 (fte=full time equivalent)⁹

two organisations said that degradation in physicians' performance could cause medical errors "sometimes leading to patient injuries and death."

Several US studies have underscored the concern about harms to patients. A study of 2737 first year residents found that doctors who worked extended shifts "reported 300% more fatigue-related preventable adverse events resulting in a fatality."

The new studies' waiver on working hour restrictions extends for at least one year after completion of the studies.

Carome also said that the studies violated research ethics because the patients were not told that they were in a study and therefore could not consent to participation. A 2010 survey showed that a majority (81%) of members of the US public said that they should be informed if their resident doctor had been working for more than 24 hours, and 80% said that they would want to request a different doctor.

Jeanne Lenzer, New York [Cite this as: BMJ 2015;351:h6295](#)

BMA rebuts concern that striking doctors wouldn't attend crisis

The BMA has rebutted concerns raised by NHS England's medical director that junior doctors who were striking would not respond to a major incident.

Bruce Keogh wrote to Mark Porter, the BMA's chair of council, on 19 November after the BMA's ballot showed that 98% of junior doctors voted in favour of strike action over changes to their contract.

In his letter Keogh sought assurances that junior doctors taking part in industrial action would be available to respond to a "major incident" if needed.

Porter responded, **"The entire medical profession, would of course react appropriately"** Mark Porter, BMA
"I would like to reassure you and members of the public that were an unprecedented external incident to arise, junior doctors, and indeed the entire medical profession, would of course react appropriately, as we have seen on previous occasions."

More than 3000 junior doctors accused Keogh of a "disrespectful and politicised" intervention in questioning their loyalty to the NHS in the event of a crisis.

Abi Rimmer, BMJ Careers

[Cite this as: BMJ 2015;351:h6322](#)

FIVE MINUTES WITH ...

Johann Malawana, chair of BMA's Junior Doctors Committee

Earlier this month 98% of junior doctors in England voted in favour of industrial action. Despite this mandate, the BMA is still keen to reach a negotiated agreement, Johann Malawana tells *The BMJ*



I think we've always been clear that our primary aim is not to go into industrial action at all costs. Our goal is to try to end up with a negotiated settlement and a negotiated contract, and we've said that all the way through this.

"Over the last two months the government has had several opportunities to step back from the brink, but it has refused to engage with us in a constructive way. We hope that the health secretary will enter into meaningful conciliatory talks first—and then ultimately into a proper negotiated settlement.

"If we get to the point where we have taken three days of industrial action and we are still looking at what happens in January then we will need to re-evaluate the situation and make a decision in December as to what the next step in this dispute is.

"Ultimately this isn't a game, despite what Jeremy Hunt seems to think. Ultimately what happens in this media circus of the politics of the dispute is less important than the long term impact on the NHS. We

need to retain this group of staff in order to deliver the service over the next 10 to 15 years and beyond.

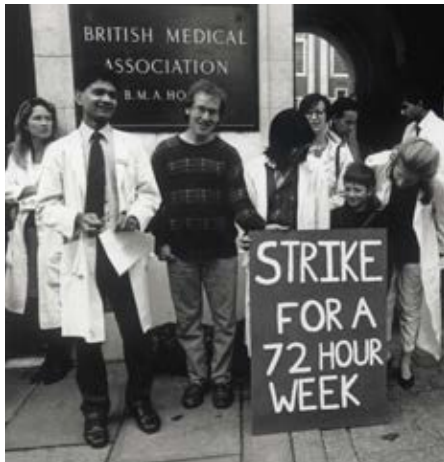
"We have seen a lot of statements from the Department of Health that have been quite harmful to the perception of the NHS among members of the public. A lot of that has been to try to induce fear, to affect public opinion with regard to junior doctors. What we have seen consistently, I think, is that this has backfired on the department.

"It's very concerning that they keep trying to do that, because what we need from them is a rational position that understands the health service, and makes sure that the public understand that they shouldn't be scared of what's going on in the health service.

"If there is a major terrorist attack I cannot imagine a doctor who would not just drop everything and go into their hospital. The approach of the government is extremely insulting to junior doctors."

Johann Malawana was talking to Abi Rimmer, BMJ Careers

[Cite this as: BMJ 2015;351:h6332](#)



RAJESH JANTILIA/AP/GETTY

Previous strikes have shown that it is possible to disrupt elective services while ensuring that emergencies are treated promptly and effectively

individual doctors. An 18 day strike by 500 interns in Chicago in 1975 led to brief jail terms for seven of the strike leaders. However, this followed their decision to ignore a court order to end the action.¹⁴

Harm to patients

A recent systematic review reported mortality data from five doctor strikes, all of which saw patient mortality remain the same or fall during industrial action (table, above).¹⁵ Two further studies have been published since that review.^{16 17}

In 1976, between 25% and 50% of physicians in Los Angeles County, California, withheld care for all but emergency cases over five weeks. Three studies used a range of approaches to examine the consequences of this strike, and all found that mortality fell during the strike period.¹⁸⁻²⁰

In 1983, 73% of doctors in Jerusalem refused to treat patients inside hospitals over a salary dispute. During this four month action, emergency departments were staffed as on weekends and many doctors provided care for ambulatory patients in tents outside hospitals for a fee. A subsequent analysis of death certificates found no excess mortality during the strike.²¹ A second action in Jerusalem, in 2000, led to the cancellation of all elective hospital admissions. There were fewer funerals held in Jerusalem during these three months than during the same period in the preceding year.²³

Junior doctors in Spain went on strike for nine non-consecutive days in 1999. A study from one emergency department (in which

all resident doctors ceased treating patients) reported no mortality difference between strike and non-strike periods.²²

National mortality data have been studied for only two countrywide doctor strikes.^{17 24} In 2003, most doctors in Croatia went on strike for four weeks, during which they provided only emergency care and at the level usually available at weekends. A study that analysed both total and cause specific mortality found no significant association between the industrial action and patient deaths.²⁴

In 2012, the BMA organised a single “day of action” as a response to government pension reforms. The aim was to boycott non-urgent care but many doctors continued working as normal; the government estimated that only 8% of the

medical workforce participated.²⁵ There were fewer in-hospital deaths on this day, both among elective and emergency populations, although neither difference was significant.¹⁷

The only report of increased mortality associated with strike action comes from South Africa. In 2010, all the doctors in one province ceased to provide any treatment to their patients for 20 consecutive days. Only one hospital continued to provide services during this period to an estimated population of 5.5 million people. Although their data are poorly reported, authors from this hospital found that the number of emergency admissions fell during the strike period but that the odds of death for these patients increased by 67%.¹⁶ This may be because patients delayed seeking treatment and so were more likely to present in extremis during the strike.

No mortality difference between strike and non-strike periods —findings of a study into 1999 strike by junior doctors in Spain



Why don't patient deaths increase during doctor strikes?

Many explanations have been proposed for why doctor strikes in high income countries have not been found to increase patient mortality. Importantly, all such strikes guaranteed provision of emergency care, at least at the level usually available at weekends. In addition, many were incomplete, with physicians declaring a strike but continuing to provide routine services to patients. This was most apparent during the 2012 UK strike when it was sometimes difficult to determine which doctors were actually taking action.¹⁷ Similarly, during the 1983 Jerusalem strike, the provision of care to ambulatory patients may

Wider political context underlying the NHS junior doctors' dispute

Unhappy doctors are back centre stage with a vengeance

Whatever the rights and wrongs of the dispute over the junior doctor contract, the ramifications will be felt throughout the NHS for some time to come. These have their roots in a wider political context that may prove decisive in settling the longer term fate of the NHS.

This dispute has striking echoes of the deep malaise among doctors in the late 1990s and early 2000s, also a time when the NHS was under severe financial pressure and undergoing reorganisation. An editorial in *The BMJ* in 2001 asked why doctors were unhappy.¹ It suggested the causes were multiple but highlighted one in particular: the mismatch between what doctors were trained for and what they are required to do. Trained in one medical specialty, doctors found themselves spending more time thinking about issues like management, improvement, finance, law, ethics, and communication.

Subsequent analysis by Jack Silversin and colleagues suggested that the cause of doctors' unhappiness was "a breakdown in the implicit compact between doctors and society: the individual orientation that doctors were trained for does not fit with the demands of current healthcare systems."² The old compact that was no longer regarded as fit for purpose had two aspects: what doctors gave and what they got in return. Doctors sacrificed early evenings, studied hard, saw patients, and provided "good" care. In return for these sacrifices doctors got reasonable remuneration; reasonable

work-life balance later; autonomy; job security; deference; and respect.

The mismatch between the gives and gets was the cause of growing dissonance over what doctors might have reasonably expected the job to be and how it was.³ Silversin's contribution to the debate was significant because he worked on the physician compact at Virginia Mason Medical Center (VMCC) in Seattle. There is a nice irony here because the health secretary, Jeremy Hunt, earlier this year publicly sang the praises of the VMCC, holding it up as an exemplar for the NHS.⁴

Among the new imperatives suggested by Silversin and colleagues intended to create a happier workforce and improve care for patients were greater accountability; patient centred care; being more available to patients; working collectively with other staff to improve quality; evaluation by non-technical criteria and patients' perceptions; and action to counter the growing blame culture.

Unhappy doctors syndrome

Notwithstanding important gains in some of these areas, especially during the years of new investment which ended in 2008, the current dispute has led to the "unhappy doctors" syndrome resurfacing and for not dissimilar reasons in regard to pressures on staff, the need for a better work-life balance, and concerns over patient safety.⁵

But there are two further underlying pressures that have a bearing on the dispute. Firstly, the coalition government foisted deeply unpopular changes on the NHS that were widely opposed by NHS staff.⁶ Since the implementation of the Health and Social Care Act 2012, staff have been living with the consequences of a dysfunctional and fragmented



The health secretary assiduously wears his NHS lapel badge: reverence for the institution or reminder to transform it?

health system not of their making. The erosion of trust between NHS staff and politicians was therefore well entrenched before the junior doctors' dispute gained traction.

Secondly, this government is not trusted with the NHS. The health secretary may assiduously wear his NHS lapel badge whenever he appears in public or on television. However, it is unclear whether this is to show his reverence for the institution he presides over or to remind him to transform the NHS into something more aligned to his government's neoliberal ideology. The unprecedented financial pressures on the NHS seem linked with a perception that the government's real agenda is to dismantle the NHS as part of a wider redesign of the public realm.⁷

Institutions like the NHS and BBC stand out as aberrations in the government's vision of a smaller state in which public services are largely privatised or outsourced.⁸ The deep seated anger felt by junior doctors is to some degree a manifestation of a deeper frustration with the government's stewardship of the NHS.

The issues that came to the fore some 15 years ago have not disappeared. Unhappy doctors are back centre stage with a vengeance, and resolving their concerns remains as big a challenge now as then, regardless of the immediate outcome of the present dispute.

Cite this as: *BMJ* 2015;351:h6317

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Merging alcohol giants threaten global health

Alcohol has comparable health risks to those of tobacco but none of its pariah status

The world's two largest beer manufacturers, Anheuser-Busch InBev (AB InBev) and SABMiller, have agreed in principle to merge. At £70bn (€100bn; \$106bn) this would be the third largest deal in corporate history, establishing a dominant position in the global beer market.¹ Here we focus on its implications for the growing epidemic of alcohol related harm across low and middle income countries.

The new company will produce an estimated one third of all beer sold worldwide and will be market leader in 24 of the world's 30 largest beer markets.² Importantly for global health, the merger is driven by prospects for expansion in developing countries. In promoting the deal to investors, AB InBev highlighted the complementary geographical strengths of the two businesses in "key emerging regions with strong growth prospects, including Africa, Asia and Central and South America," with a particular emphasis on Africa as "a critical driver of growth for the combined company."³ This ambition mirrors industry analysts' identification of Africa as the "final frontier for beer,"⁴ projected to be the world's fastest growing region for alcoholic drinks over 2013-18.

SABMiller, which originated in South Africa, is the established industry leader in the region and so is well placed to exploit growth across sub-Saharan Africa. The health implications of this forecast are disturbing: market growth on this scale is predicated on "exploiting Africa's low per capita

The proposed merger represents a major threat to public health



SOPHIE MONGALVY/APP/GETTY IMAGES

Critical drivers

consumption of beer," targeting low income consumers to drive increased sales.⁴

This expansive trajectory echoes that of transnational tobacco companies, with which the alcohol industry shares strategic similarities and has close corporate links as well as comparable health effects.^{5 6} Thus far, however, global health and development agencies have engaged with these two industries on starkly contrasting terms.

Vector analysis

Tobacco companies are regulated as transnational vectors of disease on the basis of a fundamental conflict of interest with public health; voluntary approaches have been rejected as inadequate and inappropriate, and there are coordinated regulatory strategies centred on the WHO Framework Convention on Tobacco Control.⁶ Conversely, SABMiller, for example, participated in the UN high level meeting on non-communicable diseases that produced a declaration emphasising scope for voluntary measures and partnerships with producers in reducing alcohol related harm.⁸ SABMiller was also represented at a consultation on the process of reforming WHO's engagement with non-state actors,⁹ and company led initiatives have even received development funding from the UK's Department for

International Development and the Global Fund.^{8 10} The proposed merger with AB InBev represents a major threat to global health, to which researchers, funders, and regulators must respond more effectively. The new sustainable development goals provide opportunities here, through the focus (in goal 3) on reducing mortality from non-communicable diseases, including through strengthened prevention and treatment of harmful alcohol use. Importantly, the goal also includes a commitment to strengthen "the capacity of all countries, in particular developing countries, for early warning, risk reduction, and management of national and global health risks."¹¹

The global alcohol industry comprises such a risk and should be regulated accordingly. Currently it occupies an ambiguous space in which an indirect acknowledgment of serious health effects coexists with the prospect of partnerships and shared objectives.

Public health must therefore do more to ensure that conflict of interest with alcohol companies is recognised and addressed. Acknowledging such conflicts in the terms for WHO's interactions with non-state actors, and protecting against them on the same basis as for tobacco, would be an appropriate starting point.

[Cite this as: BMJ 2015;351:h6087](#)

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What the Paris talks mean for health

A strong deal to tackle global warming is essential to prevent more death and disease, reports **John Vidal**

What is happening?

This year's UN climate summit is the culmination of 20 years of intense talks to reach a new agreement to tackle global warming. It will be judged a success if the 196 countries going to Paris next week deliver a new, legally binding treaty committing all countries to reduce, or to cap, their greenhouse gas emissions. If it also gets them to increase their ambition enough to hold global temperatures to a maximum increase of 2°C by 2030 it will be seen as a historic deal likely to set the world on a clean energy path. Expectations are high because the climate situation seems to be worsening. This year has been marked by the highest average global temperatures, the highest concentrations of carbon dioxide in the atmosphere, and extreme weather, floods, and droughts across the world.

Any cause for optimism?

Yes. There will be dramas and fallout but over 160 countries, representing 85% of the world's emissions and including China, the United States, and the European Union, have already made public their intended cuts. In addition, many of the world's mega-cities have drawn up ambitious plans and over a trillion dollars has been divested from fossil fuel companies. Together these pledges will not hold global temperatures to the 2°C target, but negotiators are confident that ambitions can be raised in time.

What could go wrong?

Plenty. Until recently, most rich countries were confident of a deal,

if not a strong one. Since November, though, the mood has chilled. The negotiating text for the Paris talks is now much longer than it should be, and the reality of how difficult it will be to bridge major splits on key issues is now apparent. At least 100 countries will be pressing for a much more ambitious deal, some will grandstand and deliberately delay or undermine a deal, and the outcome depends on whether countries compromise enough to reach consensus. That means the French hosts and powerful players like China, the US, and the EU will have to twist arms tight to push a deal through.

What is the health element?

Climate change is now widely understood to be likely to undermine all gains made in global health over the past 50 years. A strong deal in Paris is recognised as the best chance to stave off more frequent and severe natural disasters, instability in food and water supplies, and the spread of infectious diseases, all of which affect human health. There will be no specific mention of health in the final agreement, but several health summits in the city over the next two weeks will argue that tackling climate change is practically and ethically essential to promoting public health.

Is money a problem?

Always. Developing countries will hold the rich to a pledge they made in 2009 to "mobilise" \$100bn (£70bn; €90bn) a year from 2020 for developing countries to use to reduce emissions and adapt their economies. Rich countries want to offer money from carbon markets



ALAN APAYDIN/BACAPPA

Climate change is likely to undermine all gains in global health over the past 50 years

and private finance, but poor countries do not trust this and want to see public money committed. Claims by the rich that over \$60bn was raised for climate finance in 2014 have raised questions about double counting and the redirection of existing aid budgets.

What is the mood like?

The political mood is far more positive than before the Copenhagen talks in 2009, but concern is growing that the negotiators have little time left to iron out differences in week one to give the politicians clear choices in week two. The Paris atrocities have added a sombre note and are expected to concentrate minds. But massive security around the 100 world leaders and 40 000 delegates will mean the talks will be held in effective isolation. All demonstrations have been banned for understandable reasons, but the danger is that governments will be seen as out of reach and unaccountable.



See our online tool to learn more about the health impacts of climate change at <http://bmj.co/cch>

And if it fails?

There is no alternative.

John Vidal is environment editor of the *Guardian*, London john.vidal@theguardian.com

Cite this as: *BMJ* 2015;351:h6316

Climate science: your questions answered

After *The BMJ* published an article on the science of anthropogenic climate change last year (*BMJ* 2014;349:g5178), it received questions about various aspects of climate science. Here **Flora Whitmarsh, Brian Hoskins, and David McCoy** answer some of those questions

Just as in the original article, we draw on the findings of the fifth report of the UN commissioned Intergovernmental Panel on Climate Change (IPCC),² the most comprehensive analysis of climate science available. Last year, the Royal Society and the US National Academy of Sciences also published a report, *Climate Change: Evidence and Causes*, which summarises the status of climate change science.³

How is the reported increase in Antarctic sea ice compatible with global warming?

Sea ice is not to be confused with the land based Greenland and Antarctic ice sheets, both of which are shrinking, as expected with rising temperatures. There has also been an overall global decline in mountain glaciers, permafrost, and snow cover, which is consistent with anthropogenic climate change. Whereas the extent of Arctic sea ice has decreased by 0.73-1.07 million km² per decade since 1979, Antarctic sea ice has increased by 0.13-0.20 million km² per decade.²

The anomaly in the Antarctic is due to its geography. Unlike in the Arctic, where the extent of sea ice is constrained by the North American and Eurasian land masses, Antarctic sea ice forms in the open ocean with less land constraining its formation. Antarctic sea ice is also thinner and mostly melts each summer, whereas Arctic sea ice survives longer (although the amount of sea ice lasting more than two years has declined rapidly since 1979). Changing patterns of Antarctic sea ice drift may also be linked to changes in local winds⁴ that may have been caused by the stratospheric ozone hole in the southern hemisphere.⁵

Half the temperature increase is claimed to have happened before 1950, while most CO₂ emissions have taken place since then. Doesn't this suggest that CO₂ emissions are not responsible for global warming?

This claim is incorrect. In the IPCC reports, linear trends for surface temperature (which are based on three datasets) show that global average surface temperatures increased by 0.85°C between 1880 and 2012, and by 0.72°C between 1951 and 2012. The evidence is strong that most of the warming since 1880 took place after 1950.

Some media reports say that the climate is less sensitive to CO₂ than the IPCC previously thought. Have predictions of global warming been exaggerated and can we have faith in the IPCC's future climate change projection models?

The measure of long term warming, which takes into account feedbacks acting over the course of several centuries, was estimated in the recent IPCC report to be between 1.5°C and 4.5°C. In the previous IPCC report, published in 2007, the lower end of this range was 2°C. The decision to reduce this (from 2°C to 1.5°C) in the more recent report formed the basis for claims in the media that the climate is less sensitive to CO₂ than previously thought.

However, short term warming due to a doubling of CO₂ over 70 years was estimated to be between 1°C and 2.5°C in the latest IPCC report, which is roughly in agreement with the 2007 estimate. This short term warming estimate is more relevant for policy because it defines the warming we might expect this century.

A more recent study, based on inserting observed values in a very simple model, estimated the short term warming to be 1.05-1.80°C.⁶ Although the upper end of this estimate is lower than that of the IPCC report, the study's findings still mean that it would only increase the time taken to reach a given level of warming by a few years. Thus, while there are uncertainties about the precise relation between increases in the rate and concentration of atmospheric CO₂ with the rate of global warming, these uncertainties have relatively little bearing on what we need to do in terms of climate policy.

Why is rising sea level a problem when this seems to be so slow at present?

Global sea level rose by an average of 19 cm between 1901 and 2010, at a rate of 1.7 mm/year. However, the rate of rise has been increasing and is currently about 3 mm/year and projected to be 8-16 mm/year by 2081-2100. This would result in global sea levels 26-82 cm higher than the 1986-2005 average, depending on emissions. Under the IPCC's highest emissions scenario, we are likely to see changes of up to a metre.

An estimated 1-2.3% of the global population live within 1 metre of sea level.⁷ Continued sea level rises compounded by increases in storm surges and intensity of storms and coastal erosion will place these and many more people at severe risk.

Is it true that the stratosphere is cooling, and how can this be compatible with global warming?

The stratosphere (the portion of the atmosphere between 10-18 km and 50 km above the land) has indeed cooled over the past 50 years, although this cooling

IAN JOUGHIN/NASA





The extent of Arctic sea ice has decreased by

0.73-1.07
million km² per decade
since **1979**

Over the course of several years, turbulent water overflow from a large melt lake carved this 18.3 m deep canyon in the Arctic

has levelled off recently. This is because, with increased greenhouse gas content, the stratosphere loses heat more effectively to space, as well as other factors such as ozone depletion and declining water vapour levels in the stratosphere. However, this does not negate the fact that ocean, land, and atmospheric temperatures below the stratosphere are increasing because of the greenhouse effect.

How can global warming be consistent with increasing cold weather in some locations?

Although global average surface temperatures have been increasing over decades because of human induced climate change, temperatures also fluctuate over shorter timescales because of fluctuations in the amount of solar radiation reaching the Earth's surface and internal climate variability.

As well as natural fluctuations in solar activity, the amount of solar radiation reaching the Earth's surface is affected by volcanic eruptions emitting small particles into the atmosphere. These reflect solar radiation and cause the globe to cool for one or two years.

Natural internal climate variability can also affect global surface temperatures through phenomena such as El Niño, which causes a release of heat from the ocean to the atmosphere, and La Niña, which causes the ocean to take up heat. Atmospheric and surface temperatures can also be strongly affected by heat exchange across the ocean, year and the weather pattern.

Is the claim that there hasn't been any significant rise in temperatures over

the past 18 years true, and can this be compatible with global warming?

Global average surface temperatures have definitely increased over the past 150 years. However, there has been substantial variability, including periods of short term cooling. The rate of increase in global temperature has been much smaller since 1998 compared with that of the previous 50 years. This is due to a combination of a downward phase of the solar cycle reducing the amount of solar radiation reaching the Earth, a series of small volcanic eruptions, and a redistribution of heat from the surface to the deeper layers of the ocean.

The absorption and distribution of heat within the ocean is important. Around 90% of the excess energy caused by increasing greenhouse gases is stored in the oceans, mostly in the top layers (above 700 m of depth). Heat penetrates to the lower layers of the ocean only when carried there by currents.

Heating of the shallower layers is not uniform either: the El Niño Southern Oscillation affects the uptake of heat in the surface layers of the Pacific from year to year, and similar processes occurring on decadal timescales may have contributed to the slower rate of global warming since 1998. However, this "pause" is inevitably coming to an end.

Isn't the natural interglacial cycle of the Earth more important than any human influence on the climate? And won't global warming help prevent the Earth from entering a new ice age?

The current interglacial era, which has lasted since the end of the last ice age, is driven primarily by changes in the Earth's orbit around the Sun; this varies on timescales of tens to hundreds of thousands of years.

Changes in the distance of the Earth from the Sun, caused by the Earth's elliptical orbit, influence the amount of solar radiation reaching the Earth. Changes in the tilt of the Earth's axis of rotation also affect the amount of solar radiation that reaches the high latitudes in summer, which is critical to the onset or retreat of glaciation. Furthermore, interglacial warm periods are enhanced by feedbacks such as the release of greenhouse gases caused by the initial warming.

The current warming due to greenhouse gas emissions is occurring much more quickly than warming would occur in the interglacial cycle and is happening during a warm period in that cycle. Concern over what we are doing to the climate should outweigh any concern over a move to a new ice age.

Isn't the IPCC a political body? Can we trust it to represent the science of climate change correctly and reliably?

Each statement in the IPCC executive summaries is linked to statements in the main body of the relevant report, which is written by hundreds of scientists who are unlikely to agree to any changes to the executive summaries that were not consistent with what they had written. The approval of the summaries by world governments lends political weight to the IPCC reports, but they remain evidence based scientific documents.

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Cite this as: *BMJ* 2015;351:h6216

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FROM THE ARCHIVE: THIS WEEK IN 1915

Charles A Morton disputes the claims of Sir Almroth Wright and other “aseptic” surgeons that antiseptics are of no value in the treatment of infected wounds. Sir Wright believes that as long as the wound is kept in a favourable condition the resistance of the tissues is enough to deal with the infection. He also claims that they can do no good at the time of infection because they cannot penetrate “the solid barriers of albuminous substance, provided in the early stages of the wound by exposed muscles and connective tissue.” Morton recommends free application, for a considerable period, of either hypochlorous acid or hypochlorite of soda solution, and ends by pointing out that surgeons opposed to antiseptics have inadvertently been using them in the form of—albeit weak and useless—saline solution.

• Cite this as: *BMJ* 1915;2:778

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John Tooke

The hunt for brown trout



John Tooke sprang to national prominence in 2007 when asked to lead an inquiry into Modernising Medical Careers, the new training structure for doctors. His report was generally welcomed and led to the creation of Medical Education England, the precursor to Health Education England. Originally a specialist in diabetes and vascular medicine, Tooke led the bid to establish the Peninsula Medical School and became its inaugural dean in 2000. From 2009 to July 2015 he was head of the School of Life and Medical Sciences at University College London and academic director of UCL Partners. He is president of the Academy of Medical Sciences and a director of BUPA.

What was your earliest ambition?

To play rugby for England, but premature fusion of the epiphyses and a lack of speed and talent prevailed. With the benefit of hindsight, medicine emerged as a goal in my early teenage years after delays in the diagnosis of my mother's brain tumour.

What was the worst mistake of your career?

Probably not leaving the Peninsula Medical School, which I had led from inception until the imminent divorce of the two parent universities.

What was your best career move?

Both my move out of London to Exeter in 1987 (which traditionalist colleagues viewed as career suicide) and my move back 22 years later to take on the vice provost health role at UCL—an institution with the creativity and the commitment to collaboration that, for me, represents what academia should be about.

Bevan or Lansley? Who has been the best and worst health secretary in your lifetime?

In terms of aggravating the primary/secondary divide (a real flaw in our system if we wish to realise truly integrated care) and committing further structural upheaval including distancing public health from mainstream medicine, Andrew Lansley has a lot to answer for.

To whom would you most like to apologise, and why?

To my golf partners, for putting up with my infrequent attendance at our supposedly weekly four ball game because of other pressures.

If you were given £1m what would you spend it on?

Selfishly: a flat in London so that I didn't have to give up my beautiful Devon home. Selflessly: charities that support childhood education in the world's most challenging environments.

Where are or were you happiest?

My time as a BHF research fellow in Stockholm was special: for the first time in my married life with two young children I achieved some semblance of work-life balance.

What single unheralded change has made the most difference in your field in your lifetime?

In the diabetes field, perhaps the rediscovery that patients are the key determinants of their outcome (something Robert Daniel Lawrence well understood) and that education and empowerment are critically important.

What book should every doctor read?

Atul Gawande's *Being Mortal*.

What is your guiltiest pleasure?

Bacon sandwiches, but I don't really do guilt.

What is your most treasured possession?

My Christian Strixner hand built split cane fly rod, given to me when I retired from my vice provost health role at UCL: a beautiful piece of kit with which to pursue my passion for fly fishing. When wading in a Devon river with overarching trees, searching for the haunts of the elusive *Salmo trutta* (brown trout), I am in my element, albeit with a wading staff close at hand.

Cite this as: *BMJ* 2015;351:h6245