Doctors online: "Like flies to honey"

The BMJ website is 20 years old this week. **David Payne** talks to Tony Delamothe, the launch editor, and fellow digital pioneers Richard Smith and John Sack about how the internet transformed doctors' reading habits

In 1995 most internet usage was in the United States. Physicians and academic researchers in North America waited two weeks for the latest issue of *The BMJ* to arrive by post.

Richard Smith, editor of *The BMJ* at the time of the website's launch, describes himself as a "natural early adopter of not only things that do turn out to be significant but also things that turn out to be crazy."

He adds: "It seemed to me the internet was going to have tremendous reach, that it offered possibilities of reaching out to a completely new audience. In those very early days the main users of the internet were US academics, and historically we had always tried to reach out to the US."

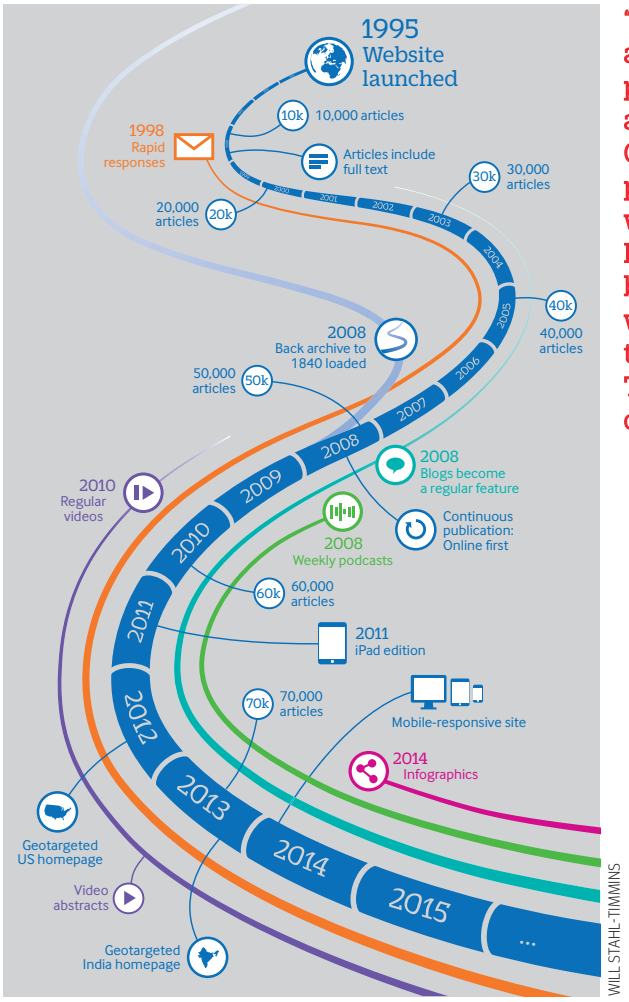
Smith urged his *BMJ* colleagues to discover all they could about the internet. At the time Ronald Laporte, now an emeritus professor at the University of Pittsburgh, had just published an editorial in *The BMJ*, "Global health and the information superhighway," outlining the internet's potential to connect public health practitioners worldwide through data sharing, email, and online journals.[1]

Tony Delamothe, deputy editor, says: "When it was published he said, 'I'm really grateful you published that editorial, but it's clear you understand nothing about this new world. I'm organising a study day in Washington. Why don't you come over and hear about what's happening?'

"Nobody really had a clue at the time, so I flew to Washington and spent time with people from NASA and the World Health Organization and the people making the website for the White House. On the plane back I filled a pad with all the wonderful things we could do.

"It was like the industrial revolution, being in at the beginning of something profound. You felt something big was happening, something groundbreaking and wonderful.

"We recognised the prime users of the internet were American academics. But it was the world wide web, and the whole world was out there."



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"I flew to Washington and spent time with people from NASA and the World Health Organization and the people making the website for the White House. On the plane back I filled a pad with all the wonderful things we could do." Tony Delamothe, deputy editor

Evolution

Between 1995 and March 1998 the online journal was a "brochureware site"[2] of selected highlights from the latest weekly print journal. But reader feedback requesting full text access to all articles necessitated the move to HighWire Press's scholarly publishing platform, based at Stanford University, California.[3]

HighWire Press had launched in the same week as *The BMJ* website,[4] and the journal was its first international general medical title. John Sack, HighWire's founding director, explains: "We were set up to provide a community approach to the development of the technology so that we would be tightly linked with the people using it—the researchers, the clinicians, the editors.

"We took a completely different approach in part. We started with a database, a text based search engine, hyperlinks that went everywhere. At the time many publishers, the large commercial publishers, were only doing hyperlinks within their own text.

"They were building these walled gardens, afraid to let people link somewhere else. Soon after that we came to Google's attention, which was also started at Stanford. We started participating with very large search engines. We connected with PubMed."

As well as providing full text articles, HighWire helped to solve the administrative problem of choosing letters for publication.[5] Smith explains: "*The BMJ* gets a lot of letters. Every morning I would be given a pile of yellow files of all the letters we'd received.

"We took ages to publish those letters [in print]. There were many of them we couldn't publish. And I always wanted to publish anything that was very critical. It seemed to me that's the nature of science and journals and arguments.

"When we launched rapid responses [in 1998] we were able to post them every single day, including Saturdays and Sundays. It meant readers could engage with the journal in a way that was much more real than engaging with it simply through paper."

HighWire also enabled the journal to cluster content around topic collections, as well as the print issue table of contents. Sack adds: "The concept of collections organised by something other than date enables someone to register, say, for updates about malaria, so they get an email every time *The BMJ* publishes something new in that area."

When *The BMJ* website launched, the internet had an estimated 30 million users. Ten years later there were a billion. By 2010 that figure had doubled. In 2014, there were three billion. Today around 40% of the world's population has web access.

Sack says: "The traffic numbers were pretty extraordinary. And once we connected Google in, I think [because of] the type of general medical content that *The BMJ* has, it was just like flies to honey."

Free access posed only a low risk in the early days, explains Delamothe. "We weren't affecting any of our revenue streams in the early days by giving everything away."

In 2004 the journal did introduce a business model that combines paywall content alongside open access articles.[6]

Delamothe says: "I sort of regret the introduction of access controls. We could have just hung on in there. Facebook doesn't charge and various other massive sites online don't charge and they get much more traffic. We might have been able to think about a business model down the line."

bmj.com at launch

When *The BMJ* website launched, the internet had an estimated 30 million users

Smith adds: "There was a time when it felt to me as if *The BMJ* had almost disproportionate influence because you could just go straight into the site, no password, no payment, nothing. We could be heard more loudly.

"I left just before access controls came in, but I am pleased that it is possible to keep the research freely available because the value of research is in the research. It's not in the publication of it."

Where next?

What will be the next big development in scholarly online publication? Sack says: "I think we're going to see a lot of change in how the consumer part of the web influences what the rest of us do.

"The scholarly web, the medical web, those aren't separate webs. Back in the 1990s, in the 1995 era, almost everything on the web was the academic web. But now we're so influenced by the commercialisation of things that I think we're going to see more and more rapid types of communication."

Smith adds: "I'm struck by how much things haven't changed. We're still a long way off fully exploiting the web in the distribution of science. It astonishes me that the scientific paper is still essentially the same as it was 200 years ago. We're beginning to have the possibility of adding the full data set. That surely should be happening faster than it is.

"In the high energy physics world, the minute authors finish a paper they put it up on a server. All the other physicists can see it, and a lot of them comment, and [formal] publication is the end of that process, not the beginning of it.

"We played around with the idea of doing something in medicine. We launched a site where people could do that. But virtually nobody did. People were just too scared.

"I've come round to the realisation that academics in many ways are the most conservative people in the world, which is sort of ironic. And maybe science academics are especially conservative. They cling to journals and impact factors and that way of thinking."

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ANATOMY QUIZ

Sagittal T2 weighted magnetic resonance image of the female pelvis

A: Outer myometrium
B: Inner myometrium or junctional zone
C: Endometrium and intraluminal secretions
D: Cervix
E: Posterior fornix of the vagina
F: Rectum
G: Bladder
H: Sacrum
I: Vagina

STATISTICAL QUESTION

Measuring the detriment of treatment: number needed to harm

Statements *b* and *d* are true, whereas *a* and *c* are false.

CASE REVIEW

A limp with an unusual cause

1 The main differential diagnosis is between polyarticular septic arthritis and reactive arthritis. Other possibilities include seronegative inflammatory arthritis, connective tissue disorder, and polyarticular gout.
2 Septic arthritis as a result of disseminated *N gonorrhoeae* infection is the most likely diagnosis because of the abrupt onset of arthritis and systemic illness shortly after sexual intercourse with a new partner.
3 Initial investigations include blood tests (white blood cell count, C reactive protein, erythrocyte sedimentation rate, blood cultures), radiography of the affected joints, and aspiration of synovial fluid from the affected joints for analysis (Gram stain, microscopy, and culture). Nucleic acid amplification tests should be performed on genital, pharyngeal, or rectal samples (guided by sexual history) to look for gonococcal and chlamydial DNA.
4 Gonococcal septic arthritis is treated with a seven day course of antibiotics. Current UK guidelines recommend an intravenous third generation cephalosporin (such as ceftriaxone), with a switch to oral therapy once there is clinical improvement and organism sensitivities are known. Sexual contacts should be sought and tested (partner notification).

Air pollution in UK: the public health problem that won't go away

Sixty years after the Clean Air Act, air pollution is back in the headlines

PHILIP TOSCANO/PA

The government has been accused of a failure to act while drivers of diesel cars, who were encouraged to believe they were doing the environment a favour, are now categorised as polluters in chief. Air pollution now kills 29 000 people a year in the UK, according to the headlines. In 2011 a Commons committee said: "The costs to society from poor air quality are on a par with those from smoking and obesity."[1]

How has this happened?

Air pollution of all sorts has declined sharply in the past 25 years according to official figures.[2] Nitrogen oxide levels have fallen by almost two thirds from their 1990 peak, and particulates have more than halved over the same period. But the decline has slowed, and recent studies of the health effects of these two pollutants have raised the bar. While pollution is actually lower than it used to be, the damage it does is better quantified.

Can it really cost 29 000 lives a year?

The figure comes from a 2014 report by the Committee on Medical Effects of Air Pollutants[3] and relates to particulates—small particles less than 2.5 microns in size, called $PM_{2.5}$. Using risk estimates calculated by a large American Cancer Society study of several hundred thousand people in US metropolitan areas, the committee concluded that mortality increases 6% for every 10 $\mu g/m^3$ rise in $PM_{2.5}$. At 2008 concentrations (8.97 $\mu g/m^3$) that was reckoned to have an effect on mortality equivalent to 29 000 deaths in the UK at typical ages of death.

There are big uncertainties. The committee estimated a 75% probability that the risk lay between 1% and 12%, so deaths could be as low as 4700 or as high as 51 000. That represents a range of loss of life expectancy at birth of between one month and one year.

As time passes, the science is becoming more robust, according to Ian Mudway of the environmental research group at King's College London. "It has become more pressing to deal with these issues," he told a Commons inquiry last year.[4] Meeting the current limits for particulates, nitrogen dioxide, and ozone should be seen as "the minimum expectation to protect public health."

Why is the UK in the dock?

The UK meets all European targets for particulates but falls short in reducing levels of nitrogen dioxide, which has serious, though less well documented, health effects. The European Commission has launched an action against the UK while the UK Supreme Court, in a case brought against the government by the environmental law group Client Earth, has ruled that the UK should draw up a plan by 31 December to cut nitrogen dioxide levels.

The main reason for UK non-compliance is diesel. Diesel engines emit more particulates and nitrogen oxides (NOx) than petrol engines, despite a succession of EU standards designed to clean them up. Particulates are reduced by filters that are fitted to newer vehicles approved under the Euro 5 regulations, but official tests used to measure NOx seriously underestimated the amount the newer vehicles would produce.

Real world NOx emissions from Euro 5 compliant cars approved since 2009 now exceed those on cars approved under Euro 1 regulations in 1992 and "are in the region of five times the limit value" the European Commission has admitted.[5] As Mudway put it: "The technology has not delivered."

The UK has encouraged the use of diesel cars through a favourable tax regime based on carbon dioxide emissions, with the result that in 2011 diesels outsold petrol cars in the UK for the first time. The rapid growth of diesel cars with high NOx emissions was thus the result both of mistaken environmental incentives and the failure of the EU testing regime.

Is the UK alone in missing targets?

No. The EU has 16 cases running against member states for breaches of particulate levels. The case against the UK is the first for NO_2 levels. Alan Andrews, a lawyer with Client Earth, says that the UK could have sought an extension to the deadline for meeting the EU standard, as other member states did, but chose not to.

What's to be done?

The long term answer is cleaner vehicles, such as electric, hybrid, or hydrogen powered. The Euro 6 regulations that came into force last September are tougher but tests to ensure vehicles meet them won't be introduced until 2017. It will then take at least a decade for the changing vehicle population to translate those improvements into lower pollution levels.

Short term, enforcing low emission zones can have worthwhile effects. London has had such a zone since 2008. Heavy vehicles that do not meet emission standards either have to clean up or pay £100 or £200 a day, depending on size, to enter the zone. Cars are not currently included but will be when the ultra-low emission zone is introduced in 2020. However, the new zone will cover a much smaller area (the congestion charge area), risking displacing polluting vehicles on to neighbouring streets. Transport for London claims that when all parts of the plan are implemented, NOx emissions in the zone should fall by up to 51%.

Other cities have been reluctant to follow, and there is no national framework. Germany has 50-60 low emission zones, the UK only one, plus three more limited efforts in Oxford, Norwich, and Brighton. A nationally enforceable standard that would oblige heavy goods vehicles and buses to retrofit pollution reducing technology should be the aim, says Client Earth, together with a shift to walking and cycling.

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