

Health for All, Care for You

Unlocking the value of
Personalised Healthcare in Europe

**A research report in
partnership with**

**Vlerick Leuven Gent
Management School**

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What is personalised healthcare? A methodology – enabled by modern genetic, biopharma, diagnostic and ICT technologies that attempts to tailor the treatment to the individual patient. Rather than one-pill-fits-all, doctors use growing knowledge of the human genome, and of other biomarkers of health and disease, to offer targeted prevention measures and to optimise treatment strategies. No one is suggesting treatment is not already personal, in that healthcare professionals make an assessment of each patient before deciding how to treat them. But the tools of personalised healthcare provide deeper insights and allow treatments to be more finely honed to individual needs.

The end result will be greater effectiveness, fewer side effects, longer and healthier lives, and more sustainable healthcare systems. The barriers include technology, financing, cost and change management. Personalised medicine is already in use in a few fields including oncology, cardiology, rare diseases. But introduction and uptake is still slow, not least in Europe.

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FOREWORD

Health for All, Care for You

The objective of personalised healthcare – to deliver more appropriate, targeted care – is something that patients, payers and providers embrace. But as was demonstrated in an initial programme of research on the subject, published by Science|Business two years ago, there is also some concern that despite the long-term benefits, personalised healthcare will push up costs in the short term, and this has created a barrier to its deployment.

In a second phase of research on personalised healthcare reported here, researchers at the Vlerick Leuven Gent Management School worked to develop health economics models to elucidate the cost benefits of taking a more personalised approach to screening and treatment for breast cancer in the first model, and prevention and treatment of acute cardiac syndrome (heart attack) in the second.

In the earlier research, 64 per cent of the 840 respondents to a survey carried out by researchers at the Karolinska Institutet said they thought personalised healthcare would deliver improved outcomes. And respondents agreed that while there are technical difficulties and change management issues, the main hurdle in the path of personalised healthcare is the need to demonstrate that cost benefits will follow on from the high up-front investment that will be required.

The need for a pan-European view was emphasised by the fact that 80 per cent of respondents to the Karolinska survey felt cooperation is needed at an EU level to deliver standards and operational frameworks to underpin personalised healthcare systems.

The first phase of research gauged opinions and sized up the barriers. Building on these findings, this second study uses real-life data to feed computer simulations of the impact that adopting personalised healthcare measures would have in breast cancer and cardiovascular disease.

Some of the outcomes are surprising, but the overall message is clear: personalised healthcare is not a leap of faith, but will deliver concrete improvements, driving up the quality of care, reducing the cost per patient and increasing the sustainability of our health systems.

Nuala Moran

Managing Editor
Science|Business



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About the report

The study into the cost benefits of personalised healthcare was conducted through a collaboration between Science|Business and Vlerick Leuven Gent Management School. The Vlerick team was led by Walter Van Dyck, Associate Professor of Innovation, with researchers Daniel Gassull, MBA, Gergely Vértes MBA, Prateek Jain and Muhilan Palaniappan. Erik Tambuyzer acted as Project Manager on behalf of Science|Business.

Support for the project came from a broad consortium, including Speedo International, Pfizer, the COST Office, the European Federation of Pharmaceutical Industry Associations, NXP Semiconductors and IBM.

The full results and bibliography are published online at www.sciencebusiness.net

Under the microscope: Studying the costs and benefits of personalised healthcare

New information and communications technologies – embodied in e-health systems – are key to unlocking the benefits of personalised healthcare. A study by Vlerick Leuven Gent Management School, in partnership with Science|Business, shows the combination of ICT and diagnostic stratification if scaled up to large populations in Europe, could improve patient care and reduce treatment costs for breast cancer and cardiovascular disease.

By NUALA MORAN

For the past decade, there has been mounting interest in personalised healthcare: tailoring treatment and prevention therapies to individual population groups. But progress has been slow. Why?

Certainly, the promise is high. A potent combination of computer and communications technologies, diagnostic tests, medical devices, new biopharmaceuticals and plain old patient management is increasingly seen as the way of the future for healthcare. To test that, a series of trials have begun in Britain, France, Germany, Belgium, Sweden, the US, Canada and other developed nations.

But it's by no means a done deal: broad deployment, across an entire national health system, is still some time away. The obstacles: cost, training, administration, financing – in short, everything to do with the slow, cumbersome machinery of preventing disease, and treating illness among diverse populations of millions of people.

The nub of the problem – big promise, but big obstacles – was highlighted in a 2010 study by Karolinska Institutet, the famed Swedish medical school, conducted in collaboration with Science|Business. In a telephone and online survey of healthcare professionals, researchers, industry executives and government authorities in four EU countries, the Karolinska team found strong agreement on two, seemingly paradoxical points:

1. In the long run, personalised healthcare can improve patient outcomes and save money.
2. In the short run, personalised healthcare will cost a lot of money.

It's also noteworthy that these attitudes are uniquely European: in the US, experts say, a more jaundiced view of personalised healthcare seems to have taken hold – perhaps a victim of the partisan warfare in Washington over the future of healthcare generally. In Europe, by contrast, the Karolinska study showed that a majority of experts still have a broadly optimistic view of the technology's potential, even as they are aware of the potential difficulties.

So now, in a second phase of research, we probe more deeply into the whys and wherefores of these attitudes. Why the difference between short-term and long-term costs?

The new research, by Vlerick Management School during 2011, gathered data from personalised healthcare studies in several countries and used the data to simulate “what if” scenarios in which new personalised healthcare tools are implemented. The simulations are intended to provide health economics models of the benefits both for individual patients and for healthcare systems.

The potential cost savings, according to the Vlerick study: 37 per cent for breast cancer, and 46 per cent for cardiovascular disease

THE VLERICK LEUVEN GENT MANAGEMENT SCHOOL STUDY

The study focused on interventions in two areas – screening for and treating breast cancer, and prevention of acute coronary syndrome – heart attacks (as an example of cardiovascular disease) and probed the data to understand which types of costs were pushing up the bills, and which types of intervention could help patients the most. The researchers ran the data through their statistical models, simulating the kind of population-wide scenarios that a health authority would need to consider.

Obviously there are many ‘ifs’ in this kind of analysis: it’s based on the results of individual pilots and trials in different countries, and it depends on the fidelity of the computer models. And of course the validity of the outcomes depends on execution of the changes that are modelled – cost savings will not reach the bottom line if resources are simply shifted to another disease area. But it is, in health economics, an increasingly common method for experts to run ‘what-if’ scenarios – and it is a widely-used way to tease out the difficult answers that a health ministry or private insurer will need, in order to decide on their own strategies for personalised healthcare.

Still, the outcomes are surprising – with good news, and bad news, for all parties. Here’s a summary.

Health economics models for personalising healthcare

The aim of the study was to generate a health economics framework for making healthcare systems more personalised. The two disease areas were selected with the help of clinical advisers and experts who were interviewed in depth by the Vlerick researchers (a list of interviewees appears on page 24). As a result of these discussions, breast cancer and cardiovascular disease were singled out as being areas where there is relevant, robust data around which to build a model, and because there is some existing evidence that the personalisation measures assessed in the computer simulation have an impact on outcomes.

In the breast cancer model the objective was to assess the impact of smarter screening to pick out women most at risk, followed by stratification of patients into different types in subsequent rounds of screening. The aim: to identify women at the early stages of the disease and treat them with therapies that are now available that can cure breast cancer if it is treated early; reduce overall costs by screening women at low risk less frequently; and reduce the number of women with late-stage disease, which is harder (and more expensive) to treat.

Cardiovascular disease covers a broad range of pathologies. The study took one of these, acute coronary syndrome – which leads to heart attack – and looked to see if three personalisation measures applied at different points across the treatment pathway from prevention, assessment and follow-up, would reduce the number of patients needing to be treated as emergencies in ER. (Emergency Rooms).

QALYs as the measure of value

Both studies used one of the main tools of Health Technology Assessments, the QALY, or quality-adjusted life year, as the yardstick for assessing cost-effectiveness. Although accepted as being somewhat crude, the QALY is a measure intended to make it possible to compare the value of a treatment or intervention for one disease, with that of another treatment or intervention for a different disease.

QALYs are a measure of increase in life expectancy and quality of life derived from any treatment. In a QALY 0 equals death and 1 equals perfect health for one year. QALYs are used in a number of countries for assessing the “health gain” of individual treatments and of judging the value of a treatment or intervention in one disease against the value of a treatment or intervention in another.

Breast cancer and cardiovascular disease were singled out as being areas where there is relevant, robust data around which to build a model, and because there is some existing evidence that the personalisation measures assessed in the computer simulation have an impact on outcomes

Study One

Health-economic impact of new strategies for personalised healthcare in breast cancer based on electronic health records and diagnostic technologies

The choice of breast cancer in women

- There is great interest from scientists and a strong and growing body of knowledge relating to more personalised approaches to treating cancer.
- Among various cancers where personalisation is being applied, breast cancer has been chosen because:
 - Breast cancer is the cancer of highest prevalence among women in a number of countries in Europe ⁽¹⁾
 - There is a high cost of treatment – around €900 million per annum in the UK ⁽²⁾, for example
 - Breast cancer guidelines and screening programmes are in place and are largely harmonised across Europe, making it a good exemplar
 - Risk factors and screening/diagnostic technologies are available and are more reliable than is the case for other cancers ^(3,4)

(1) [http://www.nice.org.uk/CG80-](http://www.nice.org.uk/CG80)
 (2) www.nhs.uk and www.hm-treasury.gov.uk
 (3) Featherstone H, et al. "The cost of cancer", Research Note 2010, Policy Exchange
 (4) <http://www.breastcancer.org/symptoms/diagnosis/>

SNP Test (Diagnostic Technologies)

- SNP test (Single-Nucleotide Polymorphism diagnostic test) is a genetic diagnostic test used for detecting mutations of relevant breast cancer genes in individual patients.

Mutations critically enhance the risk of breast tumour development in women ⁽¹⁾

- BRCA1 and BRCA2 (high mutation prevalence)
- TP53, FGFR2, TNRC1, MAP3K1, and LSP1 (medium mutation prevalence)
- CHECK2, gene (ATM), BRIP1, PALB2 (low mutation prevalence)

- A wide range of SNP tests for breast cancer are commercialised by various European and US enterprises.

(1) <http://cancerhelp.cancerresearchuk.org/type/breast-cancer/about/risks/definite-breast-cancer-risks>

One of the main reasons for choosing to study the effect of personalisation in breast cancer is that guidelines for screening are in place and tend to be harmonised across Member States.

Another factor making breast cancer a good exemplar is that there are a number of genetic and other risk factors which are generally accepted as being relevant for diagnosis and prognosis, and for which tests are available.

The data used in the study came from the UK where all women over 50 years of age are invited for regular screening. If that points to a potential problem, a woman is recalled for further tests, and moves further along the diagnostic and treatment chain.

Obviously, the more women that progress to further assessment and treatment the greater the cost for the health system. At present all women over 50 are screened at regular intervals, but what if there was a way of stratifying according to risk profile? This would justify reducing the frequency of screening for those at low risk and concentrating more attention on women with recognised risk factors, be it family history or breast cancer genes, for example.

As the SNP Test table shows the means are already at hand to test for a panel of single nucleotide polymorphisms – a DNA test – that will make it possible to stratify women into high and low risk groups and screen them accordingly. This is done by factoring together genetic risk and medical history using risk analysis software to

interrogate comprehensive electronic health records. Such electronic health records contain a complete medical history and the digital format enables the risk analysis to be run automatically.

The team at Vlerick used a computer simulation to assess the costs and benefits of applying such stratification to 100,000 women over 25 years. They assumed that all the women are free of breast cancer at the beginning of the simulation and thus have a QALY of 1. The team based the simulation on 2011 treatment guidelines for breast cancer by the UK National Institute for Health and Clinical Excellence, and drew on experimental data from the KU Leuven

teaching hospital in Belgium and the UK National Health Service database, access to which was provided by Cancer Research UK.

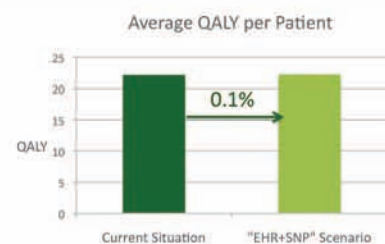
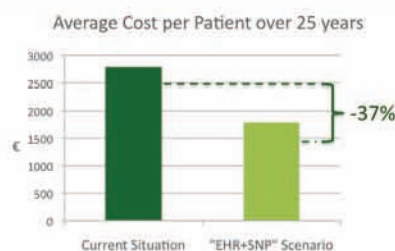
Result One

Taking the 100,000-strong cohort and running the model over 25 years, the average cost per woman of treating breast cancer falls by 37 per cent.

However, because even today mortality from breast cancer in the developed world is not as high as it once was, the impact of this treatment on the health of the entire, average population is not great: That is, there is only a marginal improvement in terms of QALYs. Why?

RESULT 1: On average, the implementation of new screening strategy reduces total patient cost of healthcare by 37% without affecting average QALY

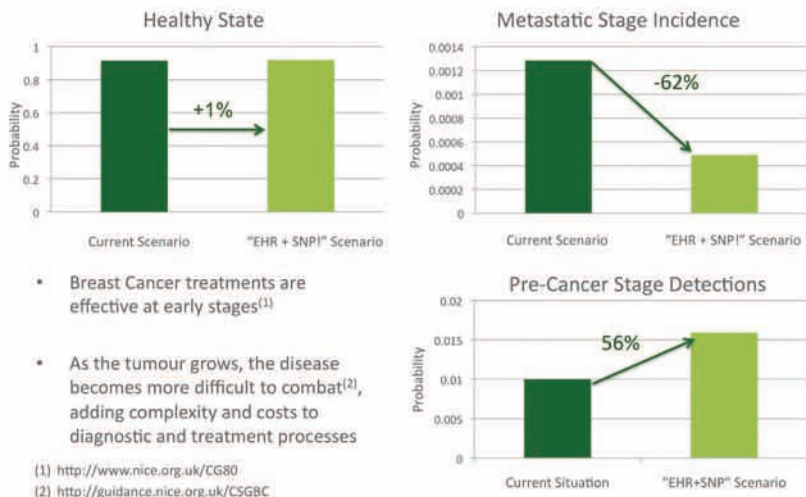
Scenario	Average Cost per Patient over 25 years	Average QALY over 25 years	Δ Cost (%)	Δ QALY (%)
Current	€2845	21.99		
EHR + SNP	€1788	22.02	-37 %	0.1 %



Incremental Net Monetary Benefit*	€84 / patient / year
Incremental Net Health Benefit*	0.0024 QALY / patient / year

*Willingness-to-pay = €35,000 / QALY

RESULT 2: New segmentation strategy reduces the incidence of advanced stages of the disease (metastatic) by detecting cancer at an earlier stage (Pre-Cancer)



The big cost savings come from catching more women earlier in the disease cycle – avoiding the costs that would come from late-stage treatment with surgery, radiation and other expensive therapies.

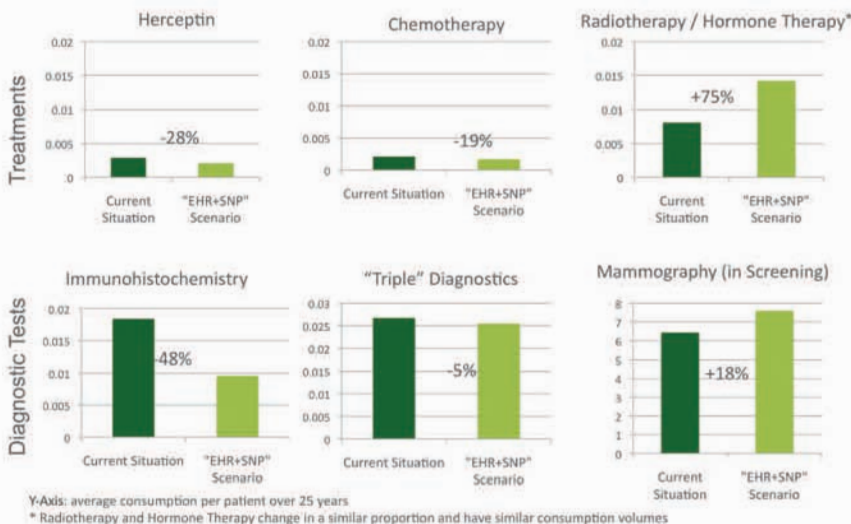
But because those expensive treatments are pretty effective already, the health impact – averaged across an entire nation of millions of women – is not very noticeable.

The bottom line: these technologies are a cheaper way to tackle the breast cancer problem. The outcome is no better or worse, but the cost is a lot less – and that matters to healthcare budgets.

Result Two

As you would expect from the foregoing, there is a significant drop in the level of advanced, metastatic breast cancer. Overall, 56 per cent of the women are diagnosed with breast cancer at the earlier stages of the disease rather than progressing to later stages that are more costly to treat.

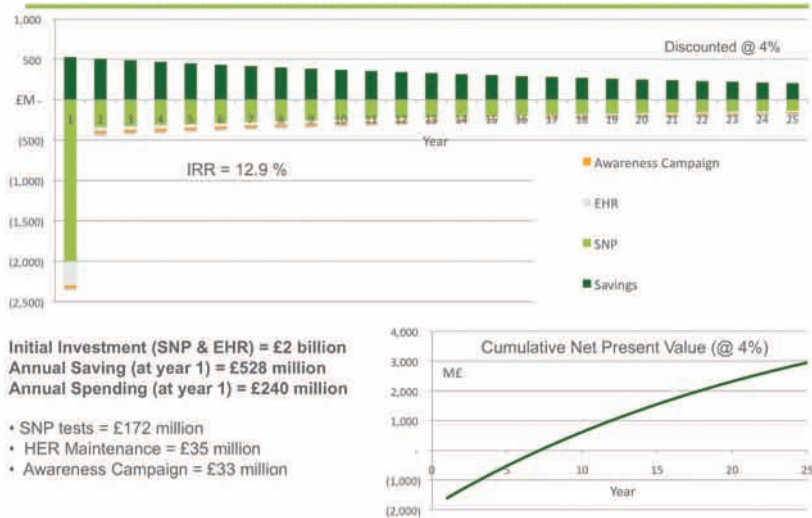
RESULT 3: New segmentation causes increased screening while utilisation rates of treatments and diagnostics for advanced stages decline



Result Three

The use of chemotherapy declines by 19 per cent, between the current (real life) system and a stratified system using electronic health records and genetic testing. On the other hand, the use of radiation treatment and hormone-based drugs, which are deployed in the earlier stages of disease, goes up by 75 per cent. Again, the technology is shifting the entire treatment profile to an earlier stage of the disease. So, more early-stage treatments and fewer late-stage treatments. Result: net lower cost.

RESULT 4: Pay-back of investments in EHR and SNP tests to target population is achieved in 6-8 years and savings climb up to £3 billion in the UK-based model over 25 years



Overall, the computer simulation shows that smart screening results in better detection at an earlier stage, when the disease is more easily treated. Keeping women in the earlier stages results in lower cost of treatment. In total the model shows an incremental net monetary benefit of €84 per patient per year.

Result Four

This saving, however, does depend on a large capital expenditure up front to bring in the new system, and with the computer simulation calling for an investment of £2 billion, it is six to eight years before this investment starts to deliver net benefits. In addition, it should be noted that delivering this saving depends on the successful implementation of the new stratified screening system.

Study Two

Cost effectiveness analysis of investments in prevention and in diagnostic technologies and telemonitoring in cardiovascular disease

Why choose acute coronary syndrome (ACS)?

- Cardiovascular disease as a whole has attracted attention from the scientific community as being an area where prevention, diagnosis and treatment is amenable to personalisation.
- Among various cardiovascular diseases, ACS has been chosen because:
 - The main risk factors can be addressed via prevention and lifestyle programmes ^[1], for example, the risk of recurrent coronary events decreases by 50 per cent one year after stopping smoking ^[2]; high risk of coronary heart disease is amongst the adverse health effects that are known to be associated with being overweight ^[3]
 - ACS is one of the most preventable causes of death
 - There is a high incidence rate and a very high cost for healthcare systems
 - ACS is chronic disease that reduces quality of life for patients over a long term.

1. <http://www.nejm.org/doi/full/10.1056/NEJlAa2706740>
 2. <http://medlineplus.gov/medlineplus/article/01919735-overview/anc2aa66b2b4>
 3. <http://circ.ahajournals.org/content/117/24/3062.full.pdf+html>

Exercise is good for you. We all know that. But if you are a general practitioner, that knowledge becomes a professional tool when confronted with different patients, each with different risk profiles. In this light, the possibility of prescribing specific types of exercise, combined with new diagnostic and monitoring technology can take the individual care that GPs have always provided to new, more personalised levels.

Prescribing exercise is a form of personalised treatment, with the GP in control. At the same time point-of-care diagnostics permit GPs to make more precise assessments of a patient's condition, and telemonitoring helps improve compliance in patients who are prescribed statins to control their blood cholesterol levels following treatment for a heart attack.

The Vlerick Management School research considered the impact of three approaches:

1. Exercise – keeping people out of the system in the first place by encouraging people to take more exercise. This has been shown in various studies to have a beneficial effect, reducing the incidence of heart attacks by 10 per cent on average. These studies have not distinguished between the benefits of different types of exercise. Awareness campaigns to promote more exercise need to be sustained over several years to be effective and this can be expensive.
2. Point-of-care – this new technology

enables GPs to diagnose at the bedside or in their surgeries, instead of referring patients for tests in hospital. This not only has a cost impact in terms of testing, it also means more patients are managed by their GPs, and fewer people end up in ER.

3. Telemonitoring – people who have suffered one heart attack are at risk of having another. Adherence to drug therapy with statins to reduce cholesterol levels is an important element of preventing another attack. However, patients often neglect to take these drugs because the therapy is long-term and has no immediate impact on how they feel.

There are telemonitoring systems to

provide automatic reminders and also to provide alerts to health care staff if a patient appears to be at risk of another attack. Telemonitoring should reduce costs by increasing compliance with cholesterol-reducing drug therapy and by enabling pre-emptive treatment if another heart attack is threatened.

However, such monitoring systems do raise the question of who is responsible for responding to alarm – the GP? A cardiologist? A nurse in a call centre? – and this has implications for the cost of telemonitoring.

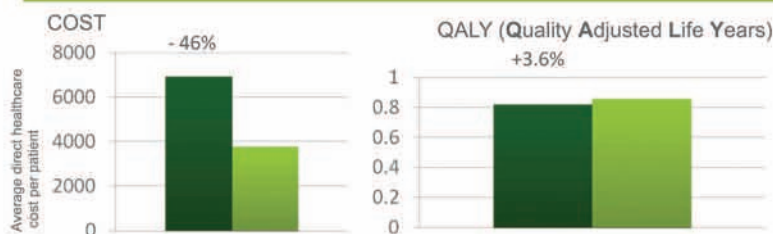
On the basis of published data, the research concluded that monitoring would cost €1,200 per patient per year and reduce hospital admissions by 10 per cent. Data sources included, in the UK, the York Health Economics Consortium and in Belgium, the KU Leuven teaching hospital.

Experience gathered from the real-life deployment of one such system, Bosch's Health Buddy, shows compliance with taking medication increases dramatically. The Vlerick study found even a doubling of compliance from the current level of 34 per cent – well within the improvement claimed by Bosch – could have a profound effect on cost.

Result One

The researchers ran the computer

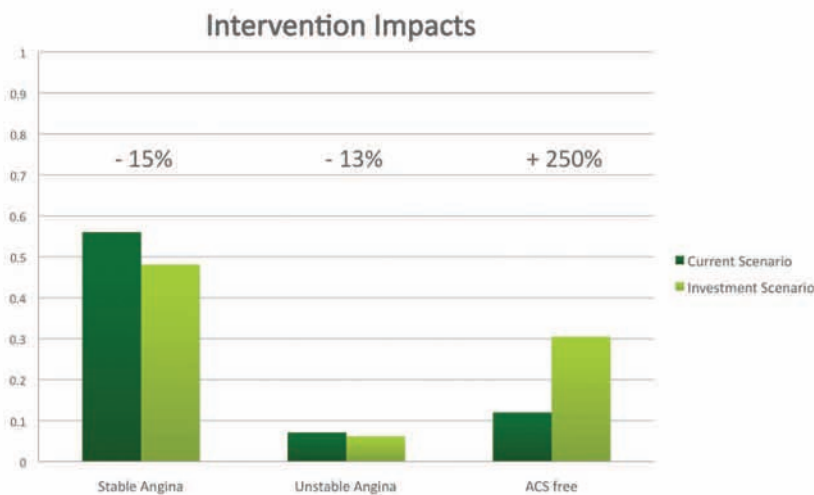
RESULT 1: UK – (Based on data from 2004) cost reduction of 46% and QALY increase of 3.6%, but...



	COST per Patient	QALY	Cost Δ	QALY Δ
Current scenario	€6920	0.819		
Investment scenario	€3755	0.855	- €3165 (-46%)	+0.036 QALY (+ 3.6%)

...this is highly dependent on two critical and uncertain factors, which are: probability of patient adherence to medication and cost consequence of non-adherence to medication.

RESULT 2: Reduced incidence of ACS and doubling of 'healthy' citizens in the cohort population



RESULT 3: Increase in QALY shows that all three interventions should be implemented (UK data shown)

Health Care Intervention	Δ Cost (€)	Δ QALY	INB (€)	IHB (QALY)
Primary Prevention (exercise)	292	0.018	927	0.026
Point of Care Technology (remote testing)	480	0.006	690	0.019
Tele-Health Monitoring	-3008	0.019	3674	0.104
TOTAL (3 Technologies combined)	-3164*	0.036	4424	0.126

*Interventions impact different populations sizes based on probabilities and do not sum vertically

INB= Incremental Net Monetary Benefit (€)
 IHB= Incremental Health Benefit (QALY)
 WTP = Willingness to Pay (€35k / QALY)

simulation applying all three approaches simultaneously. The aim was to keep patients with chest pains who were not at immediate risk of a heart attack out of ER. Overall, costs fell by €3,165 or 46 per cent, compared to the status quo.

Result Two

Taken separately, the effects of primary prevention through exercise, the use of point-of-care, and the use of telemonitoring are all positive. Overall, in the model population there was a big increase in the number of people who remained free of acute coronary syndrome.

This points to a difference in what personalisation means in cardiovascular disease versus breast cancer. Preventative measures can have a much greater impact in cardiovascular disease.

Result Three

In the 100,000 subjects in the model there was not just a cost-benefit, but also a health benefit.

Result Four

Using the three personalisation measures in combination resulted in:

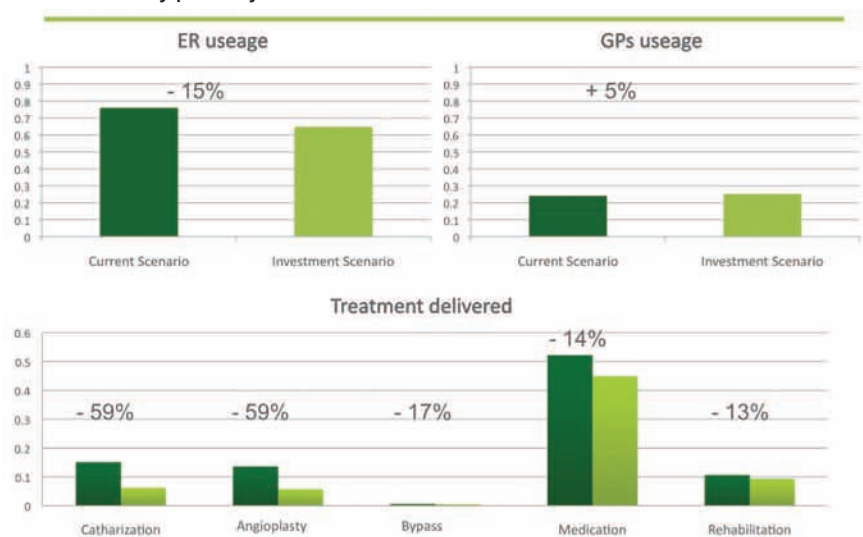
- a 15 per cent reduction in referrals to the emergency room
- a 59 per cent fall in angioplasty
- a 17 per cent reduction in bypass surgery
- a 14 per cent drop in the use of medicines
- a 13 per cent reduction in the use of rehabilitation services.

By contrast, there is a 5 per cent increase in the use of GPs' time – as the family doctor becomes an even more important part of the healthcare system.

In terms of return on investment, the biggest saving comes from telemonitoring, with an investment of €160.5 million per annum on equipment, saving €824.5 million per annum overall.

From a pure cost perspective, it might be argued that telemonitoring should be deployed in preference to prevention measures or point-of-care. However, telemonitoring benefits the smallest number of people – that is, those who have had a heart attack. From a health economics perspective, the bigger benefit is derived from keeping people out of the system in the first place, by encouraging them to do more exercise, or treating them before they have a heart attack.

RESULT 4: Reduced healthcare consumption and increased utilisation of less costly pathways



Based on the evidence available currently, these technologies could cut costs in the long run, and improve the health of populations overall

Personalised healthcare has the potential to improve health and cut costs

In summary, the two worked examples, based on real life data, demonstrate there are significant long-term savings from investing in prevention, point-of-care and telemonitoring. The computer simulation looks at implementing personalised healthcare measures overnight, but in the two examples of breast cancer and acute coronary syndrome, introducing personalised medicine would take time.

As the researchers also point out, healthcare systems in different member states offer different levels of provision, leading to variations in the size and timing of the benefits that will accrue on the introduction of personalised healthcare. In terms of prevention, women are more health-aware than men, and this would also have an influence on the outcomes.

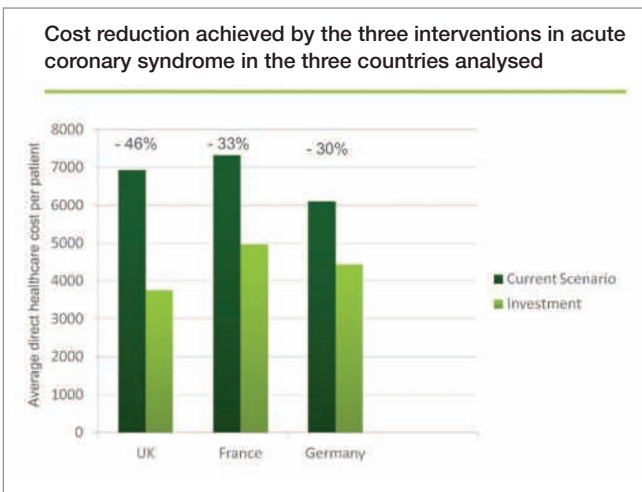
The business case for personalised healthcare will need to be looked at country-by-country, because the timing and the extent of benefits will vary, depending on the prevalence of and provision for, particular diseases, as the figures below show.

It should also be noted that if the results seen in these computer simulations play out in real life, there will be significant and important benefits that are not captured in these studies. The researchers had to confine the parameters to make the study manageable, and so did not fully capture the value of people remaining healthy, active and able to work.

But the bottom line emerges pretty clearly: based on the evidence available currently, these technologies could cut healthcare costs in the long run, and improve the health of populations overall. They would do so by stratifying patients into at-risk groups early on in a disease cycle, so that low-cost prevention measures can be prescribed, or inexpensive early-stage treatments can be administered. Fewer people would progress to the later, more-costly stages of these diseases.

For Europe, experts in the field say, this poses a special opportunity. The unified, government-led structure of healthcare systems in most European countries encourages the kind of broad, population-wide economic analysis that the Vlerick researchers conducted. If you look at this from a health economics-point of view, it starts to make sense – and that view can be important to health ministries and authorities in Europe. This is also true in the US, but there, by contrast, the fragmented nature of healthcare leads to more decisions being made on a micro-economic basis, from the point of view of individual insurers or health maintenance organisations.

So it is just possible that Europeans could be the first to benefit from these technologies.



Three interventions together are cost-effective in each country
Health economics interpretation of the results

Country	Δ Cost	Δ QALY	ICER	INB	IHB
			$ICER = C_1 - C_0 / E_1 - E_0$	$INB = WTP \times (\Delta Q) - \Delta C$	$IHB = \Delta Q \cdot QC / WTP$
UK	-3164	0.036	-87896	4424	0.126
FR	-2359	0.036	-65528	3619	0.103
DE	-1660	0.036	-46111	2920	0.083

ICER = Incremental Cost Effectiveness Ratio
 INB = Incremental Net Monetary Benefit
 IHB = Incremental Health Benefit
 WTP = Willingness to Pay (€35k / QALY)



Ruxandra Draghia-Akli, European Commission

There are thousands of diseases in the current classification, noted Ruxandra Draghia-Akli, Director of the Health Directorate at DG Research and Innovation. In introducing personalised healthcare changes will be needed, for example breast cancer will be classified as a number of subsets, not a single disease. Conversely, diseases now classified as different entities may turn out to involve a single pathway.

“In effect we are looking at refining the definition of health and disease – to the point where the current definitions will be obsolete,” Draghia-Akli said.

This is necessary since many current drugs have limited efficacy. Either they don't address all patients affected by the disease, or patients may not be able to metabolise them in an optimum way.

Personalised medicine has the objective of ensuring correct diagnoses – to prevent inappropriate treatment and to deliver the right dose for the right patient, at the right time. “We will need arduous studies to show what changes need to be made,” said Draghia-Akli.

There will be a “triple win” from achieving this, with benefits for patients, cost-savings from not administering ineffective drugs, and the promotion of innovation in drugs that are targeted and will provide a greater treatment effect in patients who respond.

The basic research and innovation needed to achieve this has been scoped by the health unit at the European Commission and will be advanced in the Horizon 2020 research programme running from 2014 – 2020. A number of projects will be pursued to cement the foundation stones of personalised medicine into place:

- Increasing and systematising understanding of the relationship between genes and disease, building on genome sequencing and large scale genome-wide association studies
- The development of tools for analysing data and stratifying patient populations – this will enable the pharmaceutical industry to develop more targeted drugs and allow information coming from the 'omics (genomics, proteomics, metabolomics, etc) to be applied to better classify disease
- Testing personalised medicine approaches in humans – an area of research that will be particularly important and complex – to allow uptake of these new therapies into healthcare
- Redefining disease – which alongside creating new markets will provide the means to ensure people are getting the correct treatment. This is a really big opportunity, Draghia-Akli believes. It may be more expensive in the first instance, but currently 30 – 60 per cent of patients are prescribed drugs that will be ineffective for them, or cause adverse reactions.

Driving uptake by the European Union's healthcare systems will be difficult, Draghia-Akli said, noting there are technologies available today that could revolutionise treatment, but are difficult to get into practice.

Above all, it is important to put patients at the centre. “Remember we are doing it for them, for all of us,” Draghia-Akli said.

EU healthcare R&D has made progress already in putting the pillar of personalised medicine in place, with a number of projects on patient stratification, genetic biomarkers, epigenomics, the validation of

biomarkers and the use of rare diseases as models for personalised medicine, amongst others, getting funded in 2010 – 11.

In addition to this list, the EU has also contributed to international projects, including the Cancer Genomics Consortium, The International Human Genomics Consortium and MetHit, a project that is unravelling the genomes of all the microflora that inhabit the human gut and have such a profound effect on drug metabolism.

The area of personalised medicine will be in the forefront of future development in healthcare. “We are certainly preparing and the Health Directorate of DG Research and Innovation has a unit dedicated to it,” Draghia-Akli said

One thing is evident – the huge amounts of data involved in redefining disease according to its genetic influences, and stratifying patients on this basis, and on the basis of other 'omics data, will require investment in ICT to make the information useful.

DG Research and Innovation and their colleagues from other DGs have placed priority on ensuring the immense amounts of data in 'omics projects are underpinned by a common approach to data collection, handling and storage, Draghia-Akli noted. “We do want to be more integrated and we always keep harmonisation in mind. It is difficult though: we are in a global situation; whose rules are going to apply?”

The challenge for Horizon 2020, “Health, Demographic Change and Wellbeing,” will work on these issues. “It will take a comprehensive view, looking across health, prevention, diagnosis, treatment and care in an integrated way,” Draghia-Akli concluded.

“In effect we are looking at refining the definition of health and disease – to the point where the current definitions will be obsolete.”

Zoran Stančič, European Commission



ICT is a critically important element of personalised healthcare, and DG INFSO has been working in concert with DG Sanco and DG Research and Innovation to overcome barriers hampering its implementation, noted Zoran Stančič, Deputy DG, Information Society and Media Directorate General.

In the last ten years there has been a wealth of activity in R&D and piloting of smaller e-health systems, receiving many million euros of financing, and bringing together stakeholders from industry and academe to produce a wealth of new knowledge.

More recently, the Commission has supported larger-scale pilots involving public authorities from member states, and moving on from research to deployments of e-health systems. This can be difficult: the health sector is huge, at around 10 per cent of total GDP, or €1.5 trillion per annum. "Because healthcare is so big and so many people have an interest, it is a very sensitive issue – you can't revolutionise it just like that," Stančič said.

In this respect the launch of epSOS – European Patients – Smart Open Services – on November 10, 2011 was an important step forward. epSOS makes it possible for patients to access their data held in one member state, in the language of a medical practitioner who is treating them in another member state. Apart from the obvious utility, epSOS also provides a working demonstration of how to provide secure online access to medical records and e-Prescriptions across borders.

Improving regulations

The Commission is also making continuing efforts to improve the regulatory framework. The recently adopted Directive on Cross-Border Healthcare has the double benefit of improving provision for patients, whilst also providing a live demonstration of the value of technical standards and harmonised regulations in the field of e-health.

Healthcare remains the responsibility of individual member states. However, said Stančič, "We are also trying to engage more with national authorities in an e-health task force, to bring together individual patient groups, industry and professionals working in health. This is crucial: you can't impose things; everyone has to be engaged from the beginning."

In addition, a series of government level e-health initiatives are being coordinated by the Austrian Ministry of Health, to build more cooperation and bridge from R&D to full-scale deployment. "We want everyone to see the benefits and to drive forward deployment," Stančič said.

Horizon 2020 and Innovation Union

While e-health has reached the stage where it is ready for deployment, DG INFSO will continue to fund R&D to support the application of e-health to personalised healthcare. One significant initiative looking to deploy research findings in the public and private sectors will be the EU's Innovation Partnership in Healthy Ageing.

The new approach to be adopted by Horizon 2020, the Commission's proposed €80 billion R&D and Innovation

programme, to run from 2014 – 2020, will also propel e-health and personalised healthcare further forward, Stančič believes. "The move to bring together research and innovation to address societal challenges is very important," he said.

Barriers to adoption

epSOS and the Cross-Border Healthcare Directive are demonstrations of progress, but one major obstacle remains to the deployment of e-health – the need to improve the IT skills of medical practitioners. Senior health personnel find it very hard to find the time for developing new skills, Stančič said.

In addition it is necessary to:

- Create clear incentives, by showing how e-health saves time
- Provide legal clarity about what is permitted in dealing with personal medical data held in a digital format
- Build confidence and skills in IT procurers
- Have concrete data to demonstrate cost benefits, both in financial terms and in terms of patient satisfaction.

"We have a wealth of knowledge; we need to demonstrate cost benefits across different domains," Stančič concluded.

"We are also trying to engage more with national authorities in an e-health task force, to bring together individual patient groups, industry and professionals working in health."

The prize of personalised healthcare is there, but how to attain it?

A look at what it means for policy makers

The message from the Vlerick research is clear: personalising healthcare will deliver benefits for patients, who will suffer less disease overall and less severe disease in general. At the same time it will reduce the cost per patient of treating disease. And although this was not assessed in the research, it follows that there will be societal benefits flowing from reduced morbidity and dependence.

That is the vision, but the question remains of how to attain it. The research adds to a growing body of academic knowledge, reinforcing further what has been learned from pilot studies. And it feeds seamlessly into work on healthcare policy now progressing in capitals across Europe.

To explore the policy implications, Science|Business organised a roundtable discussion on 24 November 2011 in Brussels, with leading officials of the European Commission, industry executives and academic experts. Hosted by the British Ambassador in Brussels, the meeting produced an action list for policy-makers and healthcare providers:

- 1. International standards are needed for e-health systems interoperability**
- 2. Unique European patient identification numbers will be required**
- 3. Active systems with minimum/emergency data records are providing useful services and should be used as exemplars to build public and medical confidence in electronic health records**
- 4. There have been many pilots of e-health and personalised healthcare, and some of personalised medicine. Now it is time to apply this knowledge to large-scale trials**
- 5. Individuals should be able to access and acquire information to monitor and manage their own healthcare, in terminology that they can understand**
- 6. There must be more interplay and engagement between bottom-up and top-down (policy) initiatives**
- 7. The cost per patient of personalised healthcare is lower, but realising savings will require systemic/organisational change.**

E-health is one of the foundations of personalised healthcare, and Europe's healthcare systems cannot deliver personalised care unless the broad array of technologies that must be brought to bear are linked together through the glue of information and communications technology, embodied in robust e-health systems.

There is a risk that the chronic under-investment by the health sector in computerisation becomes a barrier to implementation of personalised healthcare.

John Crawford, Healthcare Industry Leader Europe at IBM, noted that healthcare as a whole spends far less on ICT than any other sector, at between 0.5 and 3 per cent of total budgets. "This is low compared to other industries and seems to indicate there is an inherent inability to take up innovation enabled by information technology," Crawford said.



Participants hear results of the Vlerick study at the 24 November meeting at the British Embassy Brussels.

The same is not true of the take-up of other, discrete technologies such as medical imaging or keyhole surgery. The problem with ICT is the lack of evidence of information technology as an effective tool in medicine. “While clinicians and other healthcare professionals welcome technology at a departmental level, for example, digital medical imaging, the value of comprehensive Electronic Health Records is questioned,” said Crawford.

Size matters

Smaller countries have a better track record in e-health because they have an advantage in terms of scaling ICT systems. Failures in implementation – most notably in the National Health Service computerisation project in England – occur where a top-down approach is taken to try and install a single system in countries with large populations.

It follows that the best e-health systems in operation currently are regional, such as those in Catalonia in Spain and Lombardia in Italy, or in smaller countries including Denmark, Luxembourg, and Scotland.

Some of the best examples of e-health have been developed gradually to cover a population, a factor that is often to the advantage of smaller countries and regions says Wojciech Dziworski, Head of the Sector, Innovation and Healthy Ageing of the Innovation for Health and Consumers Unit.

Political will and persistence

In fact, many of Europe’s healthcare systems are pretty well equipped in terms of record keeping and data acquisition at the separate levels of GPs, clinics and hospitals, but this is not joined up across these fiefdoms, or nationally. Achieving such national integration requires political will and persistence, and strong governance. “Denmark has been consistent in pursuing this for twenty years,” Crawford noted.

Ingrid Klingmann, Chair of the European Forum for Good Clinical Practice, said it may be difficult to execute, but it is a matter of national and European interest to have compatibility and interoperability in e-health. This is critical in unlocking the value of data repositories for use in research. And where there is a common interest it has proved possible to agree standards, Klingmann noted.

A potent example is CDISC, the Clinical Data Interchange Standards Consortium, a non-profit organisation that has succeeded in setting out standards for the exchange of clinical trials data. The standards are used in the US and Europe. CDISC pulls together interested parties, who all have advantages to gain. The

UNLOCKING THE VALUE OF PERSONALISED MEDICINE

standards cover the organisation of clinical trials data and are driven by practical needs. "Industry is required to pull in data from many countries because there is a lot of subcontracting and many multi-site trials," Klingmann said.

However, as another speaker noted, one of the most oft-cited examples of a successful e-health system, Kaiser Permanente in the US, is not a good role model, since it relies on enforced standards and minimum variation, which is only possible because all the users are members of Kaiser Permanente.

Standardising clinical terms

In short, scaling remains an issue. So too does interoperability, though this issue is going up the list of priorities. For example extra effort is now going into the development of SNOMED, a standardised dictionary of clinical phrases and terms, under the stewardship of the International Health Terminology Standards Development Organisation, a body that represents 17 countries, including the US.

Another example is the development of document sharing protocols tailored for healthcare. Of particular significance is the recent launch of European Patients - Smart Open Services (epSOS), under which seven EU countries to date, have committed to move health records across national borders using standard protocols. Twenty-three companies have signed up in support of the epSOS standards, and there will be a lot to learn from this programme.

Another factor holding back e-health is a tendency to think patient records must be comprehensive. In fact, subsets of patient data that are easier to agree on and to handle, have their place in personalisation and in improving healthcare.

epSOS contains the minimum data set needed for a patient to get safe care. Similarly, in Scotland, the Emergency Care Health Record was set up in 2004 after the population was asked for permission to store records containing names, addresses, name of GP, medication taken in the last 12 months and allergies, in a national system, for use in emergency and out-of-hours care. Only 1,700 people (0.1 per cent of the population) requested an opt out, and the repository is now used 40,000 times per week.

Unique patient identification numbers

By asking permission to hold certain data and explaining why it would be useful, the Scottish system avoided charges that data was being accumulated indiscriminately.

At the same time, it is acknowledged that e-health systems need to go further in getting information seamlessly moved from hospitals to pharmacies, to GPs, and to nursing and social care services in real time. This raises the requirement for a unique patient identification number, rather than individuals having different numbers in pharmacy, GP and hospital systems, as occurs at present.

Andre de Swaef, General Advisor at Belgian health insurance body RIZAV INAMI, noted that a further issue is deciding who "owns" the data and is responsible for curating and storing it, and maintaining its integrity.

Linking the grass roots to policy makers

It is obvious that both top-down and bottom-up approaches have a role to play in establishing the e-health underpinnings of personalised healthcare, believes Magdalena Radwanska, Senior Officer Life Sciences at COST, the European Cooperation in Science and Technology. COST has been involved in e-health networks spanning 36 countries, in which scientists have worked with patients' organisations and industry at grass roots level.

"After four years this needs to be taken up through enhanced networks that provide access to policy makers. We've got to get the bottom-up to meet the top-down," Radwanska said.

A roundup of views on personalised healthcare in Europe



John Crawford IBM

Discussion of costs and benefits in personalised healthcare is tricky. Typically, says Crawford, the positive financial returns come six or more years after the initial investment – and this is borne out in the Vlerick study.

While there are clear and demonstrable cost benefits, in real life projects it may not be the case that savings filter down to the bottom line. “History shows us healthcare systems don’t reduce in size: instead resources tend to get redeployed for another set of patients,” Crawford noted.

e-health and other personalised healthcare measures are concerned with improving the quality of care and the long-term sustainability of healthcare systems. This is achieved because although the ageing population and the increased incidence of chronic diseases such as diabetes means more people need treatment, effective deployment of e-health means that the unit cost per patient declines.

There is a sticking point however, as Crawford noted. “In the short term, over 5 – 10 years, these measures don’t cut costs unless you reduce overall provision or redesign services to make the saving.



Bart de Loore, NXP

To successfully deploy personalised healthcare solutions, it is very important to align all actors in the value chain, says Bart De Loore, Vice President New Business and Managing Director NXP’s Personal Health business.

NXP is working to apply its specialist knowledge to design semiconductors for use in body-worn medical devices like hearing aids, implants, patient monitoring devices and also for point-of-care diagnostics.

“For example, in the case of point-of-care diagnostics, NXP is developing advanced microchip biosensors. To bring a successful product to market, very different and complementary challenges need to be addressed: sample preparation, microfluidic development, biological assay development, clinical testing, obtaining authority and reimbursement approvals, and so on.

If players do not team up, we miss out on the opportunity to bring breakthrough concepts to market.”



David Robinson,
Speedo International

Why would a company that makes swimming costumes be involved in a programme of research in personalised healthcare? It is because the customers of Speedo see swimming as synonymous with health.

“Along with helping top athletes improve their performance through our advanced materials and design, we also listen carefully to how swimmers at every level view their swimming experience” says David Robinson, President Speedo International. “When we ask our customers why they swim, an ever-increasing number are using swimming as part of their personal health approach, based on an implicit view of its positive effect on their health and wellbeing.”

This led Speedo to make a fuller investigation of why people perceive swimming as healthy, and to look in detail at specific benefits. There are a number of studies into the health benefits of participating in sport, but there are clear and distinct benefits that have been linked to swimming, including increasing heart function and weight loss.

“When you talk to people about the specific benefits of swimming their desire to participate increases,” Robinson said. They are interested to know how many calories they burned on a particular swim, how many strokes they swam, and so on. This information on personal performance helps people to improve

and swim more sustainably.

“The benefits of swimming can then be linked directly to prevention,” Robinson said. “By measuring the benefits an individual can get from swimming we are providing information that can help people avoid cardiovascular disease.”

Swimming can help people stay healthy for longer in old age and keep them out of the healthcare system. “Speedo is very much aligned with efforts to promote healthy ageing,” Robinson said.

This example and the findings of the research into prevention of cardiovascular disease, highlight one of the most important requirements of a truly personalised healthcare system, which is providing the information, or the means to acquire the information, that will allow every individual to decide how they are going to act to maintain their health, or monitor chronic conditions.

More services are needed to open up this aspect of personalised healthcare and many of these will be consumer services rather than services that are delivered by the healthcare system. The push will come from consumers to make access to information and monitoring easier. It will not be necessary to wait for all the big organisational issues around personalised healthcare to be resolved, it is possible to make progress now.



Robert Wells, OECD

Europe needs to avoid a discussion about “winners and losers” if it wants to move personalised healthcare forward, believes Robert Wells, Head of the Biotechnology Unit in the Science and Technology Policy Division of the OECD.

Wells, previously a co-founder of the Personalized Medicine Coalition, a US-based advocacy group, recalled that an analysis of how personalised medicine will impact different stakeholders, carried out on behalf of the Coalition, had highlighted that much of the cost would fall on payers. “It didn’t show where the benefits are,” noted Wells.

Much of the baseline data in this US study was consistent with the findings of the Science|Business research. However, the US has a very complex system on the payer side, involving numerous private companies, and the analysis indicated that this is where the cost burden was concentrated.

With its single payer systems, Europe is in a position to avoid this dichotomy. But in the US or Europe, “Personalised healthcare needs to be portrayed as a societal win,” Wells said.

The OECD will be playing its part, with work programmes in personalised medicine and global health, e-health and policy issues relevant to the use of biomarkers. “There are a number of areas where we can facilitate the definition of standards amongst our member countries, and where we can identify best practices,” Wells concluded.



Adam Heathfield, Pfizer

Advances in genomics and the understanding of biology of different diseases are making it possible to develop personalised medicines that work on highly specific targets and precise groups of patients. At Pfizer, we are applying our strengths and existing knowledge in this area through each stage of the research and development of our medicines, identifying it as our ‘precision medicine’ approach to drug discovery.

Many of the benefits of personalised medicines were outlined in the first Science|Business project: greater treatment effect, fewer side effects and fewer medicines being prescribed for patients who won’t benefit. So the technology is promising, but like all innovations the case needs to be substantiated.

One of the key things for Pfizer is to be able to demonstrate the value that healthcare providers will derive from new and more personalised medicines that are coming through the company’s pipeline, says Adam Heathfield, Director Science Policy Europe for Pfizer.

The debates about the value of personalised medicine can be rather narrowly focused on the costs and benefits of specific medicines, but there is also a lot of interest in how health systems need to be designed to make the best use of the kinds of new

medicines that are becoming available.

A one-size-fits-all approach has been associated with pharmaceutical companies and the “blockbuster model” but it is also the way that many elements of healthcare systems operate. It will be necessary for health systems to move on from this model in the same way that there have been major changes in industry’s R&D model. “If care pathways are designed on the basis that all patients are essentially the same, and if there is under-investment in new diagnostics to identify important differences between cases, it is harder to launch new personalised medicines; healthcare systems are often not set up to accommodate them,” Heathfield said.

Companies are often challenged to explain how health systems can afford new personalised medicines and diagnostics. In fact, there are many ways in which personalised healthcare can increase efficiency, and research such as that carried out in the Science|Business project is needed to broaden the policy debate. “It demonstrates how new technologies open up the potential to run healthcare systems more effectively and liberate the resources to adopt much-needed innovations” said Heathfield.



Phil Gingrey

The scope for EU/US collaboration

Experts urge US, EU to work together in healthcare technologies

Biosimilars, e-health and personalised healthcare are among areas targeted for collaboration

By RICHARD L. HUDSON

When it comes to healthcare, if the US and Europe worked together they could cut costs, spur innovation, and tackle problems that healthcare systems on both sides of the Atlantic now confront, according to a group of experts brought together by Science|Business in Washington DC. "If we would find ways to have an overall common approach in healthcare we could achieve much more," says Alexander von Gabain, Austrian biotech entrepreneur and chairman of the European Institute of Innovation and Technology.

"If you go into an emergency room where you don't speak the language, or maybe you can't even talk because of injuries, for the doctors to be able to take your card and swipe it [to get an instant medical history] can be very important. It should be there globally."

Phil Gingrey

"We have to find ways of getting healthcare costs down – by working together, expanding best practice, and cooperating intellectually and financially," agreed Bart Gordon, former chairman of the US House Committee on Science and Technology and now a partner at Washington law firm K&L Gates. The call for transatlantic cooperation in healthcare came at a meeting on Capitol Hill in July 2011 hosted by Rep. Phil Gingrey, a Georgia Republican and medical doctor. Calling for greater US/EU collaboration on electronic medical records, Gingrey praised a \$19 billion US e-health project, funded as an element of the 2009 economic-stimulus bill, and suggested a global dimension be added. "If you go into an emergency room where you don't speak the language, or maybe you can't even talk because of injuries, for the doctors to be able to take your card and swipe it [to get an instant medical history] can be very important. It should be there globally."

Together, Europe and the US make a vast market for healthcare: more than 800 million people, with a similar range of health problems. Yet they have different regulatory systems, payment methods and market conditions. In recent years, Washington and Brussels have been trying to collaborate more in a few specific areas. In e-health, they have begun developing common technical standards, there is regular sharing of information, occasional joint calls for grant proposals between US and EU agencies that fund basic biomedical research, and the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) have a number of initiatives that aim to reduce the current duplication of effort between the two bodies.

But cutting costs and improving healthcare will require much more collaboration, the experts said. The meeting, supported by the Sandoz International division of the Swiss pharmaceutical company Novartis, was held to air some specific proposals for cooperation. Four emerged: caring for the ageing population, stimulating innovation, regulating new biological medicines, and developing health economics models of the value of e-health and personalised healthcare.

■ Idea 1: Work together to develop new approaches to caring for the ageing population

Proposed by Harriet Wallberg-Henriksson, President, Karolinska Institutet

On both sides of the Atlantic, the population is greying. Between 2000 and 2030, the percentage of people aged 65 or older will rise in North America from 12.6 per cent to 20.3 per cent. In Europe, the number above the age of 65 is projected to climb from 15 per cent to 24.3 per cent. But at the same time, there are serious health challenges, such as smoking, sedentary lifestyles and a rising tide of chronic diseases such as diabetes. “So the conclusion isn’t clear whether these people will age in good health or in bad health,” said Wallberg-Henriksson, whose Stockholm medical university names the Nobel Prize in Medicine or Physiology. She added, “What can be done?”

Already, noted Wallberg-Henriksson, the US and Europe separately are ratcheting up their efforts to cope with this ageing, increasingly infirm, population. The European Commission’s “Healthy Ageing” project will coordinate research, regulation and policy that touch on the problem in the EU; and in the US the Centers for Disease Control and the National Institutes of Health (NIH) have a number of programmes directed at healthy ageing too. But better still, she said, “The US and Europe can develop shared methodologies and coordinate efforts.”

A particularly fruitful area for cooperation, believes Wallberg-Henriksson, would be in the use of information and communications technologies – for healthcare management, and social care, and the telecare, electronic monitors, alarms and other devices that need to come together in the form of assisted living systems. This could entail joint calls for research grant proposals from the NIH and the European Research Council. Or, she said, it could involve new funding schemes for e-health technologies for the aged, to stimulate innovation. A joint planning group would get it started.

■ Idea 2: Coordinate, and focus on, broad innovation policies

Proposed by Alexander von Gabain, co-founder, Intercell AG, and Chairman of the European Institute of Innovation and Technology

Most transatlantic collaboration to date focuses on research and education – and it misses the broader aspects of innovation. “You need entrepreneurs to take up the ideas,” from the lab and bring them to the marketplace, said von Gabain, co-founder of the vaccines company Intercell, based in Vienna. “Innovation needs the knowledge triangle,” the interplay of research, education and business, believes von Gabain. This dynamic, while operating in the US, is “underutilised” in Europe, he said. To succeed, “We have to get a much more holistic approach.”

A good place to start trying to improve the whole innovation system, is with the regulators, von Gabain argued. Amongst other products, Intercell has developed a vaccine for Japanese encephalitis. “I know the pain of getting an FDA license, an EMA license, a [national] Austrian license ... It would simplify things a lot if we could take the synergies of these different systems” to speed drug approvals globally.

Another barrier to global innovation, von Gabain said, is the complexity of trying to raise finance from one market to another. “We should come to a more unified system,” of capital markets. Finally, said von Gabain, the complex nature of many health problems means



“The US and Europe can develop shared methodologies and coordinate efforts.”



To succeed, “We have to get a much more holistic approach.”

greater collaboration on cross-disciplinary innovation is needed on both sides of the Atlantic. Complexity requires input from statisticians, the food industry, hygienists and other disciplines, besides traditional pharmaceutical researchers. Today, he said, “The innovative space is more than just first-class basic research.”

Others gathered at the meeting concurred. “We have to focus on the whole chain of getting to market; it’s not just basic research” that matters, said Ulf Dahlsten, principal advisor to the European Commission’s Director-General for Information Society and Media. “We are living in a competitive world. If we and the US are going to be successful we have to shorten the time to market.”

■ Idea 3: Harmonise the regulatory process for biosimilars

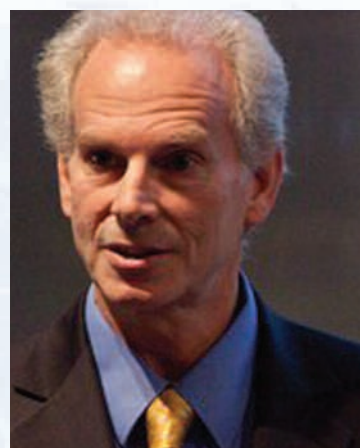
Proposed by Mark McCamish, Global Head of Biopharmaceutical Development, Sandoz International

The past few decades have seen great growth in the variety and use of so-called biologics – medicines in which, through recombinant DNA technologies, researchers trick a cell into making a hormone, an anti-cancer therapy or other biologically active molecule used as a drug. These are expensive to develop; and “that expense limits the access of patients to use them,” said McCamish. In response, his company and others develop ‘biosimilars’ – in essence, high-quality equivalent forms of the medicine that can come to market at a lower cost when the original patents expire.

The impact of biosimilars can be profound. For instance, McCamish cited the case of GCSF, granulocyte colony-stimulating factor, a medicine that stimulates the bone marrow to produce more stem cells and boost white blood cell production. This can counteract the immunosuppressive effect of chemotherapy in cancer patients. But when GCSF first appeared on the market, it was so expensive that in the UK it was generally used by doctors only after damage to white blood cells already occurred; better, experts said, would be to administer GCSF from the start of chemotherapy to prevent the problem from appearing at all. When Sandoz launched a biosimilar GCSF in the UK, it was at half the price of the original drug – and the result was a 25 per cent increase in appropriate use of the medicine to benefit patients. “There was a cost-benefit,” he said.

“My idea is to collaborate to a greater extent on the global development of biosimilars,” said McCamish. At present, he said, US and European regulators take different approaches to the licensing of biosimilars – resulting in expensive duplication of research on both sides of the Atlantic that dramatically increases the costs and delays the patient benefit of these medicines. Generally, to clear a biosimilar for market one must show it is functionally the same or equivalent to the original medicine; however, both regulators generally require comparison to the original medicine labelled for use in their own region, even if the medicines were manufactured in the same plant and comparable in all aspects. In other words, in the approach they use, the label you put on the bottle is more important than what is in the bottle.

In addition, in Europe there are now 14 ‘guidances’ published by regulators for the process. In the US, however, the FDA is just developing its approach to regulating biosimilars. For example, there is disagreement even over how to name a biosimilar. The EU has been following a World Health Organisation standard for naming of biologics, while the FDA is creating a different naming protocol. This could confuse physicians, pharmacists, and insurance companies over which product they are giving a patient. That makes it harder to implement use of these cost-effective medicines and to share and compare results, McCamish said.



“My idea is to collaborate to a greater extent on the global development of biosimilars.”

■ Idea 4: Working together on the economics of e-health

Proposed by Walter van Dyck, Associate Professor of Innovation, Vlerick Management School, Belgium

Increasingly, healthcare agencies have to study the overall cost of keeping people healthy, rather than how much they spend on pills or hospitals alone. That requires health economics to develop models of how particular interventions and treatments impact on cost and the quality of care. In Europe, where the taxpayer is footing most of the bill, there is already a strong tradition. “With all our little governments and small budgets, we have more practice at this than in the US,” said van Dyck.

The importance of health economics will only grow as the technology of healthcare shifts beyond medicines to include more computer and communications technologies – for closer, more personalised monitoring of patients, diagnosing disease and handling treatment in the home. “My proposal would be to focus collaboration on e-health economics,” van Dyck said.

Whilst he cautioned against drawing too strong a conclusion from any individual study, van Dyck said that overall the field of e-health economics can help policy makers better manage the cost of healthcare. Sharing data and methods could benefit healthcare systems on both sides of the Atlantic.



“My proposal would be to focus collaboration on e-health economics.”

Overcoming the obstacles to collaboration in healthcare

What are the barriers to US-EU collaboration? There are, of course, fundamental policy and market differences that can't be bridged: the US won't nationalise healthcare, and Europe won't privatise it. But the proposals aired during the meeting were more practical – sharing information, coordinating drug approvals, commissioning joint research, and the like. Even for these activities, however, there are still some fundamental gaps that need bridging:

- Regulatory views of costs and benefits differ. Because they pay the bills, European healthcare agencies naturally look at the economics of new medicines. The FDA, by law, does not
- There is a natural tendency to parochial, not-invented-here, thinking – especially among inward-looking US health regulators
- It's nobody's job to push for collaboration.

So how to overcome the barriers to collaboration? One answer is focusing some high-level attention to the problem: it would take a push, for instance, from the powerful US Office of Management and Budget to break through the not-invented-here attitude of the FDA. Another answer is money: budgetary pressures on both sides of the ocean will force healthcare authorities to look for new ways to do more with less – and that could include sharing information, knowledge and costs, with others.

“We're cutting. The Europeans are cutting. The message is: How can you save money” through collaboration, said Gordon. “The mutual threat to our standards of living will force us to come together.”

Budgetary pressures on both sides of the ocean will force healthcare authorities to look for new ways to do more with less – and that could include sharing information, knowledge and costs, with others.

Health for all, Care for You

Executive Summary

In 2010 Science|Business reported on a survey of attitudes to personalised healthcare amongst industry professionals across Europe carried out by the Karolinska Institutet in Stockholm, Sweden.

In all 80 per cent of respondents to the survey believe personalised healthcare could cut medical errors – but financial, technical and regulatory barriers are standing in the way. However, “With the right investment and R&D, personalised healthcare has the potential to be the most significant development in medicine for years,” said Carl Johan Sundberg, Associate Professor at the Karolinska Institutet, commenting on the survey results.

Sectors represented

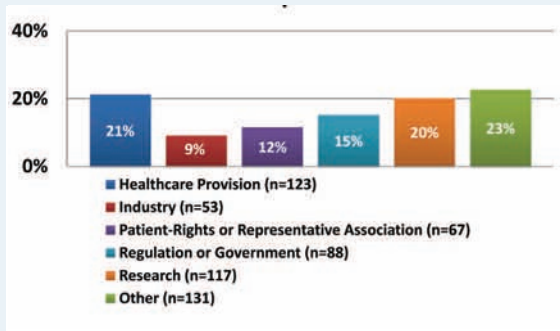


Figure 1 What is your main line of work?

Geographical distribution

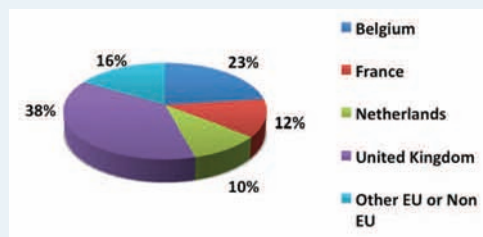


Figure 2 In which of the following EU member states is your primary line of work?

Over 80% believe that personalised healthcare will reduce medical errors

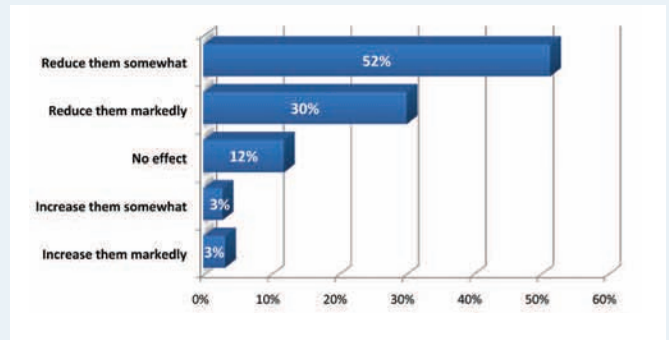


Figure 3 To what degree do you believe that personalised healthcare will reduce the likelihood of medical errors (including unnecessary treatments)?

Respondents to the survey, based in Belgium, France, the Netherlands and the UK, agreed that at the same time as improving patient safety, personalised healthcare could save money over the longer term. But at present short-term thinking about the level of investment needed and the regulatory change required, is holding back progress.

In total 64% believe “improved patient outcomes” to be a major benefit of personalised healthcare

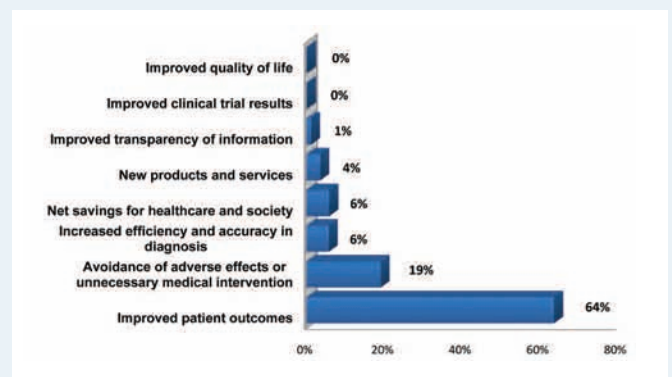


Figure 4 What do you consider to be the major benefits of personalised healthcare?

Key Findings

- 80 per cent of respondents believe personalised healthcare will reduce medical errors
- 64 per cent of those surveyed believe improved patient outcomes will be a major benefit of personalised healthcare
- 46 per cent think total healthcare spending will be reduced by personalised healthcare approaches in the long term (15 years), but 58 per cent see it increasing costs over the shorter term (five years).

Distribution of perceived scientific barriers

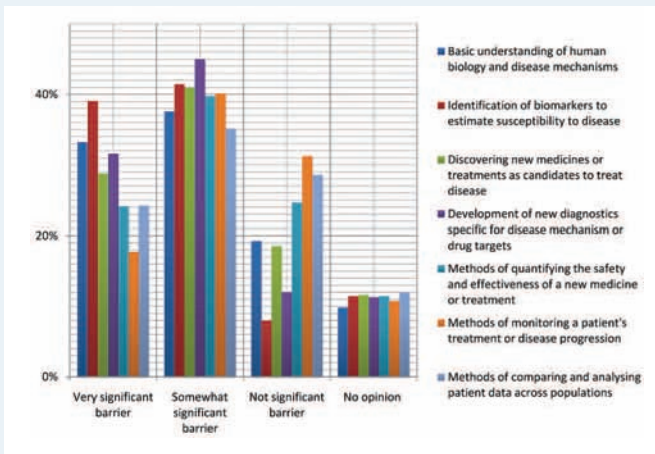


Figure 5 What are the most important scientific barriers still to be overcome in the development of personalised healthcare?

In total 58% think overall healthcare spending will increase short-term (5 years)

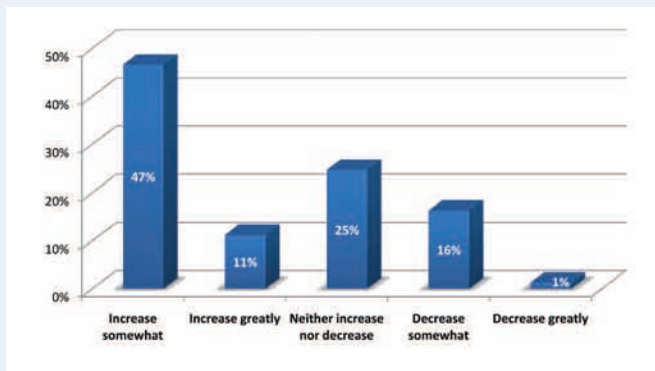


Figure 6 How do you think personalised healthcare will affect total healthcare spending short-term (5 years)?

In total 46% think overall healthcare spending will decrease long-term (15 years)

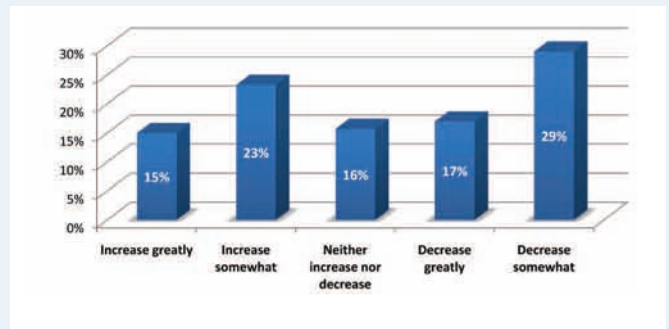


Figure 7 How do you think personalised healthcare will affect total healthcare spending long-term (15 years)?

Barriers to development

- Over 60 per cent of respondents agree that the absence of clear regulatory guidelines is causing a delay in the marketing and authorisation of personalised healthcare products and services
- 45 per cent identified insufficient funding in R&D and misalignment between research policy and research conducted as very significant barriers
- 80 per cent of respondents believe Europe-wide cooperation will be necessary for the development and adoption of personalised healthcare.

The survey showed that a majority of respondents are familiar with the concepts and objectives of personalised healthcare and think it will lead to major benefits both for patients and healthcare systems. Along with better outcomes, almost half of respondents (46 per cent) believe personalised healthcare has the potential to lower total healthcare spending in the longer term (15 years).

But for the array of technologies that are involved to be fully implemented and integrated across the healthcare value chain, both scientific and structural hurdles will need to be overcome. And the majority of health professionals who took part in the survey say without a greater understanding of human biology and disease mechanisms there cannot be a smooth transition from the traditional one-size-fits-all healthcare paradigm, to personalised healthcare.

What is to be done?

Overwhelmingly, respondents believe further EU cooperation will be necessary for the successful development and adoption of personalised healthcare. Although healthcare policy and delivery is the responsibility of member states, 84 per cent believe Europe-wide cooperation is needed for personalised healthcare to succeed.

Commenting on the results, Carl Johan Sundberg said, "These findings show that personalised healthcare is at an inflection point. [Future developments] will have a profound impact on the effectiveness and cost of future treatments."

Personalised healthcare provides a means of confronting the shortcomings of the traditional one-size-fits-all model of diagnosis and treatment of disease, and subsequent rehabilitation and health monitoring. "Combining information about an individual's genome and biomarkers with lifestyle factors, and through the use of e-health systems, healthcare providers are presented with an enormous opportunity," Sundberg said. "However, for personalised healthcare to be successfully adopted, numerous scientific, economic and social issues must be addressed."

About the survey

Almost 600 academic researchers, healthcare professionals, patients' group representatives, regulators and industry professionals took part in the survey, carried out in the second half of 2009. The majority of respondents were based in

Belgium, France, the Netherlands and the UK, four of Europe's leading healthcare markets.

The study was organised by Danielle Lewensohn, a research assistant and consultant at the Unit for Bioentrepreneurship of the Karolinska Institutet in Stockholm, Sweden.

Defining personalised healthcare

For the purpose of the survey, the following definition was used: personalised healthcare is the use of information to tailor treatment to individual groups. This can include using genetic data, diagnostic tests or patient databases for portions of the population. The aim is to maintain health, prevent disease, or improve the outcome of medical therapies.

More than 80% believe in European-wide cooperation for personalised healthcare to succeed

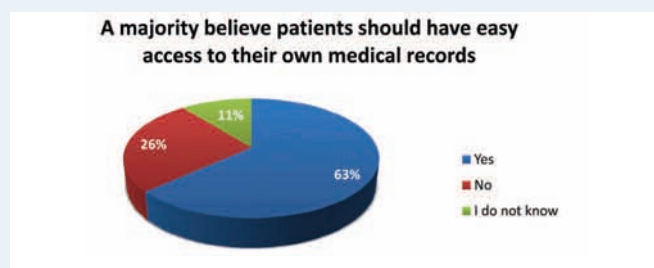


Figure 8 "European-wide cooperation is needed to succeed in the development and adoption of personalised healthcare."

A list of the experts interviewed by the Vlerick Researchers when scoping the second Science|Business personalised healthcare study

Interviews

Health Economists:

Prof Dr. Steven Simoens, Health Economist, KU Leuven, Belgium

Prof Matthew J. Taylor, Senior Consultant, York Health Economics Consortium Ltd, University of York, UK

Diego Ossa MD, MSc, Health Economist and Outcome Research, Novartis

Medical Experts:

Prof. Marc Sabbe, Head of Emergency Department, KU Leuven Faculty of Medicine

Dr. Prof. Herbert Schuster, Internal Medicine, INFOGEN Institute for Health Research and Health Management, Germany

Prof. Wilfried Mullens Oost-Limburg Hospital, Belgium

Prof. Pieter Van der Voort, Head of Cardiology, Hasselt Telemedicine

Dr. Frank Buntix, a GP in Leuven, Belgium

Other interviews

Dr. Jan Van Emelen, Innovation Director at the Independent Health Insurance Fund, Belgium

Stephane Van Rooijen MD, MBA Head of Cardiology, Genzyme

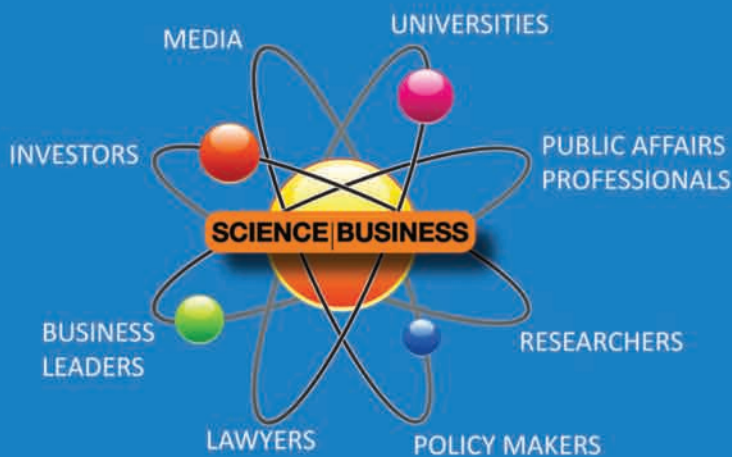
Prof. Dr. Bruno Flamion, Professor of Physiology and Pharmacology at the University of Namur, Belgium

Filip Frederix, NXP, Bioengineer, expert in medical devices

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