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Independent Technology Research Report

DIGITAL HEALTHCARE
Local Challenges, Global Opportunities

Digital technology is coming of age in the healthcare sector

Governments, insurers, employers and most importantly patients and their physicians recognise that digital technology is the key to meeting the challenges of healthcare provision in the 21st Century. The most relevant and exciting digital services and applications are being developed by fast growing SMEs.

Healthcare systems worldwide are facing unprecedented challenges

Global healthcare spend accounts for 10.6% of GDP. Spend is forecast to grow more than 5% annually to 2018 as the global proportion of those aged over 60 increases from 12% in 2013 to 21% in 2050. The nature of the challenges faced varies across national markets, but the impetus for new models of healthcare is clear globally.

Digital enables transformational models of admin, funding and care

Cloud software, smartphone applications, online marketplaces and data analytics are established technologies that the healthcare sector is only now embracing. They are key as healthcare seeks to become more efficient and patient centric, paying for outcomes delivered and with much care and treatment provided remotely.

B2B models are best placed – but sales strategies must be multifaceted

Digital healthcare companies selling to, or partnering with, enterprise level clients will be the winners in the medium term. SMEs must sell in at the board and departmental, national and local level to maximise their chances of success.

SMEs must be healthcare experts as well as digital natives

Healthcare is incredibly complex – from heavy regulation to labyrinthine decision making to multi-layered payment systems. The most successful in the space will be those who embrace the complexity and thrive on it.

Investment is gaining momentum - Q3 2015 was a record quarter

$1.5bn was raised by digital healthcare companies in Q3 2015. US companies continue to account for the majority of funds raised in the sector, but there is also a vibrant earlier stage community of European digital healthcare companies. M&A volumes are increasing steadily, driven by interest from a wide variety of strategies.
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Introduction – The Global Healthcare Market

Healthcare affects us all, with the quality of education, treatment and support to which we have access being a key determinant of life expectancy and quality, and political administrations often judged a success or failure based on the outcome of their policies in the sector. While decisions made at every level of healthcare are characterised by a necessary level of risk aversion given the potential effect on an individual’s life, there is a general acceptance amongst patients, physicians and administrators that digital healthcare technology is a key part of the solution to the very real demographic and economic challenges they face – indeed, it is scarcely possible to think of a more important use of digital innovation.

Total healthcare spending worldwide was $7.2 trillion in 2013, accounting for 10.6% of global GDP and forecast to grow at >5% annually to 2018. Increases in spend are being driven in large part by increases in life expectancy, leading to ageing populations – the UN forecasts that the global share of those aged over 60 will increase from 11.7% in 2013 to 21.1% in 2050 – and a related increase in chronic conditions (defined as long lasting conditions or those that develop with time). Other factors that contribute to increasing healthcare spend are the development of emerging countries – a developed country typically spends c. 10% of GDP on healthcare vs. an emerging nation’s c. 5% - and advances in treatment or technology that come with high costs.

*Figure 1: Healthcare spend as a percentage of GDP*

[Diagram showing healthcare spend as a percentage of GDP for various countries]

Partially balancing this rising trend is a widespread effort by those who pay for healthcare – central or local governments, insurers, employers and individuals themselves depending on the system – to realise cost savings and efficiencies to meet the challenges posed by the demographic time bomb of an ageing population. The scale of this challenge varies between markets, with the need for improved efficiency most marked within Western Developed countries such as the UK, where the monolithic, state funded NHS recently announced a close to £1bn deficit in the first three months of its current financial year alone, Germany, where a comparatively high quality level of care is placing a strain on government and employers facing the prospect of the proportion of population aged over 60 increasing from 27% in 2002 to 39% in

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1 Economist Intelligence Unit, 2014
2 UN DESA, 2013
2050, and in particular the US, where a huge c. 17% of GDP is spent on healthcare but with the US continuing to rank well below countries spending 10% or less of their GDP in terms of life expectancy.

This highlights the major geographical differences between healthcare systems, with a country’s approach growing out of decades, even centuries of culture, legislation and reform programmes. Even within a national healthcare system there is often a large degree of fragmentation in how care is commissioned, paid for, provided and regulated, which can present barriers to innovation and the adoption of technology. Lack of interoperability between software, databases and general procedures is perhaps the greatest barrier of all and the most often cited reason for a failure to innovate. But, as we will show, this fragmentation can also work for small, fast growing companies with a strong understanding of how their specific market works and the stamina and patience to identify where the need for their technology is strongest. As the diagram above shows, there is certainly no shortage of potential partners or customers within the ecosystem.

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3 Ibid
Digital Healthcare and the Trends Shaping it

We define digital healthcare as the delivery of health services (e.g. consultations, advice, diagnostics, treatment) via digital means or the enhancement of physically delivered health services through the application of digital technology (e.g. enterprise software, data analytics, online). For the purposes of our report “digital” excludes medical technology such as sensors or testing equipment, while “healthcare” excludes the broad wellness category of wearable devices intended to monitor and improve lifestyle or fitness.

Digital healthcare is enabled by a number of wider technology trends:

The rise of the smartphone

Perhaps the most significant technology trend in digital healthcare has been the unprecedentedly rapid rise of the smartphone, the most rapidly adopted technological innovation in the history of man – one in four Americans owned a smartphone within two years of their launch in 2007, vs. thirteen years for a similar level of adoption of mobile phones4. One in four people worldwide now own a smartphone5. These devices are the natural result of Moore’s law, which states that over the history of computing hardware the number of transistors in a dense integrated circuit (and therefore computing power) has doubled approximately every two years – more than two million transistors can now fit into a smartphone, meaning that more than two billion people worldwide now carry around a powerful computer that may soon cost them as little as $35 to buy. Interestingly, the over 55s were projected to be the age group experiencing the fastest increase in smartphone penetration in recent years, with the gap in adoption rates between the older and younger generations close to vanishing by 20206. This widespread availability of personal computing power is perhaps the key plank of digital healthcare.

Figure 3: Technology adoption

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Big data and artificial intelligence

IBM estimates that we are now creating 2.5 billion gigabytes of data every day, with >90% of the data which currently exists having been created in the last two years alone. Healthcare data is also accumulating at an unprecedented rate, from sources including electronic health records, genetic and public health data, and research and behavioural information – digital healthcare data is forecast to reach 25,000 petabytes by 2020. Such volumes can only be managed by technology, with the ability to cross reference individual with population level data, or to learn from everyday interactions between patients and physicians, key to some of the most innovative digital healthcare models.

The connected human

A trend which includes both electronic connectivity between people – Facebook has 1.3bn registered users, or one in six people on the planet from a standing start in 2004 – and the recent explosion in connected devices – by the end of the current year there will be a total of 25 billion connected devices worldwide, or c. 3.5 for every human. This hyper connectivity facilitates both information transfer between lay people and between patients and their physicians, a key enabler of digital healthcare.

Digital engagement

Human beings are fascinated by digital technology – the average American now spends more time on tech and media than they do on work or asleep. Driven by the power of the smartphone, the ubiquity of wireless and mobile broadband and the world class design of many digital applications and services, consumer engagement with digital technology has huge potential within healthcare.

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2 IBM Big Data Success Stories (2011)
4 Activate, 2016 Tech Media Outlook
Key Global Digital Healthcare Business Models

In this section we consider the key business models within digital healthcare, and highlight the most exciting companies pursuing them.

Digital “telemedicine”

Mobile apps and websites which address challenges of cost, availability and convenience by delivering consultations and care from a distance. Solutions which leverage artificial intelligence to personalise healthcare or reduce the need for human interaction are particularly exciting.

Eric Topol, in his book “The Patient Will See You Now”, writes at length about the edifice complex within healthcare – the obsession with the physical hospital as the centre of the system. He cites data from Patient Safety America which suggests that one in six deaths in the US are due to preventable “lethal events” in hospitals\(^\text{10}\). It is not surprising then that many of the most exciting digital healthcare companies are building on the existing achievements of the telemedicine industry – delivering healthcare from a distance through telecommunication and information technologies.

Telemedicine has traditionally consisted of:

- ‘Store-and-forward’ (acquiring medical data and transmitting it to a physician for assessment);
- Remote monitoring (particularly useful in the management of chronic conditions in a cost effective and convenient way), and;
- Interactive (real time physician consultation and assessment).

A number of digital healthcare companies are pursuing interactive models based on video consultations with GPs.

The patient pays a one-off fee or subscribes to allow recurring use. Teladoc (see sidebar on page 21), listed on NASDAQ, is one of the largest providers of these services in the US.

This model is most exciting when combined with the ability to reliably respond to more basic medical questions through the use of artificial intelligence and to provide ongoing personalised monitoring through the algorithmic analysis of clinical and activity data. Its convenience for the individual is further enhanced when combined with the safety net of a physical consultation with a GP or specialist should that be necessary. babylon (see sidebar and figure 4) offers a model combining each of these elements.

\(^\text{10}\) Eric Topol, The Patient Will See You Now
Chronic health conditions account for c. 80% of healthcare spend in developed countries and also drive much of the waste in the system with non-adherence to medication alone costing €127bn annually in the EU and $290bn in the US\textsuperscript{11}. Remote monitoring solutions that improve the efficiency of care and treatment for those suffering from chronic conditions have the potential to eliminate some of this waste. For example, uMotif (see sidebar on page 9) offers a health management solution which seeks to engage patients with Parkinson’s disease or other long term conditions such as diabetes, or those requiring post-operative care following heart or cancer surgery, in the management of their own health. The solution is provided through web and mobile apps which inform patients, remind them to take their medication and also provide a data feed to the patient’s doctor, enabling intervention where required or simply making regular appointments more efficient.

**Digital technology can also support families in caring for vulnerable relatives**

3rings offers a simple solution based around a plug which sends a signal to family members when an everyday appliance is used. The company is also working towards more complex solutions that will integrate with sensors that are already in smart devices such as Nest thermostats or smoke alarms.

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**Figure 4: babylon’s end-to-end healthcare solution**

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\textsuperscript{11} uMotif, 2015

Source: babylon, 2015

Your.MD. offers a smartphone personal assistant that democratizes healthcare and allows patients to take control of their health.

It uses NHS data and artificial intelligence to give users knowledge and control. The app uses technology to empower people across the developed, and developing world, to get the information they need to stay healthy.
Digital treatment or diagnostics

Moving beyond virtual consultation to actually deliver diagnosis or treatment remotely, often leveraging the ever increasing capabilities of the smartphone to deliver results as good or better than those achieved through traditional methods.

Perhaps the area of digital healthcare most enabled by the explosion in the computing power available within personal devices. Commonly available smartphones can be simply and cheaply adapted to perform the functions of specialised diagnostic tools – for example, Cupris Health have created a simple attachment for a smartphone that enables it to act as an otoscope for examining the ear canal and ear drum, with the data generated by an examination capable of being quickly sent to a physician for further analysis. The applications of technologies such as this are arguably greatest in emerging countries where large distances between population centres, very low ratios of doctors to patients and limited infrastructure make direct physical examinations difficult. The significant penetration of smartphones in emerging countries, improvements in network coverage and the move by companies such as Microsoft and Mozilla to develop smartphones available for $25 to $30 suggest that there is a real market opportunity for digital healthcare companies targeting the emerging niche.

However, there is also no shortage of opportunity for companies using the core capabilities of smartphones or even basic PCs to deliver treatment in developed markets.

For example, BigHealth has launched a mobile app and website called Sleepio which provides a multiweek course of cognitive behavioural therapy for sufferers of insomnia which delivers results comparable with expensive therapy delivered one-to-one by a professional. Ieso Digital Health (see sidebar) operates a different model for the delivery of mental health therapy online – patients meet an accredited therapist in a secure virtual therapy room for a written conversation, with Ieso’s technology supporting the therapist in their responses to the patient. The company has been able to achieve recovery rates above those delivered by standard consultations with a significantly lower ‘did not attend’ (DNA) rate. As with babylon, Ieso is making use of the data gathered by its day to day business to refine algorithms and natural language processing techniques which predict outcomes and recommend treatment pathways.

Other applications for digitally delivered treatment include rehabilitation products, such as those Neuronation (see sidebar on page 23) provides for sufferers of dementia or multiple sclerosis, providing personal therapy plans around brain training programmes designed to slow degradation, or for those recovering from a brain injury to support recovery. There is also the potential for solutions to be deployed preventatively, as with SOMA Analytics’ (see sidebar) smartphone app which measures the impact of stress and provides feedback or recommends exercises to combat it, reducing stress by 15% and increasing resilience by 11%. This capability to demonstrate ROI and outcomes in line with more expensive traditional methods is at the heart of the value proposition for digital treatment companies.

Ieso provides cognitive behavioural therapy online via a written conversation. Discreet one-to-one therapy is delivered in real-time, with patients meeting a therapist in a secure online environment, at a time and location convenient to them. The service improves patient choice and access to evidence-based mental health therapy.

Ieso is currently commissioned by 25 NHS CCGs across the UK and has just launched a service in America.

Soma Analytics serves clients worldwide with patent pending smartphone applications and analytics. Soma combines advanced techniques in psychology and computer science into a product that measurably improves staff wellbeing and advances HR strategy to create the future of work.

It has offices in London, San Francisco and Munich.
Healthcare marketplaces and networks

Websites connecting individuals with medical personnel, businesses and their peers, simplifying the patient journey, enabling access to medical information and providing support. Particularly powerful in combination with the ability to process unstructured or complex information and make it easily discoverable.

The online marketplace is a well-established model for cutting through inefficiencies in a customer journey, enhancing transparency and the availability of information and bringing the power of competition to bear on pricing. It is not surprising therefore that online marketplaces have been some of the most high profile success stories within digital healthcare, particularly in the US where complexity and fragmentation are arguably at their most pronounced.

ZocDoc (see sidebar on page 20), a website and app which helps patients find a local doctor or dentist within their insurance network, review feedback from other patients, book an appointment and fill out the relevant paperwork online, raised $130m in August of this year. In common with most marketplace models the service is free to use for patients, with practitioners paying a fee to be listed. Homehero, which most recently raised $20m in June, offers a marketplace for finding, hiring and managing quality in-home carers. The carers are put through a rigorous screening process, including an in person interview, before they can be added to the service, with those wanting to hire a carer able to view an HD video of a candidate online. The company is able to offer rates 20-30% lower than traditional agencies.

These models travel well, with companies such as Zesty (see sidebar) and HomeTouch (see sidebar on page 13) aiming to replicate them in the UK.

Doctolib, a French based marketplace for finding doctors and dentists online which serves more than two million patients a month, recently raised $20m. Medigo (see sidebar on page 23) targets the $55bn spent annually by patients traveling abroad to receive healthcare. Patients typically travel due to high costs or long waiting times in developed markets, or concerns over treatment quality in developing markets. Medigo lists hospitals that are available for specific procedures or treatments online, with the guarantee that these facilities cannot charge a marketplace patient more than they would charge a local ‘walk-in’. The company is focusing on English speaking markets where high costs and long waiting times make its service highly relevant.

Whilst marketplaces focus on bringing together patients and medical practitioners, online networks serve to bring together those with particular health conditions by providing helpful information online and enabling peer interaction and support. For example, HealthUnlocked operates over 500 peer-to-peer support networks which help people with similar health backgrounds take on day to day health concerns together, supported by guidance from charitable organisations and institutions. Interactions are catalogued in an intelligent database with natural language processing used to make

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12 Patients Beyond Borders, 2013

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Zesty operates an online appointment booking platform for health and dental services. It currently operates in the UK and Holland with offices in London and Amsterdam and has plans to expand across Western Europe into 10 countries.

Zesty has raised $10m+ in funding from three US and European investors (Mangrove Capital, Qualcomm Ventures and Innovation Capital).

PatientsLikeMe’s digital platform enables patients to track and benchmark their health and evaluate and influence innovation in life sciences and healthcare, testing and validating anything from new medicines to wearable devices. It has raised the value of patient health records to the level of medical evidence, through collaboration with the FDA and publication of findings in over 65 scientific journals. To date its platform has engaged over 350,000 patients.
free text machine readable. A medical intelligence recommendation engine then refers users to content, people or services they might be interested in. TrialReach (see sidebar) is using similar technology to produce a machine readable database of every clinical trial worldwide. The company effectively acts as a B2C network, with pharmaceutical companies providing clinical trial data that patients with relevant conditions can search – pharmaceutical companies can then obtain in-depth information on the patients searching for their trials.

TrialReach’s technology is making all clinical trials machine-readable and searchable. This means that patients can search thousands of trials in seconds to find a match, by answering a few questions.

By democratizing the trial matching process, TrialReach is helping patients find access to new treatments.

HomeTouch is an elderly care digital service. Its primary offering is a carer marketplace, to connect elderly patients and their families with carers. It also offers a tablet-based application, aimed at helping the elderly become less isolated and more active, and to provide families, carers and care providers with a set of productivity, monitoring and communication tools.

Figure 5: Healthcare marketplaces and networks business model
Next generation healthcare IT

Software and solutions which aim to address the inefficiencies in how hospitals, GP surgeries and other facilities operate. The fragmented IT infrastructure within healthcare systems makes interoperability a challenge, but the ability to realise significant improvements through the application of established tech presents a real opportunity.

Healthcare IT within most national or even local systems is a patchwork of legacy systems with networks operating within silos with limited interoperability. For example, within the NHS there is an entirely different IT infrastructure for primary (General Practitioners) and secondary (hospital) care (see figure 6) – to date it has not been possible to implement the wholesale transfer of the electronic patient records that exist at the primary level to make them available within hospitals, or to create a nationwide database for research purposes (the much maligned care.data campaign).

And yet the deployment of next generation solutions, which simplify the patient journey and reduce inefficiencies such as patient non attendance at GP or outpatient appointments (“DNA” rates) through something as simple as implementing a text messaging system, is perhaps the most immediate way that digital technology can help address the looming demographic and economic challenges facing healthcare.

Fragmentation and the use of outdated systems is not restricted to centrally funded systems.

Qinec (see sidebar), which offers a software platform for the personalised management of healthcare, has found the UK private sector fertile ground for efficiency improvements. Its platform provides a single view of a patient’s journey from referral to triage, appointment booking to outcome reporting and billing. For the patient this leads to a more efficient experience, with a real time update to their referring GP or specialist and painless administration. For the healthcare provider it means reduced administration costs and a more granular view of the performance of individual practitioners. Qinec’s customers are deploying the technology across the country as part of independent sector service provision for the NHS giving the company access to this market without the usual barriers that other vendors tend to experience.

Ingenica (see sidebar) have had considerable success selling their inventory management solution into Trusts for deployment in hospitals. The inventory management module is one element of a wider Enterprise Resource Planning suite, with Ingenica able to upsell once it has secured a multi-year contract for the inventory management piece. The solution is fully cloud enabled and the first in the inventory management space to comply with the GS1 standards the government has mandated for use in hospitals as part of its e-procurement strategy.
The IT landscape for primary care is superficially more straightforward in the UK, with electronic health records kept by the vast majority of GPs, generally using one of two software platforms – EMIS Web and TPP.

EMIS have adopted an open API strategy, as part of which they have already worked with digital healthcare companies to allow them to offer additional functionality to GPs. In addition the national GPSoc programme provides a contractual framework for supplying IT systems and services to GPs. Qualifying with GPSoc can be time consuming however, meaning that integration with EMIS or TPP is potentially a simpler route for digital healthcare companies looking to sell into GPs. iPlato (see sidebar) builds digital health solutions on top of this existing primary IT infrastructure, offering a text message based appointment management platform with additional modules covering reminders to patients for check-ups or booster injections, medication management and patient experience assessment. Unusually, the business is able to sell in at the Clinical Commissioning Group (see below for additional detail on commissioning within the UK healthcare system) level, meaning that by working with 80 CCGs it is able to plug into 1,000 GP practices across the UK.

iPLATO is working in partnership with clinicians to help healthcare commissioners transform patient care. Its solutions improve patient access to healthcare and early diagnosis, enable powerful health promotion and support people living with long term conditions. Across the iPLATO network, healthcare professionals run campaigns to promote smoking cessation, weight loss, childhood immunisation and pandemic awareness as well as mobile disease management services.
Key challenges for digital technology

Digital technologies, and the companies applying them in innovative and exciting ways, would appear to be well positioned to transform healthcare. But the development of the nascent digital healthcare space has been uneven to date due to a number of characteristics of the sector:

- **Risk aversion** – “First do no harm” is the traditional motto of the physician and underpins a necessary level of aversion to risk within healthcare. A shortage of resources and political pressure to achieve efficiencies also creates a resistance to spending precious funds on new technology amongst administrators and commissioners, even where there is a clear return on investment.

- **Regulation** – often as complex as the healthcare systems it oversees, healthcare regulation is a specialist subject in itself. Identifying the correct regulation that should be sought for a new technology is often not straightforward; achieving it is time consuming and costly. In addition, many of the most exciting digital healthcare technologies require access to patient data, be it at the individual, group or even population level. This is some of the most sensitive data imaginable, with the potential to affect qualification for insurance, financial products or even employment. Medical record fraud is on the increase – the Identity Theft Resource Center estimated that 43% of identity thefts in the US were medical related in 2013. Compliance with data regulation is essential for success in digital healthcare.

- **Fragmentation and lack of interoperability** – healthcare is often commissioned at a very local level, with decisions on the rollout of new technology or innovations taken at the hospital, clinic or even departmental level; it is rare to be able to sell into a regional or national network. Healthcare IT is a patchwork of often outdated systems which do not work together, making the implementation of new tech a challenge.

- **Long sales cycles** – the rise of procurement has not excluded the healthcare sector. A sale into a single hospital can take 12 months plus, with a reference sale not always materially shortening this cycle. The holy grail of a sale at a national or regional level is no closer for most digital healthcare companies.

As we seek to understand how these challenges can be overcome it is instructive to look more closely at a few of the major geographical markets, to see how healthcare is commissioned, regulated and paid for, and what that means for digital healthcare companies.

An in depth knowledge of how the often labyrinthine structures of a national healthcare system work may be as key for success in the sector as a revolutionary product or service.

The UK

**Overview**

An estimated 90% plus of healthcare spending in the UK comes from the National Health Service, supervised by the Department of Health.

The NHS is both a source of pride, originating along with the welfare state in the immediate aftermath of the Second World War, and deep concern as the principle of universal healthcare free at the point of use runs up against the challenges of limited resources and an ageing population. Alongside the national system there is a relatively small private sector dominated by a small number of players and largely funded by direct or employer funded insurance offered by financial institutions. There is not an established culture of paying directly for healthcare.

The UK does not currently compare well with other developed countries on standard measures of care, with the EU ranking the country 24th out of European nations due to statistics such as the number of

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13 Identity Theft Resource Center, 2013
hospital beds per 1,000 people (2.9 in 2013, having fallen every year since 2010) and doctors per 1,000 people (2.71 in 2013)\textsuperscript{14}.

**Commissioning**

90\% of NHS commissioning is delegated to either Clinical Commissioning Groups (CCGs), who commission secondary (hospital) care and community services and account for 60\% of total NHS spending, or GP consortia, independent surgeries or providers of specialist services provided outside the hospital, commissioning primary care and accounting for 30\% of total NHS spending.

*Figure 7: Commissioning in the NHS*

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**Regulation**

Relevant regulation largely falls into three categories:

**Medical devices**

Digital health tools which qualify as “medical devices” must be registered with the Medicines and Healthcare Products Regulatory Agency (MHRA). The Medical Device Directive defines a medical device as “any instrument, apparatus, appliance, software, material” intended to be used for humans for “diagnosis, prevention, monitoring, treatment or alleviation” of diseases, injuries or handicaps, or for “investigation, replacement or modification” of the anatomy or of a physiological process, or for contraceptive purposes. Crucially, the obligation to decide whether a tool qualifies as a medical device falls on the manufacturer, as does the responsibility to operate post market surveillance to ensure ongoing conformity.

In relation to digital technology the MHRA has suggested that decision support or decision making software that applies some form of automated reasoning to determine dose calculations, symptom tracking or clinician guides is most likely to fall within the scope of the medical device directives. Administrative apps or websites, such as appointment booking platforms, are unlikely to constitute a medical device, but

\textsuperscript{14} European Commission, 2014
programmes which offer personalised guidance are likely to fall within the definition. There is however an exemption for platforms that enable a healthcare professional to make a clinical decision as the service ultimately relies upon their medical knowledge, with the medical professional having access to the raw data within the medical device.

**Provision of healthcare services**

If the digital technology is providing health care or adult social care in England, the legal entity must also register with the Care Quality Commission (CQC) which regulates the quality of care across England. Regulated activities include, but are not limited to, treatment of disease, disorder or injury, diagnostic and screening procedures, and assessment or medical treatment for persons detained under the Mental Health Act 1983. Where secondment, hosting arrangements or other arrangements are in place, the need to register with CQC will ultimately be based on who is responsible for the safety and quality of care or treatment.

All providers of NHS healthcare services must also hold a NHS provider licence, granted by Monitor, the economic regulator for all health and social care. In order to be granted the licence applicants must also be registered with the CQC and pass a ‘fitness’ test, which is applied to persons involved in overseeing the organisation. Anyone receiving payment for providing NHS healthcare services must consider whether they need a licence. There are a number of exemptions to this requirement, for instance if a company receives less than £10m of its turnover from the NHS.

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**Figure 8: Regulation in the NHS**

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**Data**

Organisations that have access to NHS patient data must comply with the standards set by the Health and Social Care Information Centre (HSCIC). The HSCIC develop and maintain the IG Toolkit, which compiles legal rules and central guidance to present a set of information governance requirements. Organisations are required to carry out self-assessments of their compliance against IG requirements. Where services are commissioned for NHS patients, the commissioner is required to obtain assurance from the provider that they are compliant with the IG requirements and this requirement should be set out in the commissioner-provider contract.
Innovation

The NHS IT infrastructure set out above in figure 6 above includes some world class elements, such as the NHS Choices Website, the NHS Spine and the primary care IT system, combined with a woeful history of reportedly botched IT projects such as the £10bn patient record system abandoned in 2013. There is a wide recognition at all levels of the NHS that technology can be a key part of the solution to the challenges that the system faces – the Five Year Forward View report released in 2014 devoted an entire chapter to the role of technology. But as that report recognised, to date the organisation has oscillated between central initiatives that have foundered due to a lack of local engagement, and the opposite approach of innovation at a local level, resulting in a patchwork of systems and a lack of interoperability. In an attempt to address this disconnect the National Information Board, which brings together organisations from across the NHS, has been established and tasked with setting out a series of road maps which will lay out steps towards digital initiatives such as:

- A national system for accreditation (“kitemarking”) of healthcare apps and online services;
- Fully interoperable electronic health records which patients can access and even edit, alongside the use of the NHS number for identification across all areas, and;
- Online GP appointment booking and prescribing to be routinely available

Alongside these roadmaps NHS organisations and partnerships were invited to apply to become vanguard sites for the development of new care models, some of which will involve the use of digital technology. Vanguard status comes with access to a £200m Transformation fund.

Conclusion

The NHS is a population-focused national service. This potentially makes it uniquely placed to innovate and experiment with new models of care enabled by technology.

As a taxpayer funded system in an age of seemingly never ending austerity the imperative to take advantage of the efficiency gains that digital technology can offer could scarcely be higher. There is acceptance at all levels of the NHS that technology needs to be embraced, coupled with a willingness to devote funds to foster innovation.

And yet there remain formidable barriers that digital healthcare companies looking to sell into the NHS must surmount, not the least of which appears to be a lingering distrust of private enterprise. Within reports such as the Five Year Forward View or the first report produced by the National Information Board “Personalised Health and Care 2020” there is strikingly little mention of the importance of accessing digital healthcare innovation from SMEs, with babylon the only company mentioned by name in either of these landmark reports.

British digital healthcare companies can scarcely ignore the NHS when it accounts for 90% plus of UK healthcare spend and when the potential opportunities are so significant.

But the most successful approaches seem likely to be those that combine a cross level sell into the NHS (at the individual hospital, surgery or department level but also at the CCG, consortia or national level) attuned to where funding for innovation has been granted, with a B2B or B2B2C strategy and one eye on international relevance from inception.
The US

Overview

The US healthcare system is primarily private insurance based, with many Americans covered by a scheme funded by their employers – the largest US health insurers collected total insurance premiums of $744bn in 2013.\(^\text{15}\)

The government operates two schemes to cover those with very low incomes or disabilities (Medicaid) and the over 65s with either low income or insufficient medical insurance (Medicare). Some private insurance plans cover only the most basic treatment, with anything beyond that requiring out of pocket (OUP) payments by the patient.

US healthcare spending is forecast to increase at 4.9% annually between 2014 and 2018, partly driven by the Patient Protection and Affordable Care Act (ACA) which expanded Medicaid coverage and introduced mandatory health insurance in an attempt to increase coverage and slow the rise in costs. Gallup reported that close to 90% of Americans were insured by the first quarter of 2015 – this reduction in the proportion of uninsured people will lead to total spend hitting 17.9% of GDP by 2018.\(^\text{18}\)

Alongside this increase in insurance coverage there is a move by employers to shift to high deductible insurance plans

These are schemes which offer lower premiums but which do not cover all the costs of treatment, adding to already high out of pocket costs for individuals. The increased use of health insurance marketplaces by individuals, including that operated by the government, is also adding to this trend with the aim of making Americans more conscious of the costs of treatment and reducing the number of unnecessary procedures and scans. The ACA is also generally considered to have led to an overall increase in regulation, in an effort to control overall costs. Although the US spends more on healthcare as a percentage of GDP than any other country worldwide, it ranks poorly on measures such as life expectancy (27th out of the 34 OECD nations)\(^\text{19}\) and hospital beds per 1,000 people (2.9 in 2013\(^\text{20}\)). This combination of high cost and relatively poor provision makes the US market a fertile one for digital healthcare solutions. The country is home to many of the most exciting digital healthcare businesses in the world, taking advantage of a traditional position of world leadership in medical innovation – since 1966 Americans have received more Nobel prizes in medicine than the rest of the world combined.

Healthcare provision

Total healthcare spend was estimated at $3.1 trillion in 2014, with $620bn of this paid by employers, equating to around three quarters

\(^\text{15}\) National Association of Insurance Commissioners, 2013
\(^\text{16}\) Deloitte, Healthcare Outlook 2015
\(^\text{17}\) Gallup, 2015
\(^\text{18}\) Deloitte, Healthcare Outlook 2015
\(^\text{19}\) Journal of the American Medical Association, 2013
\(^\text{20}\) Economist Intelligence Unit
of their employees’ medical costs\textsuperscript{21,22}. The US does not have a nationwide network of medical facilities open to the public, with the majority of facilities owned privately, although there are also local government owned facilities. Post ACA health insurance is now mandatory and insurers may not deny coverage due to pre-existing conditions.

**Regulation**

**Data**

The Healthcare Insurance Portability and Accountability Act (HIPAA) establishes the privacy and security standards around the use and disclosure of protected health information, along with the safeguards that must be put in place by an organisation dealing with individually identifiable healthcare information in electronic form. The Health Information Technology for Economic and Clinical Health Act (HITECH), which accompanied the Affordable Care Act of 2010, expanded the requirements of HIPAA and made them applicable to companies working with entities that deal with protected information – particularly relevant for digital healthcare companies, who therefore must ensure that they implement strong systems and safeguards to protect data.

**Medical devices**

The Medical Device Amendments to the Federal Food, Drug and Cosmetic Act provide for the regulation of medical devices intended for human use. Devices are classified as Class I, II or III, with Class I being the lightest regulated group relating to devices which do not support or sustain human life and therefore the most likely classification in digital health – Class I devices do not require premarket approval, but must comply with regulations on registration and listing with the FDA, labelling and reporting. Firms which manufacture, repackage, relabel or import medical devices are then regulated by the Center for Devices and Radiological Health (CDRH) department of the FDA.

The application of medical device regulation to digital healthcare companies came into sharp focus in 2013 when the FDA ordered the genetic testing kit firm 23andMe to cease selling its existing product to consumers until it could validate the accuracy of the tests. The testing kits were being provided with reports which provided statistical analysis of certain genetic traits – the FDA raised the concern that the science around some of this analysis was not certain and that there was a risk of individuals making health decisions based on incomplete information. 23andMe was able to continue to provide information on ancestry based on genetic samples but could no longer tell a customer anything about their health. The company’s new customer sign-up rate dropped 50%. Recently the company has been cleared by the FDA to offer 35 tests for heritable conditions or diseases – still a long way below the 254 they were screening for originally.

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\textsuperscript{21} Centers for Medicare and Medicaid Services, 2014  
\textsuperscript{22} NBGH and Towers Watson Survey 2013
State level

Regulation also operates at a state level, particularly in terms of granting permits and licences. These regulations can be highly relevant for digital healthcare companies, particularly in relation to telemedicine as individual doctors are licensed only to practice within their state. Teladoc, the largest telemedicine business in the US, recently obtained an injunction from a Federal Court blocking the Texas Medical Board from requiring a face-to-face visit before a physician can prescribe medication to a patient. The new rules were interpreted as illegally limiting competition.

Conclusion

The sheer scale of US healthcare spending has fostered perhaps the most vibrant market for digital innovation globally.

The US accounted for 79% of digital healthcare funding globally in the year ending Q3-15. The familiar barriers of fragmented systems, sparse electronic medical records and interoperability issues are as prevalent in the US as any other market, but such is the generally recognised opacity and wastefulness of the system that technologies which help address these issues are a sub-category of digital healthcare in their own right. Castlight (see sidebar on page 21) operates a SaaS tool that employers can use to achieve price transparency on the healthcare benefits they provide to their employees – simplifying the management of healthcare and reducing costs. Oscar (see sidebar on page 20) takes this a step further, placing digital at the centre of health insurance to build a new business for the post ACA market. Digital and design are at the centre of care management, claims processing and cost transparency.

Figure 9: US digital healthcare system

The US has also been at the forefront of innovation in a number of other digital healthcare categories, with established models in the US often serving as models for other businesses worldwide, particularly in telemedicine where Teladoc and Dr On Demand have pioneered the video consultation model. The ACA created a new center for innovation at the Center for Medicare and Medicaid Services (CMS), funded by a $10bn grant.
Western Europe

Overview

It is difficult to generalise about Western European healthcare systems, with substantial differences between how treatment is managed at the point of care and how patients pay and are reimbursed.

Typically administration is more localised than is the case in the UK, with local and state government playing important roles, with a greater overall degree of regulation and price control than in the US. Total spend as a share of GDP hovers at around 9% to 12%.

Healthcare provision

Hospitals and GP surgeries have fairly diverse ownership – state, mutual and friendly societies, private (including ownership by universities and religious foundations). Payment is usually made by the patient at source, with direct reimbursement then made by the state, the insurer or a mutual organisation. France and Belgium operate a smart card system whereby a family’s card will contain details of their entitlement to care and which is swiped at the point of use to initiate the reimbursement process. Reimbursement is not 100% so many citizens will then belong to a mutual association which tops this up. Germany operates a slightly different system with citizens paying c. 13% of their income into one of c. 300 statutory state sickness funds (matched by their employer) which then operate either through reimbursement or direct payment to a medical facility by the fund. Around 15% of people opt out of this system and take private health insurance. There is also a social fund of last resort for those not covered by the statutory funds or private insurance. By contrast, Sweden operates a fully government funded and highly decentralised system funded largely by local taxes. The country’s regional municipalities control the system and are responsible for healthcare provision. Small fees are levied for GP visits, prescriptions and inpatient consultations.

Regulation

Regulation or negotiation of pricing often occurs at a local level – in Germany sickness funds will negotiate their prices separately with doctor’s associations, supplemented by a uniform fee schedule for all physicians working under the social code. Regulation of medical devices is governed by the Medical Devices Directive which states that a medical device must bear the CE mark before it can be brought to market. For Class I devices which are not sterile and do not have a measuring function this mark can be obtained simply by registering with the relevant national department. For digital healthcare companies in many European markets the single most important factor in their success or failure can be qualifying for reimbursement under the rules of health insurers, mutual and sickness funds. This can be managed centrally, as in France where the Comite Economique des Produits de Sante (CEPS), under the authority of the health and economy ministries, negotiates the prices and reimbursement of medical devices. The equivalent in Germany is the umbrella organisation which covers the Statutory Health Insurance funds.
(SHIs). The route to becoming reimbursable can therefore be quite complex for innovative medical devices which are used by patients rather than physicians, outside of a hospital and which do not match a generic technical specification.

Conclusion

The healthcare systems of Western Europe are not beset by the same sense of permanent crisis as those in the US or UK, with established funding structures and a higher level of satisfaction with the level of care received.

Healthcare spend remains a relatively high proportion of GDP, but is allied to outcomes that compete well with the best globally. The threat of an ageing population does loom large, particularly in Germany, but generally as part of a wider debate about the sustainability of high cost social systems in an age of austerity. So far this has resulted in a smaller number of digital healthcare start-ups, with the most exciting amongst them tending to focus on external markets (see sidebar on Medigo on page 23) or to deploy B2B models (see sidebar on Neuronation on page 23).
Keys to Success in Digital Healthcare Globally

While the differences in healthcare systems across (and within) the key national markets are substantial, there are many common themes that suggest there is an optimal approach for success in digital healthcare — below we consider what the key elements of this approach might be.

A deep understanding of the healthcare ecosystem

Many digital healthcare entrepreneurs are imbued with a genuine desire to make a difference – while this motivation has driven some exciting innovation in the space it can quickly run up against the realities of the sheer complexity of national healthcare systems. Understanding this complexity and using it to your advantage is a key ingredient of success and can take a number of different forms:

- **Identifying a clear problem in need of a solution:** being laser focused on a clearly defined inefficiency or challenge within the sector yields greater dividends than catch all solutions. For example, TrialReach focusing on helping pharmaceutical companies find relevant participants for clinical trials, thereby addressing one of the key bottlenecks in the drug development process.

- **Locating specific or ring fenced funding:** national healthcare budgets run into the billions, but amounts dedicated to, or available for, digital innovation, tend to be far smaller. For example, while the NHS may have a total budget of £100bn companies such as Cupris Health have found it simpler to gain access to the >£20m that the Small Business Research Initiative for Healthcare, an NHS funded body, has available for companies developing innovative products that address unmet health needs.

- **Identifying an imposed target:** hospitals, surgeries and commissioning groups have limited funds and bandwidth – some digital healthcare companies are finding that the best way to get the attention of administrators is to focus on a target they have been set, such as cutting Did Not Attend (DNA) rates or increasing coming forward (those seeking treatment for a stigmatised condition such as mental illness) rates. For example, Ingenica (see sidebar on page 14) have focused their sales specifically on the GS1 certified inventory management component of their ERP software, recognising that the government’s decision to implement the GS1 standard for supply chains means hospitals have a pressing need for software that delivers this. The effectiveness of digital technologies can generally be measured more simply than that of traditional processes, but digital healthcare companies still need to understand which standardised measures are used within the industry to demonstrate fully the value they can add.

B2B models

A direct B2C sell in healthcare holds many challenges, not least because in most national markets the consumer is simply not conditioned to pay for healthcare, at least not without near immediate reimbursement.

Qualifying for reimbursement by a major insurer or provider is one way of getting past this challenge in markets such as Germany – Sonorned’s hearing treatment app Tinnitracks was one of the first apps in the country to qualify for reimbursement by an insurer, removing a key barrier for consumers. Direct B2C can also work well where the service provided is something people expect to pay for, as with HomeTouch’s marketplace for finding carers. But generally marketplace models, such as Zesty’s, facilitate contact between consumers and businesses, with the service provided free to the consumer but a charge then being made to the business.

However, pure B2B models can also be a mixed blessing with the sales cycle for a global pharmaceutical business or health insurer often every bit as long as that for a National or Regional healthcare system. Partnering with a larger corporate player or operating a B2B2C/B model can yield better results, with the digital healthcare SME harnessing the brand, scale and marketing machine of their partner to sell into consumers or other businesses. For example, iPlato is able to plug into more than 1,000 GP practices by offering a solution which works with the software provided by EMIS to a majority of practices in the UK.
Creative design / user experience

The B2C approach may be a challenge but the ability to engage consumers is paramount in digital healthcare.

The great advantage digital technology has is its ability to engage, whether that is manifested in lower DNA rates for mental health treatment when delivered digitally (IESO), higher levels of treatment adherence (Neuronation) or enhanced interaction with medical knowledge (HealthUnlocked). Each of these businesses, and the majority of those in this report, use high quality design and a focus on user experience (UX) to engage with consumers. This attribute, combined with a certain creative agility, is key to the success of private SMEs in an ecosystem dominated by the public and voluntary sectors and by global corporations.

Cross ecosystem relevance

National healthcare systems are highly particular, but the digital companies which operate in them cannot afford to be.

The US is a possible exception where the scale of spending and of the wider market allows companies such as Castlight and Oscar to develop solutions that are highly tailored to their local market, and can even motivate non-US companies to focus on the US market from an early stage (for example BigHealth, a UK business which relocated to the US to access employer demand for its cognitive behavioural therapy apps). But for non-US players being relevant across ecosystems from early on is key in order to access as many payers (national and local governments, insurers, mutual, corporates) and channels to market as possible. Medigo is a good example of this approach, with a global health tourism marketplace that connects facilities and patients across a range of markets and is also exploring corporate partnerships globally.

Long term investors

Rapid success in digital healthcare is likely to be the exception rather than the rule.

The need to comply with regulation and navigate long sales cycles means that even the best digital healthcare companies will take time to gain traction – particularly if they also need to build up significant databases or develop AI capabilities before they can realise their full potential. But our analysis in the preceding pages does suggest that the ‘size of the prize’ within digital healthcare justifies a patient approach – digital technology is widely recognised as the key to making the >$7 trillion spent annually on healthcare go further, with better outcomes for patients.

Models which work today, but with one eye on the future

In many ways the wider healthcare sector has a long way to go before it catches up with the technological innovations of the last decade.

At the same time new healthcare technologies are emerging which have the potential to revolutionise the way we think about medical treatment and our health more broadly – we explore this further in our next section. In combination this makes it essential for a digital healthcare SME to have a plan for the longer term, whether that consists in using a video consultation app to feed data to a healthcare artificial intelligence ‘brain’ (babylon), or combining a marketplace model for connecting doctors and patients with management software for surgeries (Doctolib).
The Next Ten Years

As our previous section concludes, a degree of future proofing is important for digital healthcare companies. The healthcare sector has traditionally been a laggard in adoption of technology, meaning that significant efficiency gains can be achieved by the deployment of established rather than emerging technologies. But there are areas where healthcare technology is cutting edge, alongside some developments in care models and patient journeys that could radically boost the adoption of digital healthcare technology. Below we pick out some of these key trends.

Genomics

Consumer genomics is controversial because it removes the physician from the equation and provides genetic data, and basic interpretation of that data, direct to the individual.

Earlier in our report we covered the company 23andMe, generally regarded as the first direct to consumer genomics company, able to test hundreds of thousands of DNA sequence variants for over 250 medical conditions such as heart disease, cancer and diabetes for as little as $99. But in the long term it seems inevitable that individuals will have access not just to a small proportion of their DNA sequence but to their whole genome, enabling informed decisions about their health and the care they receive. Even more exciting is the possibility of population level genetic data which will revolutionise healthcare research – by combining genetic information with other data about an individual and using modern data science to benchmark against the wider population it will become possible to provide accurate calculations of the risk of developing a particular condition and to identify lifestyle choices that could moderate that risk. The implications for wearable health technology could be particularly exciting, as we move beyond monitoring heart rate, calorie intake and activity to sweat, saliva and breath, and compare that information to the wider population, cross indexed against our own genetic code.

Electronic health records

The desirability of an electronic health record (EHR) that can be easily accessed by a patient and by the physicians treating them across GP surgeries and secondary facilities has been clear for a generation, yet very few countries worldwide have a functioning national system.

Privacy concerns (France, the Netherlands) have been a key barrier, as has the sheer scale of the logistical challenge in connecting up the disparate elements of healthcare systems (the UK, Germany). But over the next few years most European countries will seek to implement national EHR systems. In the US a sub-category of digital healthcare companies providing an EHR system has emerged, with individual organisations and practices choosing from a range of providers, although limited interoperability of these systems makes a national or regional EHR a challenge. The EHR is not only a great way of empowering the patient and facilitating choice, which is essential for the success of digital healthcare, but also opens up the possibility of integrating an individual’s medical history into a digital consultation or treatment plan.

Artificial intelligence

In a sector where clinical knowledge is estimated to double every 18 months, artificial intelligence can be key in helping physicians leverage the full scope of data and insight available to them as they seek to diagnose or treat a patient.

Programmes or applications that make use of AI can also reduce the burden on GPs and hospital A&E departments by providing health information to the “worried well” and allowing those with minor ailments to check their symptoms and obtain reassurance. Initial controversy around the possibility of AI replacing physicians over time has given way to excitement about the potential for smart tools to assist a doctor, nurse or specialist in manipulating data and knowledge and guiding them towards more consistently
accurate diagnosis and calibrated treatment. The potential to combine advanced AI with genomic data or data from a large number of EHRs is particularly exciting.

**Moving beyond the hospital**

**Between 1975 and 2013 the number of hospitals in the US dropped from 7,156 to 4,995**

Eric Topol argues that this trend will accelerate with hospitals as we know them today becoming extinct. He cites both the unacceptably high number of preventable deaths in hospitals (c. 440k annually in the US) due to factors including hospital acquired infections, serious medication errors and misdiagnoses, and their huge cost and inefficiency (the average hospital bill in the US is $4.3k per day). The ACA is supportive of this trend, reducing Medicare reimbursement for hospital stays. By ever greater use of remote monitoring technology the need for inpatient care, and thus exposure to the risks and costs of a hospital stay, will continue to reduce. The next generation of remote monitoring technologies are likely to include the use of sensors, be they specially designed or already present in the ever increasing number of connected devices in the modern home. Apps or devices which can use smartphone computing power to carry out the functions of diagnostic tools will allow ever more complex data to be shared with a consultant remotely. Over time the hospital will become a centre for emergency or intensive care only.

![Remote monitoring of vulnerable patients](image)

**Figure 10: Remote monitoring of vulnerable patients**

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24 American Hospital Association  
25 The Patient Will See You Now, Eric Topol  
26 Ibid
Value based healthcare

One of the trends driving the move away from a reliance on hospitals by removing the previous perverse incentives to maximise hospital stays, such as routine reimbursement for readmissions, is the wider trend away from volume to value (or outcomes) based commissioning (VBC) of healthcare.

VBC focuses on lowering costs and increasing the quality of care by aligning incentives and management of risk between providers and payers. The inefficiencies of the US healthcare system mean it is particularly ripe for this change of approach, with the ACA taking the first step in breaking the link between volume of care (including potentially unnecessary procedures or scans) and profit for providers. The UK is arguably better than most at extracting value from parties external to the NHS - the National Institute for Health and Clinical Excellence appraises health technologies and drugs for clinical and cost effectiveness before clearing them for use within the NHS – but building VBC into internal funding is more of a work in progress. Digital healthcare can be the key enabler of VBC due to the simplicity of demonstrating ROI and then measuring the ongoing performance of a digital solution or product.
Investment and Acquisition Dynamics

Digital healthcare financing activity

Digital healthcare funding has seen an overall increase in volume and value over the past three quarters. Recent successes for VCs backing digital healthcare companies are driving interest in the sector. This is leading to a larger number of investments and increasing deal values as investors back both new start-ups and more mature players.

Fundraising activity in the digital healthcare space has increased substantially in 2015. Between Q1-Q3 2015 there were 214 deals vs. 191 for the same period in 2014 and 161 in 2013.

Overall funding also increased, driven primarily by a number of high value rounds in Q3-15. This quarter saw the largest fundraise in the sector over the past three years when We Doctor raised $394m, while ZocDoc also raised $130m, making Q3-15 a record quarter with a total of $1.5bn raised.

*Figure 11: Digital healthcare financing activity per quarter from Q1-13 to Q3-15*

This increasing investor interest in the digital healthcare space partly reflects a number of high profile IPO (Teladoc, Evolent Health) and M&A (Softwriters) exits for venture backed digital healthcare businesses, demonstrating the potential to generate strong returns in the sector.

Average deal value has increased on a monthly basis throughout the year, reaching $44m in September. A large majority of the later stage rounds are coming from the US, with nine of the top 10 funds raised by US companies over the past three years.
Clearly the US market is later (albeit not late) stage than Europe.

This has led to a reduction in its share of the total value of deals below $30m in the space when comparing the nine month periods ending Q3-14 and Q3-15. Investors may be turning to other geographies, particularly Europe, to look for the next success stories in digital healthcare.

**Figure 12: Average deal value for twelve months ending Q3-14 and Q3-15 ($ millions)**

![Graph showing average deal value for twelve months ending Q3-14 and Q3-15](image)

*Source: CapitalIQ, Mergermarket, GP Bullhound intelligence*

**Figure 13: Deals below <$30m by geography for nine months ending Q3-14 and Q3-15**

<table>
<thead>
<tr>
<th>% deals by value</th>
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<tr>
<td>Q1-Q3 14</td>
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<tr>
<td>Other markets:</td>
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<tr>
<td>10%</td>
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<tr>
<td>US: 90%</td>
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<td>Q1-Q3 15</td>
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<tr>
<td>Other markets:</td>
</tr>
<tr>
<td>19%</td>
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<tr>
<td>US: 81%</td>
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*Source: CapitalIQ, Mergermarket, GP Bullhound intelligence*
To date in 2015, digital “telemedicine” businesses have been the most frequent fundraisers, although on a value basis online healthcare marketplaces and networks lead the field, led by rounds from We Doctor, Oscar and ZocDoc.

The online marketplace is a well-established model with a clear value proposition in healthcare, so it is unsurprising that it should be the first to reach a degree of maturity in digital healthcare.

**Figure 14: Fundraisings by sub-sector for 2015 YTD (ending 31 October 2015)**

Increased innovation, such as the development of artificial intelligence tools to support the telemedicine model, could be driving increased investment in the sub-sector. The success of companies like Teladoc has also led to a number of start-ups replicating the model in local markets.

Digital treatment or diagnostics has seen the lowest level of funding by number and similarly low levels by value. There are a smaller number of companies active in this space but funding has been available for both earlier and later stage rounds. Examples include 23andMe and Clue, a period and fertility tracking app, who raised $115m and $7m respectively.

Within next generation healthcare IT fundraising is dominated by the US; 96% of companies raising funds to date have been US headquartered. DrFirst, offering software solutions across e-medication management, secure communications and care collaboration, recently raised $25m from Goldman Sachs, and The Right Place, a SaaS platform which helps healthcare service providers match post-acute patients to the right place of care, recently received seed funding. The US has been the prime mover in this sector, with high costs of care driving providers to invest in solutions aimed at reducing inefficiencies and managing the complexities of the healthcare system. Other markets are taking note of US success in this regard; Qinec recently raised $9m to develop further its personalised healthcare management platform.
Strategic investors have participated in over a quarter of the funding rounds year to date in 2015. Excluding all deals below $30m, this increases to 57% indicating that strategic investors are particularly prevalent within later stage rounds.

AllScripts invested $200m in Nanthealth in June 2015 and Tencent recently invested in We Doctor as part of its $394m raise.

**Figure 15: Fundraisings by strategic vs. financial investors for 2015 YTD (ending 31 October 2015)**

Merck has been particularly active, with participation in eighteen rounds since mid-2012, indicating pharmaceutical companies are increasingly looking to digital healthcare to drive innovation. Investments include CareSync, provider of software for chronic disease management, and Navigating Cancer, an information and social website for cancer patients and their supporters.

Healthcare insurers, Kaiser Permanente and BlueCross & BlueShield, also make the list of leading strategic investors. These venture funds are actively investing in next generation healthcare IT businesses such as Validic and Health Catalyst, as a means of improving patients’ quality of care and reducing costs.

The leading strategic investors list also includes Google Ventures and Qualcomm Ventures. Their interest in the space has not been limited to venture capital and their strategic imperative to invest in digital healthcare is discussed in more detail in the M&A section below.
2015 has also seen an active IPO market with listings from four digital healthcare players. However, despite raising over $1bn as part of their combined IPOs, these companies have experienced mixed performance in the stock market, all underperforming Nasdaq as of 31 October 2015.

**Figure 17: Share price performance of digital healthcare companies since IPO in 2015**

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GP Bullhound - Digital Healthcare, 2015
Source: CapitalIQ, 31 October 2015
Digital healthcare M&A activity

Despite a slow start to 2015, M&A activity in digital healthcare picked up pace as the year went on with Q3-15 beating Q3-14 by 50%. But M&A activity continues to lag fundraising with just 48 deals globally to date in 2015. Many are small transactions, just 24% of deals (where value disclosed) were over $100m in value.

Low M&A volumes reflect the early stage nature of the digital healthcare sector, with potential for M&A activity to increase in line with the greater number of later stage rounds seen in Q3-15.

**Figure 18: Digital healthcare M&A activity per quarter from Q1-13 to Q3-15**

<table>
<thead>
<tr>
<th>Number of deals</th>
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The majority of targets acquired have been headquartered in the US, 63% of deals year to date. Followed by the UK and China at 8%.

**Figure 19: Deals by geography for 2015 YTD (data to 10 November 2015)**

% deals by number

France: 2%
Australia: 4%
India: 4%
Germany: 4%
UK: 8%
China: 8%
Sweden: 2%
Israel: 2%
Bulgaria: 2%
US: 63%
To date digital healthcare M&A has been driven by a range of different acquirer groups; we have identified over eight different types of acquirer who have actively pursued acquisitions within digital healthcare.

*Figure 20: Active consolidators in digital healthcare*

- **Healthcare software providers**: turning to digital healthcare companies as a source of innovative products to enhance their current offerings. Examples include System C Healthcare’s acquisitions of The Learning Clinic, provider of real-time mobile clinical systems.

- **IT services**: building a presence in digital healthcare through acquisition. Most notable is IBM, which acquired three companies in 2015 (Merge Healthcare, Phytel and Explorys). These acquisitions focused on adding further data and machine learning capabilities to its IBM Watson Health platform.

- **Internet**: companies such as Google have been building their presence in healthcare both at an investment and acquisition level as they look to replicate past successes in the consumer internet space in the healthcare market. Google acquired Lift Labs, developers of Smart utensils for people with Parkinson’s and essential tremor.

- **Pharmaceutical companies**: digital healthcare applications are increasingly becoming viable treatment tools, with pharmaceutical companies keen to take advantage of this growing trend. In 2015 Teva Pharmaceutical Industry acquired Gecko Health Innovations, a cloud based solution to simplify chronic respiratory disease management.

- **Pharmacies**: Lloyds Pharmacy’s acquisition of Dr. Thom in 2011 for an undisclosed sum was ground breaking at the time. Recent acquisition activity is limited but as pressure on pharmacies to take a more active role in wider healthcare increases there is the potential for renewed acquisition interest.
• **Digital healthcare companies**: active consolidators in their own right, acquiring rivals to increase market share and start-ups to enhance existing product capabilities. Shortly before its IPO, Teladoc completed the acquisition of Stat Health, also focused on the telehealth space.

• **Telecoms**: Telstra, the Australian communications company, has launched its own healthcare division, Telstra Health. The division originally focused on the telemedicine space, building on its expertise in telecommunications. In 2015 it completed three acquisitions; most notably it acquired Dr Foster, the health informatics company launched in conjunction with the UK Government. As the success of this division grows, other telecommunications companies may look to replicate the model.

• **Private equity**: much like the venture capitalists, private equity firms are seeing value in adding digital healthcare businesses to their portfolios.

**To date in 2015, next generation healthcare IT businesses have been the subject of the majority of takeovers within the digital healthcare sector. Acquisitions of these businesses have also been some of the largest to date, representing seven of the top 10 deals.**

- IBM acquired Merge Healthcare, medical image software solutions, for $975m
- Managed Health Care Associates invested $450m across two healthcare software deals, including Softwriters, software solutions for long-term care pharmacy providers

**Figure 21: Deals by sub-sector for 2015 YTD (ending 10 November 2015)**

Acquisition activity has been limited across the digital treatment or diagnostics space; again there are a smaller number of companies playing in this field.

- EDG Partners acquired PWN Health, a technology platform that facilitates over five million diagnostic tests per year
- Sharecare acquired Feingold Technologies, smartphone software that analyses human behaviours helping diagnose and reduce stress
Digital “telemedicine” activity has picked up substantially over 2015, with the majority of acquisitions (60%) taking place in the second half of the year.

- Geona acquired 1DocWay, telepsychiatry start up
- Diabetes Tools acquired DiabetesGuru, consumer-facing diabetes tracking app for children

There have been a number of smaller transactions in healthcare marketplaces and networks with limited disclosed deal values available and no transactions >$100m recorded.

- WhatClinic acquired Toothpick.com, online dental appointment booking service
- Burda Digital acquired jameda, physicians rating portal for $50m
## Selected Private Placements

<table>
<thead>
<tr>
<th>Date</th>
<th>Target</th>
<th>Investor</th>
<th>Country</th>
<th>Transaction Value (S)</th>
<th>Company Description</th>
<th>Sub-Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-15</td>
<td>Attune Technologies</td>
<td>QI Limited, Navalis Venture Partners</td>
<td>India</td>
<td>10</td>
<td>Web-based software solutions for healthcare delivery organizations</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Figure 1</td>
<td>Alien &amp; Company, Graph Ventures, Rho Capital, Union Square, Vision One Ventures</td>
<td>Canada</td>
<td>9</td>
<td>Medical image sharing mobile application</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Lyra Health</td>
<td>Bayer, Capital Health, Greylock, Diligent Capital, Providence Health, VerraCord</td>
<td>US</td>
<td>33</td>
<td>Data-driven platform to identify people at risk of behavioral and mental health conditions</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Ziband</td>
<td>Canstar, Rite Management, Google Ventures, Illumina, ERY Capital, NEA, Experiment Fund, Wuxi PharmaTech</td>
<td>US</td>
<td>115</td>
<td>A personal genetics company that provides ancestry-related genetic reports and uninterpreted raw genetic data</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Doctabi</td>
<td>Accel Partners, Angels</td>
<td>France</td>
<td>20</td>
<td>Platform to book doctor appointments online</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Clue</td>
<td>Union Square, Mosaic Ventures</td>
<td>Germany</td>
<td>7</td>
<td>Period and fertility tracking app</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Sep-15</td>
<td>CareSync</td>
<td>Cleanwell Group, Tuba Health, Harbert Ventures, Greyrock Partners, March</td>
<td>US</td>
<td>18</td>
<td>Provides software and services for chronic disease management, including 24/7 nursing services for patients</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Kyushu</td>
<td>New Leaf, Providence Health, Leetah, McKesson, Medica Sciences, Highland, Lux Capital, VerraCord</td>
<td>US</td>
<td>37</td>
<td>Self-based referral coordination platform that helps hospitals optimize patient access and referral management</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Clowr Health</td>
<td>Athyum Capital Management, ret Round Capital</td>
<td>US</td>
<td>100</td>
<td>Data-driven health insurance start-up that uses data to identify highest risk patients, help them become healthier &amp; improve outcomes</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Omada Health</td>
<td>Novartis Venture Partners, Andressen Horwitz, Union Square, Rock Health, DE Ventures, 8th Capital</td>
<td>US</td>
<td>49</td>
<td>Digital therapeutics, creates scalable &amp; cost-effective online behavior-change programs that address chronic disease</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Oscar</td>
<td>Google Capital</td>
<td>US</td>
<td>33</td>
<td>Health insurance company that employs technology, design, and data to humanize health care</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Sep-15</td>
<td>MardemannMedicine</td>
<td>Perlmann Group, Sands Capital Management, SunSet Partners</td>
<td>US</td>
<td>38</td>
<td>Electronic medical records systems</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Aug-15</td>
<td>HomePulse</td>
<td>-</td>
<td>UK</td>
<td>-</td>
<td>Online care platform which connects patients with caregivers</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Aug-15</td>
<td>Skin16on</td>
<td>LED Pharma</td>
<td>Netherlands</td>
<td>3</td>
<td>A mobile app that allows you to understand your risk factors for melanoma skin cancer and keep track of your mole</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Aug-15</td>
<td>ZoocDoc</td>
<td>Atomics, Bolle Giford, Founders Fund</td>
<td>US</td>
<td>130</td>
<td>Online medical care scheduling service that helps patients find doctors that accept their insurance and book an appointment</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Aug-15</td>
<td>GrandRounds</td>
<td>Greylock, Harvest-Medical Capital, VerraCord</td>
<td>US</td>
<td>55</td>
<td>Outcome management platform and end solution that connects patients with highly specialized care</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Aug-15</td>
<td>Practo</td>
<td>Sequoia Capital, Seedna Social, Anonyme, Motus Partners, Klimert Capital, Tencent, Google Capital</td>
<td>US</td>
<td>90</td>
<td>Solutions that enable users to find doctors and book appointments online</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Jul-15</td>
<td>Pager</td>
<td>NEA, Lux Capital, Montage, Goodwater Capital, Sound Ventures</td>
<td>US</td>
<td>14</td>
<td>Operates a healthcare dispatch and technology platform which provides doctor house calls services for non-emergency care</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Jul-15</td>
<td>PushDr</td>
<td>-</td>
<td>UK</td>
<td>2</td>
<td>App that facilitates online video consultation and chat with doctors</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Jul-15</td>
<td>Your MD</td>
<td>Smekling Capital</td>
<td>UK</td>
<td>5</td>
<td>Personalized health assistant application</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Jun-15</td>
<td>Medline GY</td>
<td>Vain+</td>
<td>Finland</td>
<td>1</td>
<td>Patient engagement tools, including a patient portal, telehealth monitoring tool, and remote education and coaching tool</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Jun-15</td>
<td>MCLVE</td>
<td>Bedford Funding</td>
<td>US</td>
<td>30</td>
<td>Telehealth provider of online and on-demand healthcare delivery services and software</td>
<td>Digital telemedicine</td>
</tr>
</tbody>
</table>

**Source:** CapitalIQ, Mergermarket, GP Bullhound intelligence
## Selected M&A Transactions

<table>
<thead>
<tr>
<th>Date</th>
<th>Target</th>
<th>Buyer</th>
<th>Country of Target</th>
<th>EV (m)</th>
<th>EV / LTM Revenue</th>
<th>EV / LTM EBITDA</th>
<th>Company Description</th>
<th>Sub-Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov-15</td>
<td>Tarma</td>
<td>Bunda Digital</td>
<td>Germany</td>
<td>50</td>
<td>-</td>
<td>-</td>
<td>Leading eHealth company for physician rating and search</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Nov-15</td>
<td>DocWay</td>
<td>Genoa</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Telepsychiatry startup</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Oct-15</td>
<td>Vevo Health</td>
<td>PatientSafe Solutions</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Technology to motivate and coach patients at home, using trained care liaison</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Gecko Health Innovations</td>
<td>Teva Pharmaceutical Industries</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Cloud-based solution to simplify chronic respiratory disease management and provide remote monitoring tools</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Sep-15</td>
<td>The Learning Clinic</td>
<td>Syneos C Healthcare</td>
<td>UK</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Often Vista/PAC Nurse, it’s mobile solution that records patient observables in real time</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Capsule Technologies</td>
<td>Qualcomm Life</td>
<td>France</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Provides software that helps healthcare facilities collect and process data coming from medical devices</td>
<td>Digital treatment or diagnostics</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Intraphath</td>
<td>Practo Technologies</td>
<td>India</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>Provides cloud and location based hospital management systems and EHR software solutions</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Gilwell Technologies</td>
<td>Practo Technologies</td>
<td>India</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Patient relationship platform that provides doctor appointments</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Sep-15</td>
<td>Optimus EHR</td>
<td>Yardi Systems</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Clinical content and electronic medical records software solutions for patient care applications</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Aug-15</td>
<td>DiabetesGuru</td>
<td>Diabetes Tools</td>
<td>Sweden</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>DiabetesGuru, a consumer facing diabetes masking app for children</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Aug-15</td>
<td>Two Leavens Health</td>
<td>Everyday Health</td>
<td>US</td>
<td>30</td>
<td>-</td>
<td>-</td>
<td>Saas-based analytics platform for hospital systems to identify and engage consumers and physicians</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Aug-15</td>
<td>ACP AdvancedMD</td>
<td>Health Equity Partners</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Develops cloud-based electronic health record (EHR), practice management, and medical scheduling software</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Aug-15</td>
<td>Merge Healthcare</td>
<td>IBM</td>
<td>US</td>
<td>975</td>
<td>4.3x</td>
<td>24.7x</td>
<td>Software that facilitates the sharing of images to create an electronic healthcare experience for patients and physicians</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Jul-15</td>
<td>Quantia</td>
<td>Physicians Interactive</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Parent company of physical social network, QuantiaMD</td>
<td>Healthcare marketplaces and networks</td>
</tr>
<tr>
<td>Jul-15</td>
<td>PinelCom</td>
<td>EMIS Health</td>
<td>UK</td>
<td>5</td>
<td>2.5x</td>
<td>-</td>
<td>Supplier of administration and compliance software to both the primary and the secondary care markets</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Jun-15</td>
<td>Numerex’s mPERS</td>
<td>Nortel Security &amp; Control</td>
<td>US</td>
<td>12</td>
<td>4.9x</td>
<td>-</td>
<td>mPERS telehealth business and other telehealth assets</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Jun-15</td>
<td>Stat Health</td>
<td>Teladoc</td>
<td>US</td>
<td>48</td>
<td>20.1x</td>
<td>-</td>
<td>Offers online doctor visits</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>May-15</td>
<td>Predicsys</td>
<td>Weathor</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Provides healthcare analytic solutions to health plans, providers, and other healthcare-bearing entities</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>May-15</td>
<td>Phyhel</td>
<td>IBM</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Population health management software</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Apr-15</td>
<td>Esolarys</td>
<td>IBM</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Healthcare intelligence cloud company that has built one of the largest clinical data sets in the world</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Mar-15</td>
<td>Dr. Foster</td>
<td>Telstra Health</td>
<td>UK</td>
<td>12</td>
<td>-</td>
<td>-</td>
<td>Provider of healthcare variation analysis and clinical benchmarking solutions</td>
<td>Next generation healthcare IT</td>
</tr>
<tr>
<td>Mar-15</td>
<td>Dictaphone</td>
<td>Kaneco</td>
<td>US</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Tool that both helps practices that new patients as well as communicate with their existing ones</td>
<td>Digital telemedicine</td>
</tr>
<tr>
<td>Mar-15</td>
<td>WebOMR</td>
<td>Havershealth</td>
<td>Israel</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Web-based clinical applications and electronic health record platform</td>
<td>Next generation healthcare IT</td>
</tr>
</tbody>
</table>

### Source:
CapitalIQ, Mergermarket, GP Bullhound intelligence
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