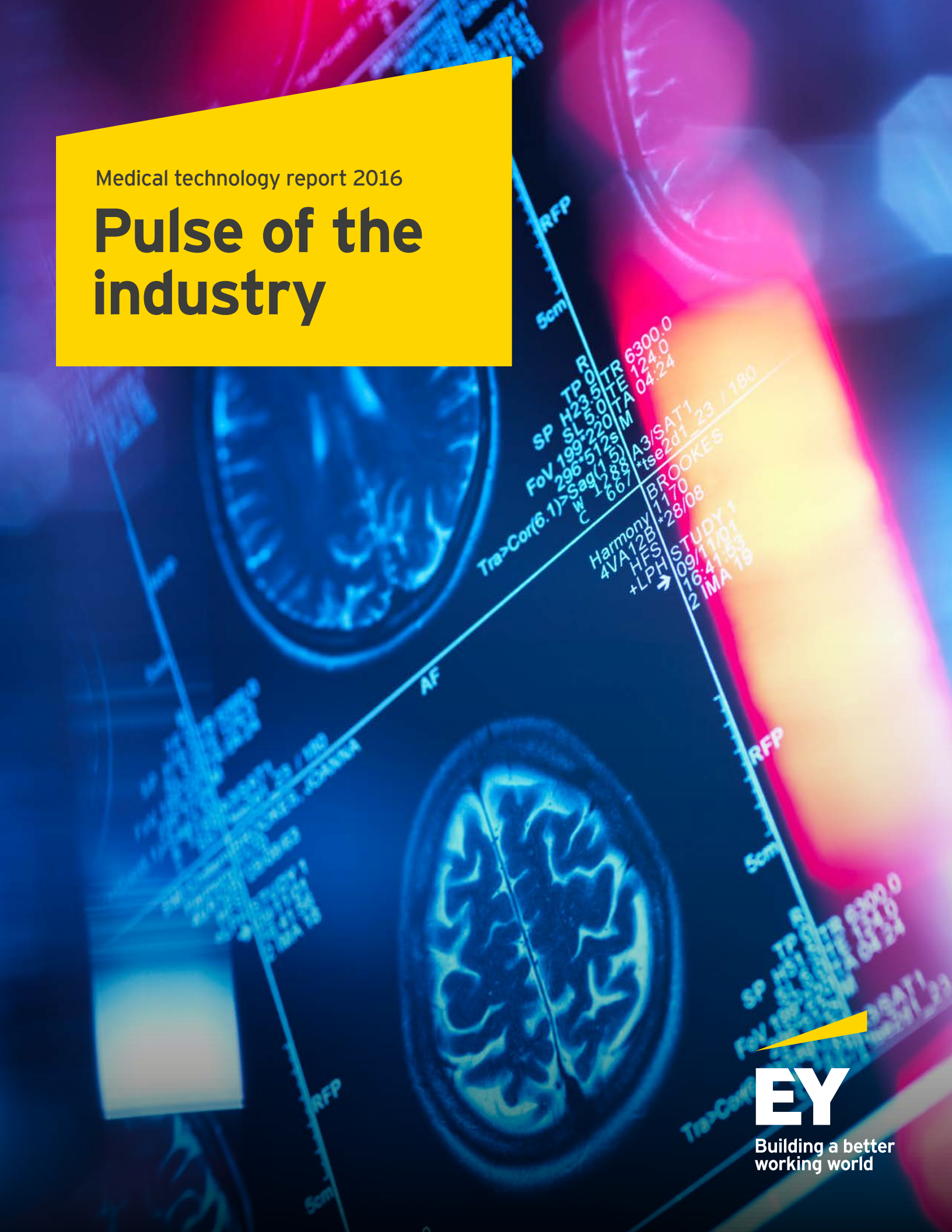
Medical technology report 2016

Pulse of the industry



Building a better working world

After another year of lackluster performance, how will the medical technology industry reignite growth? This fundamental question is central to the analysis in the 2016 edition of *Pulse of the industry*, EY's annual medtech report.

This is the ninth year we've documented the trends buffeting the medtech sector and their implications. Consumer empowerment, digital enablement and new competitors are reshaping the medtech landscape as never before; tech giants and start-ups are developing service-driven solutions and "smart" devices aimed at wellness and medtech white spaces, while engaged patients are increasingly vocal about product value.

In the face of such forces, the very definition of "medtech" continues to evolve. While there is clear demand for therapeutic focus and real-world data collection, companies' strategic responses vary tremendously. Some continue to pursue innovative business models, bolstering therapeutic depth with new digital or service capabilities, often gained by innovative partnerships. Others, meantime, must determine if they have the requisite scale to compete in today's altered health care ecosystem. These companies are asking another basic, but critically important, question: am I a buyer, ***or seller***, of medtech assets?

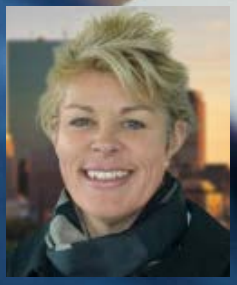
The fact that medtechs are even asking this question suggests that macro trends will continue to drive a strong environment for mergers and acquisitions, a finding highlighted in the report. But equally important, the question reinforces the notion that this is an industry in transition.

That assessment is further underscored by the report's 2015–16 key financial indicators, which paint a mixed picture for medtechs' performance, and are both caused by — and causes of — the industry's ongoing transformation.

As investors demand higher growth and the financing climate becomes less certain, the medtech industry has an opportunity to reignite performance via embracing some of those same trends — particularly consumer empowerment and digital — that threaten to disrupt it. Many have already done so, prioritizing products and solutions that improve real-world health outcomes.

As medtechs continue to adapt their business strategies, EY's global organization continues to track the pulse of the industry. You can keep up to date with our latest perspectives at our digital home, Vital Signs (ey.com/vitalsigns).

We look forward to ongoing conversations with you in one-on-one discussions and via social media. Please follow our Twitter feed (@EY_LifeSciences) for more.



Pamela Spence
Global Life Sciences Industry Leader, EY

John Babitt
Americas Medtech Leader, EY

Connect with us!

@EY_LifeSciences

ey.com/vitalsigns

Contents

Year in review

Medtech's top trends

During the 12 months that ended 30 June 2016, the medical technology industry boasted a strong M&A environment but a slight decline in revenue and a pronounced dip in profits. Pure-play medtechs fared better than conglomerates during 2015, growing the top line by more than 2%. Both groups were buffeted by currency headwinds.

Traditional medtechs that don't adapt sufficiently to the new environment risk being edged out by companies that do.

Importantly, the year featured a solid performance in venture capital financing. However, the public capital markets' appetite for initial and follow-on public offerings seemingly disappeared as the year progressed and a generally weaker financing climate emerged. In the calendar year 2015, medtech market capitalization outpaced both the broader markets and other health care sectors such as biotech, as a result of sector rotation and medtech's expansion into health services. These mixed metrics indicate that medtech is an industry in transition, adapting to fundamental shifts in reimbursement, consumer empowerment, digital enablement and the competitive landscape.

Although capital allocation strategies suggest management teams are focused on short-term priorities, there are also intriguing signs that the sector is investing in long-term innovation. In 2015-16, early-stage medtech investing reached new heights, spurred by strategic investors and a growing interest in developing tools necessary for biopharmaceutical innovation, including genetic sequencing services for diagnosis and precision medicine. (See the accompanying guest perspective "Investing in precision medicine diagnostics," by Tom Miller of GreyBird Ventures.)

The year also saw the emergence of several partnerships between medtech and infotech companies, as Johnson & Johnson teamed up with Alphabet Inc.'s subsidiary Verily Life Sciences (the former Google Life Sciences) to create Verb Surgical, and Medtronic tapped into the computing power of IBM's Watson to improve diabetes treatments. A sign of the times: Verb's stated goals of better patient outcomes and greater hospital efficiencies belie the reputation that medtech has sometimes earned as delivering merely iterative product innovations.

Shifting business models

Medtronic's embrace of health care services and J&J's participation in the creation of Verb Surgical point to increasingly blurred lines between medtech, health IT, health care services and even therapeutics. The recent formation of Galvani Bioelectronics by GlaxoSmithKline and Verily, and Boehringer Ingelheim's alliance with Qualcomm to create an Internet-connected inhaler for certain respiratory diseases, are additional evidence of the convergence taking place in the industry.

Driven by a need to deliver value to the health care marketplace, this convergence comes as medtechs (and medtech investors) pursue innovation outside the traditional boundaries of the sector. (See guest perspectives "Building connected health services," by Hans-Peter Frank of Vifor Fresenius Medical Care Renal Pharma, and "Galvanizing innovation in medtech — and biopharma," by Kris Famm of GlaxoSmithKline and Galvani Bioelectronics.)

Consequently, the very definition of "medtech" continues to evolve. There is a clear demand for therapeutic focus and real-world data collection as the health care market shifts from volume to value. How medtechs adapt their business models in response varies tremendously. What is clear: traditional medtechs that don't adapt sufficiently to the new environment risk being edged out by companies that do.

Propeller Health, for example, combines mobile apps and patient services with sensors that attach to traditional inhalers to improve care for patients with respiratory disease. Others, such as Illumina spin-offs Grail Bio and Helix, are employing traditional medtech products to build out new technology and service businesses. Each is powered by Illumina's sequencing muscle and US$100 million in venture investment. Grail aims to develop a liquid biopsy to detect disease by measuring snippets of tumor DNA in the bloodstream. Helix will offer sequencing services to third parties in the consumer genomics space.

Portfolio optimization

This technological convergence is happening in parallel with the industry's largest therapeutic device players' drive for scale and strength in their chosen core medtech categories. Abbott Laboratories' US$30.7 billion acquisition of St. Jude Medical and its announced acquisition of Alere are the boldest and most prominent acquisitions of 2015-16. They are transformational deals that add depth to Abbott's existing cardiovascular and diagnostics capabilities. Including St. Jude's own acquisition of Thoratec, Abbott was responsible for nearly half the year's disclosed M&A value.

The medical device industry is contending with pricing pressure in an environment where payers and hospital systems wield increasing influence.

But even as companies are pursuing M&A to achieve dominance in one category, they're divesting products or businesses where they don't have, or can't achieve, the economies of scale to succeed. The sale of Abbott's eye surgery business, Abbott Medical Optics, to J&J for US$4.3 billion, announced in September 2016, will be captured as part of next year's *Pulse* findings. That deal further illustrates the continued reshaping of medtech portfolios and how companies are responding to a dynamic payer and provider landscape.

Other companies remained active, optimizing portfolios with a variety of bolt-on transactions to fill portfolio gaps and flesh out geographic reach. These smaller transactions boosted the total number of M&A deals with announced terms to a record high in 2015-16. Among the year's many serial dealmakers: Thermo Fisher Scientific, Stryker and Essilor.

Scale and business model transformation often go hand-in-hand: Medtronic, less than two years removed from its transformational Covidien deal, inked 12 buyouts in 2015–16, including the US$1.1 billion acquisition of HeartWare International.

Terms of payer engagement

Though the cost spotlight has shined most brightly on the specialty drug arena, the medical device industry is similarly contending with pricing pressure in an environment where payers and hospital systems wield increasing influence. In diabetes, Medtronic's deal with the large US insurer United Healthcare positions the medtech giant as United's preferred insulin pump provider. As a result, Medtronic has sacrificed some pricing power to achieve greater market penetration.

The deal is unusual in its size but emblematic of the medtech sector's interest in teaming up with payers to improve health care quality and lower costs in exchange for guaranteed market access and share. It may also come to represent a tipping point as payers and providers increasingly seek comparative effectiveness data for medical devices and negotiate with manufacturers based on that information, either alone or through payer-provider alliances like the United Healthcare-backed SharedClarity. Highmark Health and its provider system Allegheny Health Network have created VITAL, a program to review and test approved medical devices that have yet to lock in commercial reimbursement.

In part, this shift toward better medtech-payer collaboration is being driven by the uptick in bundled payment programs, particularly in the joint replacement arena. In early 2016, the Centers for Medicare and Medicaid Services announced its Comprehensive Care for Joint Replacement program. The program sets a fixed reimbursement for all costs associated with total-knee and total-hip replacements, including in the hospital and post-acute care setting.

The five-year payment model is being rolled out in 75 geographies, where most hospitals will be required to participate. Emphasizing quality and cost allows device makers to differentiate their products by helping providers streamline and improve care delivery.

So far, the bundling program hasn't directly affected the price of implants, since reducing costs associated with hospital readmissions and infections remains the top priority. However, providers are under pressure to offer optimal care while meeting cost constraints. That has led to an uptick of interest in the Syncera program, a leaner technology-enhanced service model, developed by Smith & Nephew. On a July 2016 earnings call, Smith & Nephew's management noted the program has "exceeded expectations" and that they are considering expanding it.

Regulatory successes — and challenges

The medtech industry has enjoyed increased regulatory success over the past two years. In the US, the vast majority of devices that come to market are lower risk and can use the so-called 510(k) clearance pathway to gain marketing approval. According to the U.S. Food and Drug Administration (FDA), from 2010 to 2014 the time to decision after regulatory submission for 510(k)s dropped 13% while the percentage of those cleared increased from 11% to 84%.

About 1% of devices require more extensive testing in humans and are reviewed via the Premarket Approval (PMA) channel. During 2015, the number of PMAs in the US surged to 43, a second straight increase and a massive 72% jump over 2014. As of 31 August 2016, there were 27 PMAs, putting the industry on track to match 2015's decade-long high-water mark. And, in late September 2016, months

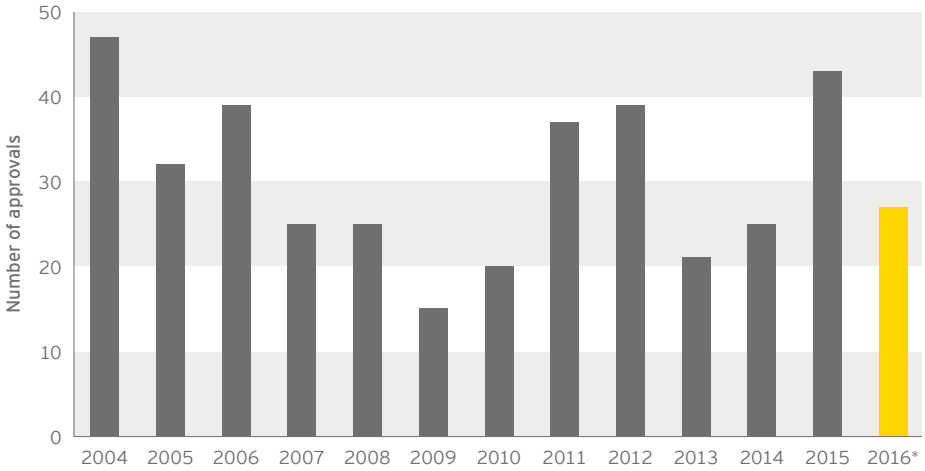
sooner than investors anticipated, the FDA approved the first-ever device designed to automatically monitor blood sugar and provide basal insulin as needed. The device, which is made by Medtronic, lessens the treatment burden for type 1 diabetics and may improve their long-term outcomes because of the opportunity to more tightly regulate blood sugar around the clock.

The jump in approvals can be explained by revisions the FDA made to the device approval process several years ago. In addition, the increase also suggests industry's willingness to generate the evidence necessary to pass the FDA's higher regulatory bar — or at least it's acceptance of the need to do so.

Adding to the warmer regulatory climate in the US, legislators suspended — at least until 2017 — the medical device tax scheduled to be implemented as part of the Affordable Care Act. For an industry struggling to generate top- and bottom-line growth, it was a welcome respite. The medtech industry is also beginning to digest guidance from the FDA around the use of real-world data, as well as FDA recommendations on mitigating device cybersecurity threats following the 2015 discovery of security vulnerabilities in Hospira's infusion pump systems.

In the EU, meanwhile, medtechs face sweeping regulatory changes stemming from the European Medical Device Regulation (MDR) that will require greater compliance and patient safety oversight. Medtechs now need to determine which areas of their portfolio are at greatest risk based on the emerging guidelines and begin the hard work of implementation. (See guest perspective "Taking a risk-based approach to Europe's medical device regulation," by EY's Lucien De Busscher and Eithne Lee.)

PMA approvals for medical devices, 2004–16



* Through 31 August 2016

Source: FDA, Includes only original applications

PE pulls back, China moves in

Seeking better growth opportunities, private equity (PE) buyers have become less active in the medtech sector. Once relatively big players, PE investors were responsible for only 8% of the non-megadeal deal flow in the past two years — about half as much as during 2010-12. The decline may continue as PE buyers see more enticing growth prospects in areas such as health care services and digital health, as well as contract research and manufacturing.

During the past year, however, PE groups did cash in on their previous acquisitions. Two of the year's top exits were Stryker's acquisition of Madison Dearborn-owned Sage Products (US$2.8 billion) and Greatbatch's acquisition of Bain Capital- and Kohlberg Kravis Roberts-owned Lake Region Medical, a manufacturing and engineering outsourcing company (US$1.7 billion). More recently, in August 2016, KKR and co-investor TPG Capital sold their minority stake in Zimmer Biomet.

Meanwhile, China-based acquirers have continued to leave their mark on the global medtech M&A landscape. During the 12 months that ended 30 June 2016, Chinese buyers acquired 15 US- or EU-based medtechs, as well as 26 medtechs in other geographies, including key emerging markets such as India, Korea, Russia and Brazil. Should current trends continue, Chinese buyers will be on pace to top 2015–16's total US$2.1 billion disclosed deal value in 2016–17.

Building connected health services

Hans-Peter Frank
Global Head, Integrated Solutions
Vifor Fresenius Medical Care Renal Pharma

As demographic, digital and financial forces continue to transform how health care is delivered and reimbursed, the currency determining value now – and in the future – is not first-in-class medicines or technologies. Instead, it's the data those products generate in real-world studies.

In this environment, the very definition of a medtech or biopharma product is changing. In primary care areas such as diabetes or heart disease, there is much discussion about moving "beyond the product," adding patient services tied to adherence or home monitoring to the traditional medtech or pharma offering to demonstrate real-world value.

In the renal space, where my company, Vifor Fresenius Medical Care Renal Pharma*, operates, we are expanding the product definition even further. Our "product" is the delivery of improved outcomes for chronic kidney patients and the health systems that pay for those patients' care. As such, our product is an integrated health service combining pharmaceutical products, dialysis and other clinical services, and predictive algorithms developed from the anonymized outcomes data we collect.

> Our product is an integrated health service combining pharmaceutical products, dialysis and other clinical services, and predictive algorithms.

When the product is also the algorithm

Let me give you a real-world example. Chronic kidney patients suffer from severe anemia as a result of both dialysis and decreased kidney function. In addition to experiencing shortness of breath, severe fatigue and impaired cognition, these patients must be monitored closely because of comorbidities such as cardiovascular disease. We can counteract the anemia with intravenous iron and erythropoietin stimulating agents (ESAs), but these drugs are costly and have side effects. ESAs, for instance, increase a patient's risk of blood clots in the veins, heart attack and stroke.

Imagine if we could monitor laboratory measurements such as hemoglobin levels to predict which patients are most likely to develop severe anemia. Based on a predictive marker, we could intervene preemptively and selectively, improving the quality of life of those patients at greatest risk, while helping the rest avoid unnecessary side effects.

We're in the process of commercializing an algorithm that can do this, leveraging approximately 100,000 patient life years of data collected at Fresenius Medical Centers. We have already validated the algorithm in our own dialysis centers. Now we are working with providers in the UK to replicate and further validate our results. We anticipate launching our first commercial pilots in other European nations by the end of 2017.

The algorithm is considered a Class I medical device. Our goal is to use these data as a basis for a new integrated health service. Vifor Fresenius will be reimbursed if we help patients avoid severe anemia based on internationally defined guidelines.

Implementation hurdles

We started working on this initiative 12 months ago as the market evolved from selling pills and devices to collaborating around value. But while it's an obvious win-win for patients, payers and

"Significant investments are required to create these algorithms, but we expect the returns will be worth the costs."

manufacturers, implementing this model is not trivial. Different health systems have different levels of readiness when it comes to reimbursing outcomes as a service. We're most interested in launching this service first in health systems in Italy, Spain, France, Canada and the UK. In Germany, health care services and products are reimbursed independently, making this model harder to effect. In the US, the diversity of payers adds significant complexity.

The algorithm for anemia hinges on structured data collected from laboratory reports. With the evolution of enabling technologies such as cloud computing and machine learning, we now have the ability to gather valuable information from unstructured data sources. For instance, we're beginning to integrate environmental and health data that influence outcomes with lab data to create a second algorithm to better manage bone and mineral disorders associated with chronic kidney disease. By mid-2017, we are confident we will have a usable algorithm.

A big opportunity

Significant investments are required to create these algorithms, but we expect the returns will be worth the costs. From now until 2025, one-third of Vifor Fresenius' revenues will come out of these initiatives.

Medtechs or biopharmas interested in building similar outcomes-as-a-service programs should keep in mind two things. First, strategic collaborations are essential. It's hard for companies to build the required skills organically because they include expertise from three different knowledge pools: pharmaceuticals, services and data analytics. Second, even though it's difficult to change today's health care delivery paradigm quickly, the evolving regulatory framework means there are new opportunities to create data-driven outcomes-based services. As an industry, we need to seize these opportunities.

** Vifor Fresenius is a joint venture between Vifor Pharma, a pharmaceutical company specializing in the treatment of iron deficiency, and Fresenius Medical Care, a provider of dialysis services.*

Investing in precision medicine diagnostics

Tom Miller
Founder and Managing Partner
GreyBird Ventures

The human genome project, completed in 2001, was hailed as a scientific milestone that would provide a foundation for a new generation of cures and diagnostics. Over a decade later, there has been robust growth in the creation of precision therapeutics as biopharma companies seek to develop medicines that can be targeted to specific patient populations.

Interestingly, there has been much less focus on precision diagnostics, defined as the tools necessary to identify these populations of responders. We founded GreyBird Ventures in 2013 and remain the only venture firm exclusively dedicated to developing these kinds of targeted medical tests.

Investing in diagnostics has never been for the faint of heart. Yet at GreyBird, we believe we are at the beginning of a very profitable investment wave marked by currently low asset values and the potential to deliver high returns.

Increasingly, the practice of medicine has evolved from being primarily experienced-based to evidence-based. The demise of the radical mastectomy and the ability to substitute less expensive pharmaceutical interventions for invasive cardiac procedures are two different examples of how longitudinal, population-based data have dramatically altered the standard of care.

> We are inevitably moving toward a world of greater therapeutic, and hence greater diagnostic, precision.

This shift from experience-based medicine to evidence-based medicine is enabled by precision diagnostics: "algorithm-based" tests designed to identify smaller and smaller patient subgroups using an increasingly complex set of genomic, imaging and phenotypic markers. Currently these diagnostics are most often used in oncology, where they identify disease signatures with extremely high sensitivity and specificity. Indeed, these precise tests have enabled the development of more than 800 targeted therapies, now in clinical trials.

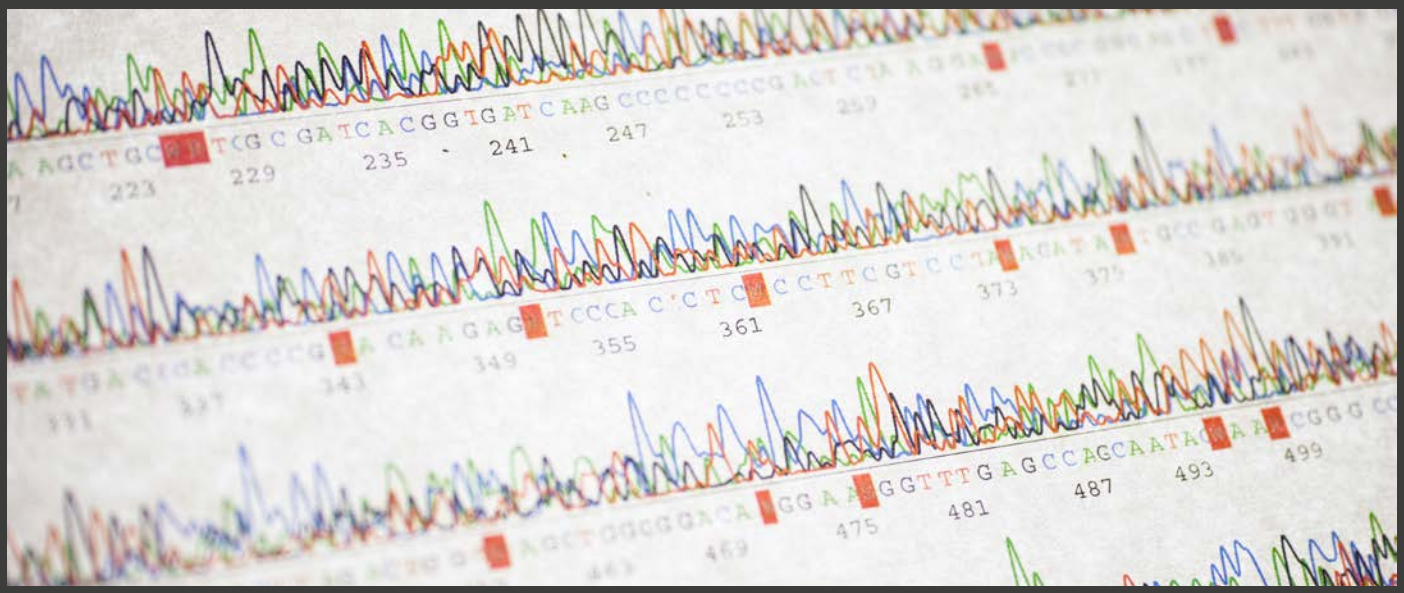
A confluence of four forces makes now the right time to invest in precision diagnostics. Technically, advances in our understanding of biological pathways have blossomed since the sequencing of the human genome. Thus, across multiple disease areas, we now have the ability to discover molecular pathways involved in disease and disrupt them pharmacologically. Clinically, meanwhile, there is rising demand for therapeutics aimed at small "orphan disease" populations where the unmet medical need is high.

This clinical need is further amplified by policy decisions such as the US' Orphan Drug Act (and similar measures in the EU and Japan), which offer market exclusivities to companies that develop therapies for underserved, small disease areas. Finally, slowing growth and poor R&D productivity have further accelerated the biopharma industry's focus on high-priced, specialty products, since the regulatory and reimbursement hurdles for these medicines are perceived to be lower.

In this environment, the only way to move from experience-based medicine to evidence-driven diagnoses is via precision tests. Clinically, physicians face an impossible challenge of matching patients to the appropriate therapy. As disease subgroups become ever smaller, pharmaceutical companies are presently unable to identify patients for their trials without high-specificity diagnostic tests and diagnostic decision support tools.

The good news is, the cost of analyzing disease signature components, whether they are genetic, physiologic or imaging-based, continues to fall. Meanwhile, the uninterrupted monitoring of patients through passive sensors and mobile devices has become ever easier, generating a wealth of phenotypic data

"The only way to move from experience-based medicine to evidence-driven diagnoses is via precision tests."



that can be mined. Simultaneously, more sophisticated machine learning technologies can be applied to analyze the complex data to extract patterns and aid the increasingly overwhelmed practitioner.

Finally, the extremely high prices for the new, targeted therapies is forcing policy changes from both governments and insurers to reduce overdiagnosis and quickly identify individuals who don't respond to therapy. The reality is that payers and at-risk providers around the globe don't have the budgets to make certain high-priced drugs (e.g., the congestive heart failure drug Entresto or the new PCSK9 inhibitors) available to all patients. In the absence of credible data that demonstrate the clinical utility in a certain patient subsegment, these organizations are taking it upon themselves to classify which patients are the most appropriate candidates for a given medicine.

These dynamics are likely to be in greater evidence in emerging markets such as China, which is responsible for over 40% of global pharmaceutical growth in the last decade. In these markets, adopting the former population/evidenced-based approaches would result in health care system bankruptcy.

Although the full impact of the four forces described above has yet to be felt, we are inevitably moving toward a world of greater therapeutic, and hence greater diagnostic, precision. President Obama's 2015 announcement of the Precision Medicine Initiative, followed by a similar announcement from the Chinese government one year later, provides further clear policy support for the underlying industrial and technical dynamics.

As all medicine begins with diagnosis, we believe that the trends of precision medicine will turn the diagnostics sector from its current moderate value/moderate growth status to one replicating the explosive growth of biotech. Such a scenario benefits clever entrepreneurs and technically savvy investors alike.

Galvanizing innovation in medtech – and biopharma

Kris Famm
VP Bioelectronics R&D
GlaxoSmithKline
President Designate
Galvani Bioelectronics

GlaxoSmithKline announced plans to combine forces with Alphabet's Verily Life Sciences earlier this year to create Galvani Bioelectronics, a joint venture focused on bioelectronic medicines. We believe these therapies represent a completely new modality that complements small- and large-molecule drugs on the biopharma side and traditional devices on the medtech side.

This approach is enabled by tiny, implantable devices that are designed to precisely control the signals associated with specific nerves in the body. The goal is to use the built-in spatial selectivity of the nervous system to modulate disease pathways by delivering electrical signals at precisely the right time to precisely the right organ.

It's still early days, but we believe this approach taps into a fundamental control system in the body that has applicability across a wide range of diseases. We are concentrating our efforts in metabolic disease, endocrine disorders and inflammatory disorders, where we hope to demonstrate proof of concept in humans within three years.

> Our ultimate goal is to develop closed loop devices that automatically and accurately switch on, or off, based on signals in the body that reflect the disease state.

Because we can selectively target nerves that control one organ or system, this approach affords a level of precision that hasn't been possible with traditional therapeutics. Unlike more traditional medicines, our therapies will only be active when the bioelectronic medicine is switched on. Our ultimate goal is to develop closed loop devices that automatically and accurately switch on, or off, based on signals in the body that reflect the disease state.

A long-term vision

Our joint venture with Verily is a long-term commitment. GlaxoSmithKline brings the biological and clinical capabilities, while Verily brings the technical know-how, including a rapid iteration mindset and an ability to derisk the technology.

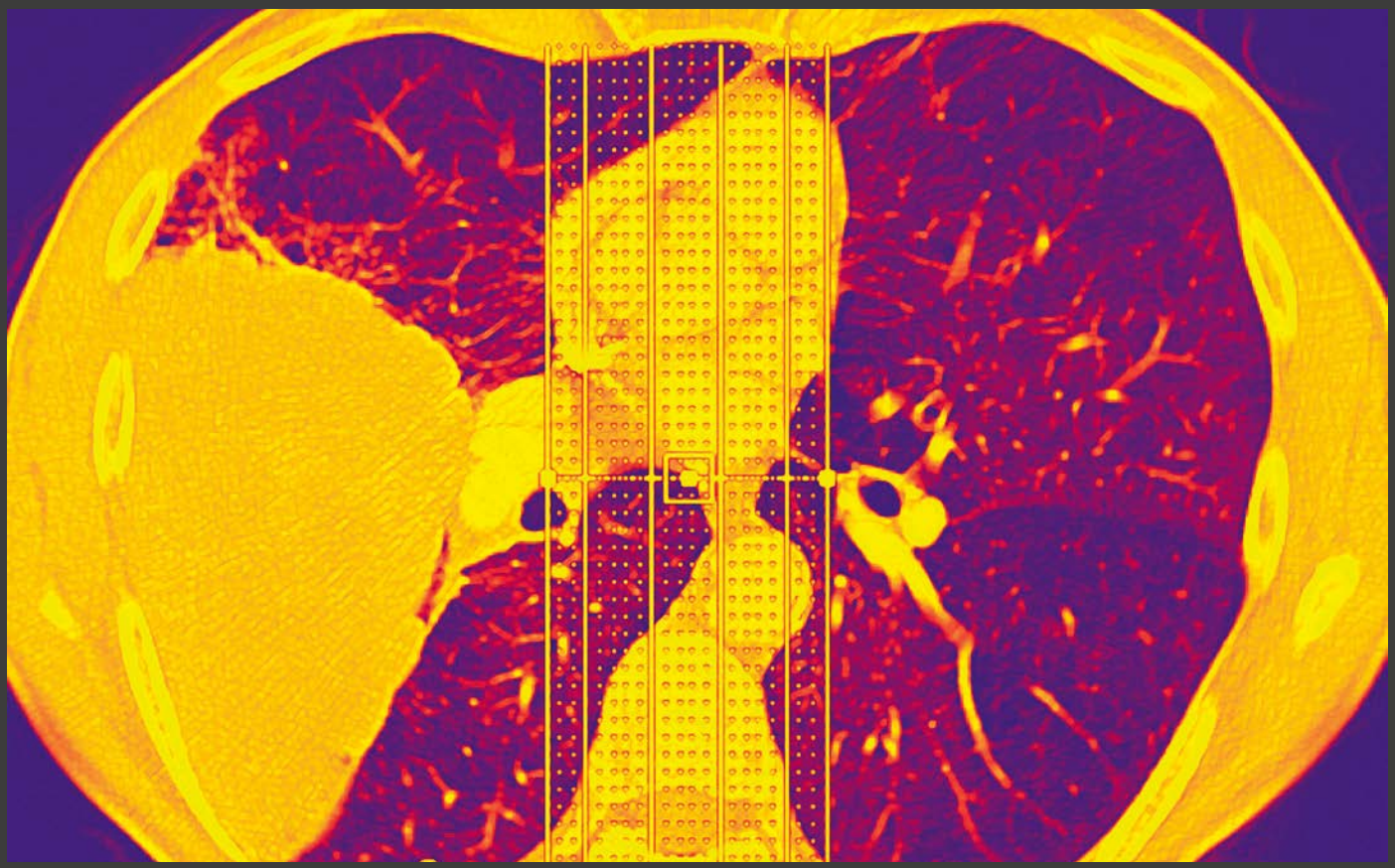
Over the next 12 to 18 months, our goal is to demonstrate as quickly as possible in animal models that this kind of precision neural modulation results in a chronic, therapeutically relevant change in multiple disease states. On the device side, we need to create a first-generation prototype that is not just stable, but can run on a low power source deep in the body.

But we aren't starting from scratch. Both GlaxoSmithKline and Verily have already individually invested time and money in the effort. These stepwise investments mean we now have, at a crude level, a mechanistic understanding of neural circuitry in healthy and diseased states.

A different kind of partner for a different kind of company

Earlier this year, we realized it was time to bring the biology and technology together and ramp up our efforts. The goal was a step change in the device technology. Verily, unencumbered by existing franchises and device technologies, has been able to focus on building a portfolio of differentiated technologies that we believe can result in this step change. On the data analytics front, Verily can also contribute significantly as we record, deconvolute and link neural signals to disease. Since these devices will continuously monitor the patient, we have the potential to generate a very rich real-world data collection.

"We believe our approach taps into a fundamental control system in the body that has applicability across a wide range of diseases."



Over the next seven years, GSK and Verily are contributing more than US$700 million to the initiative. Verily's willingness to invest, and its access to capital, differentiate the company from other device developers. Traditional medtechs more commonly acquire promising devices from smaller medtechs after the technology has proven itself. They don't necessarily invest in the early discovery process. In this instance, where we hope to create a new class of therapy with transformational potential, that willingness to co-invest over the long-term was essential.

Note, we don't believe Galvani's products will primarily compete with either biopharma or medtech products. They will be complementary. Our hope is that if we are successful, Galvani will catalyze future innovations, both technologically and therapeutically, in both the medtech and biopharma sectors, which couldn't be created by smaller companies because of the investment required.

Galvani Bioelectronics is subject to customary closing conditions, including regulatory review in several geographies.

Taking a risk-based approach to delivering EU MDR compliance

Lucien De Busscher
Partner
EY, Belgium

Eithne Lee
Executive Director
EY, UK

After four years of negotiation, the European Parliament has published the text of its EU Medical Device Regulation (MDR), setting the stage for sweeping changes across the medical device value chain.

As expected, medtechs will bear the brunt of the costs of complying with the new regulation. To reduce the costs – and execution hazards – associated with implementation, we recommend companies take a risk-based approach to compliance that involves a detailed assessment of the revenue impact, as well as the cost and complexity of remediation. By outlining a thoughtful, well-ordered approach now, medtechs can protect valuable and future revenues while making upgrades to critical business functions.

Resistance is futile

Spurred by safety concerns associated with breast implants and metal-on-metal hip replacements, the regulations come at a time when the medtech industry is under pressure: industry revenues are contracting, competitors from outside medtech are redefining innovation, and maintaining market share requires investment in new capabilities such as data analytics.

> Companies should take a risk-based approach to compliance that involves a detailed assessment of the revenue impact, as well as the cost and complexity of remediation.

But resistance to MDR isn't really a viable choice. Once the legislation is adopted, an event expected to occur by early 2017, medtechs will have three years to amend a range of activities spanning clinical trials, quality management and commercial activities such as product labeling and design. Products that fail to conform with all aspects of the regulation will lose their CE markings – and thus, the authorizations required to market them.

Simply put, complying with MDR is another stressor for medtechs at an already challenging time, potentially affecting both top- and bottom-line growth. Faced with needing to make significant investments in quality and data management in order to keep products on the market in Europe, some companies may have to forego strategic initiatives such as business development or R&D.

It's difficult to estimate just how great the costs associated with MDR implementation will actually be. Medtechs will need to invest in upgrades to individual devices as well as broader business practices. It's clear that regulators will scrutinize the sophisticated so-called Class III devices – for instance, heart valves and joint implants – more closely than simple Class I instruments such as sutures. Added requirements mandating companies collect clinical data to support product performance, meantime, may necessitate improvements to – or the additional development of – quality management processes across the business.

Thus, just how much medtechs will have to spend to make sure their devices comply with the new regulation will depend on the overall product portfolio mix and the amount of remediation required at both a product and a systems level.

Developing a risk-based agenda

To develop a risk-based MDR agenda, medtechs must examine potential threats associated with three business areas:

- Revenue impact
- Cost of remediation
- Implementation complexity

"Complying with MDR is another stressor for medtechs at an already challenging time, potentially affecting both top- and bottom-line growth."

As a first step, medtechs must identify which devices will be most affected by the new compliance regulations to predict the revenue impact. Second, companies must not only outline the remediation steps required to comply with the new legislation, but estimate the costs associated with these changes. Third, medtechs should outline how to sequence the required changes to identify any potential capability challenges. Only after completing these three levels of analysis can companies begin to understand the trade-offs associated with retiring or replacing devices versus remediating them.

The uncomfortable truth is that the expenditures associated with MDR compliance could easily amount to hundreds of millions of dollars. Because of these costs, device developers will need to make hard choices about which areas of their business to remediate first. Some may decide the costs of remediation exceed the business opportunity, choosing to sell or close down certain product lines.

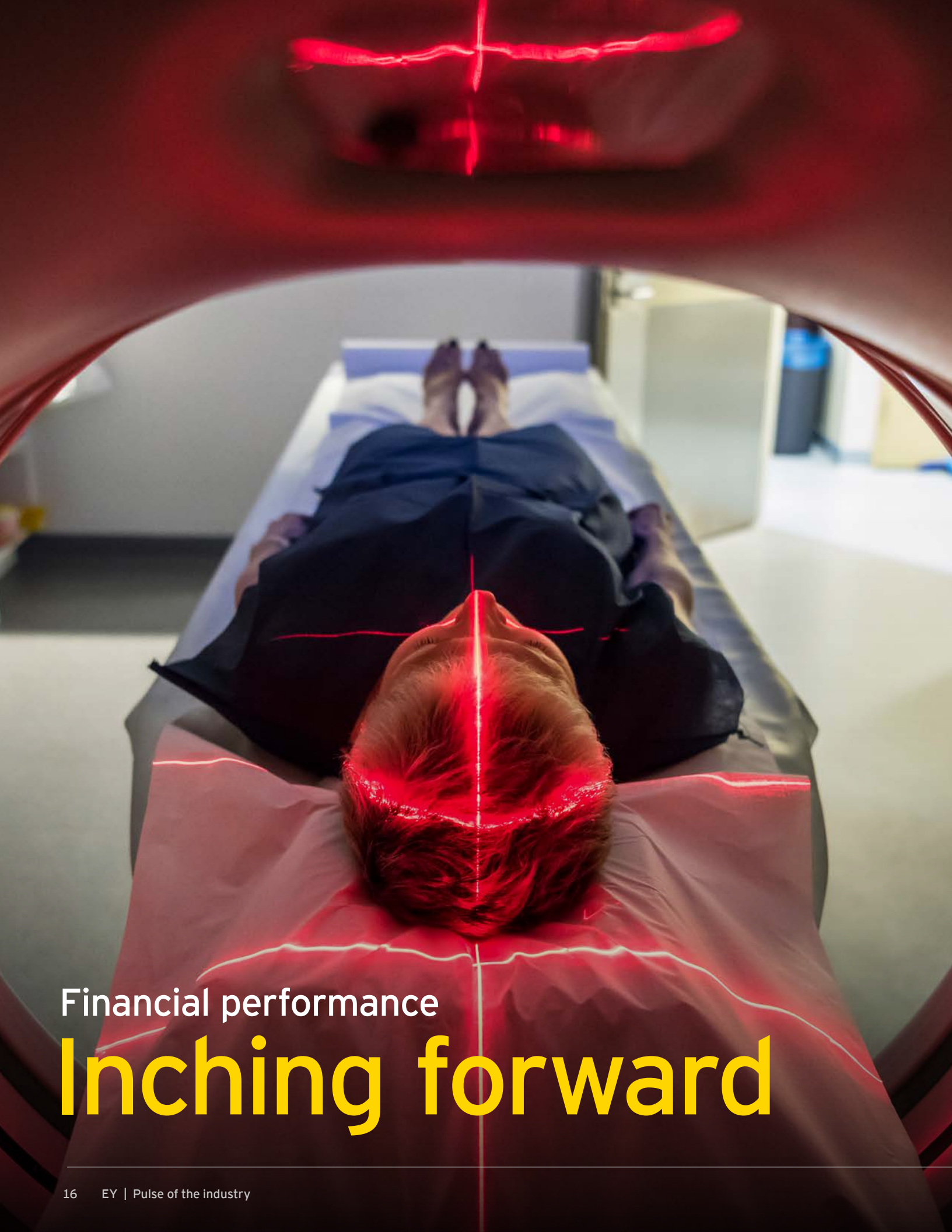
Since the changes required by the legislation are interdependent, a cross-functional approach is a must. Although clinical remediation work will take the longest to implement, companies should also be prepared to allocate significant time for labeling changes, since creating accurate translations in 28 languages is a bottleneck. The elephant in the room is whether medtechs have robust enough data management systems. Complying with MDR requires seamlessly moving information between functional groups, such as supply chain and commercial. Unfortunately, much of this information is siloed, warehoused in databases that are incompatible, making the material difficult – and more expensive – to share.

A safer world

Viewing the new regulation as an onerous, costly and distracting business threat is an oversimplification. The legislation presents companies with an opportunity to build trust with patient, payer and provider stakeholders. Also, while medtechs will bear much of the up-front costs of compliance, the investment in transparent clinical processes, product traceability and quality management systems will bolster companies' reputations, potentially facilitating the market uptake of future innovations.

Those long-standing gains must be appropriately weighed against the short-term pains of compliance. It's time for senior management teams to roll up their sleeves and begin the hard work of implementation.

Let the transition to MDR begin.



Financial performance

Inching forward

During the calendar year 2015, the US and EU medical technology industries continued to outperform the broader markets despite a marked decline in mergers and acquisitions and initial public offerings. But following three years of steady-if-uninspiring low-single-digit growth in key metrics such as revenue and net income, the medtech sector has dipped into the red.

Amid continued pricing and reimbursement pressure, total revenue for the sector fell by 1.2% and net income dropped significantly (-15.5%) compared with 2% growth in each metric during 2014. That revenue contraction is the sector's first since 2011, and was driven by currency headwinds of approximately 2%–3% on a net global basis and underperforming conglomerates.

Pure-play medtechs actually saw revenue increase 2.3% in 2015 — a far-from-stellar performance that was weaker than 2014's 5% revenue growth thanks in large part to the stronger US dollar.

As pure-play medtech growth slows for the third consecutive year, the industry appears to be in transition. To reignite performance, medtechs will need to embrace more modern capital allocation strategies, including continued investment via partnerships and M&A.

In the interim, the medtech sector's market capitalization rose by 12.7% in 2015, with 23 companies posting market cap gains of more than US$1 billion, compared with only six companies that declined by at least US$1 billion. This overall growth is less impressive than 2014's 21% growth and 2013's 31%.

Still, the sector bested overall market benchmarks, including performance of the S&P 500 (down 0.7%) and the Dow Jones Industrial Average (down more than 2%).

Medtech even outperformed the biotech sector, which increased 5% in 2015, as concerns about the sustainability of drug pricing and an overheated market sent investors searching for new opportunities. Indeed, as investors rotated out of biotech and into other areas of health care, medtechs may have been among the beneficiaries.

The continued rise and relative stability of medtech's market capitalization can also be attributed, in part, to its relatively slower upward trajectory in the first place. Medtech's practice of returning cash to shareholders didn't hurt either. The expectation that consolidation would continue following 2014's record year likely also helped keep share prices afloat in 2015 even though much of that deal activity failed to materialize until 2016.

Although the 2015 M&A and IPO markets weren't as strong as 2014's breakthrough year, nearly US$32 billion in acquisitions by medtech pure-plays and more than 30 debut public offerings during the calendar year kept investors interested in the sector, as deal activity remained solid and newly public companies contributed more than 1% to the sector's market cap gains. What's more, 2016's M&A scene is off to an impressive start, with Abbott and St. Jude announcing a US$30.7 billion deal that builds a cardiovascular medtech giant, although the capital markets have continued to cool.

Medical technology at a glance, 2014–15

(US$b, data for pure-plays except where indicated)

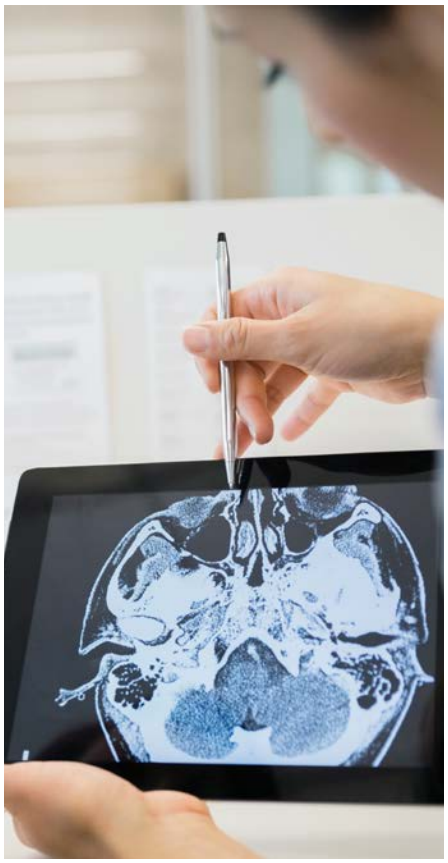
Public company data	2015	2014	% change
Revenues	$337.3	$341.3	-1%
Conglomerates	$143.3	$151.7	-6%
Pure-play companies	$194.0	$189.6	2%
Commercial leaders	$176.3	$172.0	2%
Non-commercial leaders	$17.7	$17.6	0.4%
R&D expense	$15.0	$14.1	6%
SG&A expense	$65.1	$63.3	3%
Net income	$13.7	$16.2	-15%
Market capitalization	$717	$636	13%
Number of employees	748,300	648,300	15%
Number of public companies	455	453	0.4%

Industry results include a pro forma analysis of the Medtronic/Covidien and BD/CareFusion mergers, which was necessary for comparative purposes.

Numbers may appear to be inconsistent due to rounding. Data shown for US and European public companies. Market capitalization data is shown for 31 December 2015 and 31 December 2014.

Source: EY, Capital IQ and company financial statement data.

The sector bested overall market benchmarks, including performance of the S&P 500 and the Dow Jones Industrial Average.



Delays in the implementation of closely watched medtech regulations may also have boosted investor confidence in the sector. In the EU, medtechs face sweeping change as a result of a new European Medical Device Regulation (MDR) that will require greater compliance and patient safety oversight. The broad outlines of the rules, which have been under discussion since 2008, emerged in 2015 and a draft version was released in July 2016. The additional time to implement stricter, and potentially costly, compliance regimens in one of medtech's most important markets has been a welcome respite, though the time of reckoning is fast approaching.

In the US, meanwhile, legislators suspended – at least until 2017 – the contentious medical device tax originally proposed as part of the Affordable Care Act.

Further analysis of market capitalization data shows that therapeutic device companies, the largest subgroup of pure-play medtechs, posted the largest gain in this metric, increasing 19% over the calendar year. In fact, all of medtech's pure-play subsectors remained above water, with even the imaging companies managing to eke out a slight gain of less than 1% on the year.

The sector's other financial performance metrics held relatively steady during 2015. R&D spend grew at just over 6%, roughly the same increase as the past two years. That growth was once again aided by newly public medtechs, whose contribution to R&D spending accounted for more than US$400 million. SG&A expenses grew 2.9%, less than the 5% growth seen in 2014, as general corporate expenses were trimmed

US and European medtech market capitalization relative to leading indices, 2013–16

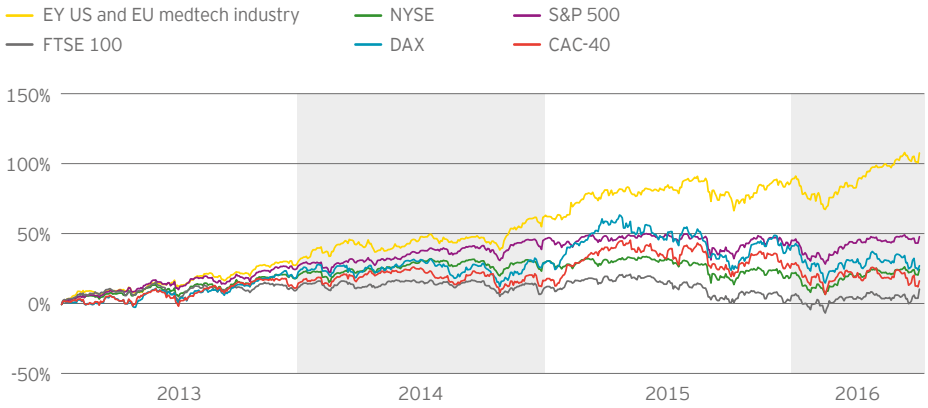


Chart includes companies that were active on 30 June 2016.

Source: EY and Capital IQ.

following the prior year's spate of large acquisitions.

2015 ended with no material change in the number of public medtechs (455 compared with 453 in 2014), but those companies employed about 15% more people than in 2014. The increase in headcount was most pronounced at industry's largest pure-plays and thanks mostly to the acquisition of privately held firms. For example, Zimmer's employee headcount increased by 75% in 2015, with 7,500 joining the orthopedic specialist via its acquisition of private-equity-owned Biomet. Employee numbers also increased significantly at Medtronic (up 75%) and Becton Dickinson (up 62%), following the respective acquisitions of Covidien and CareFusion.

Shrinking conglomerates

The sector's revenue erosion can be traced in large part to the ongoing spate of divestitures at medtech conglomerates as these companies continue to streamline their business models and position themselves for stronger future growth. The group's revenue fell by 5.5%, or US$8.4 billion, in 2015.

After selling its Diabetes Care division to Panasonic Healthcare and KKR for €1 billion in June 2015, Bayer Healthcare's revenue fell by US$1.4 billion (45%). Johnson & Johnson, which remains the largest medtech conglomerate by revenue (US$25.1 billion in 2015), saw revenue fall 9% (US$2.4 billion) year-on-year. A like-for-like operational decline of 1.4% in J&J's medtech business was exacerbated by divestitures. Its once-formidable diagnostics revenue has declined significantly since completing the sale of its Ortho-Clinical Diagnostics business to The Carlyle Group in mid-2014; in cardiovascular, the sale of its Cordis interventional business to Cardinal Health (completed in October 2015) contributed to a drop-off of US$172 million from 2014.

Baxter's spin-off of its therapeutics business into the new entity Baxalta didn't affect its medtech revenue streams, but the company posted a 6% revenue decline and cited negative currency swings as the primary culprit. On a constant-currency basis, Baxter's renal segment grew revenue 1%, but the foreign exchange impact drove revenue down US$383 million, or 10%. The group's surgical care and fluid systems businesses likewise saw increased sales hindered by foreign exchange. Other stalwarts, including Abbott and J&J, also pointed to a stronger US dollar as an impediment during 2015.

Whether or not the recently divested medtech businesses of life sciences conglomerates can excel as stand-alone entities or within the context of pure-play medtech owners remains to be seen. But it's clear that conglomerates increasingly see future growth coming from other sectors such as pharmaceuticals and agriculture, as the medtech industry grapples with tepid R&D productivity and a shift toward value-based reimbursement.

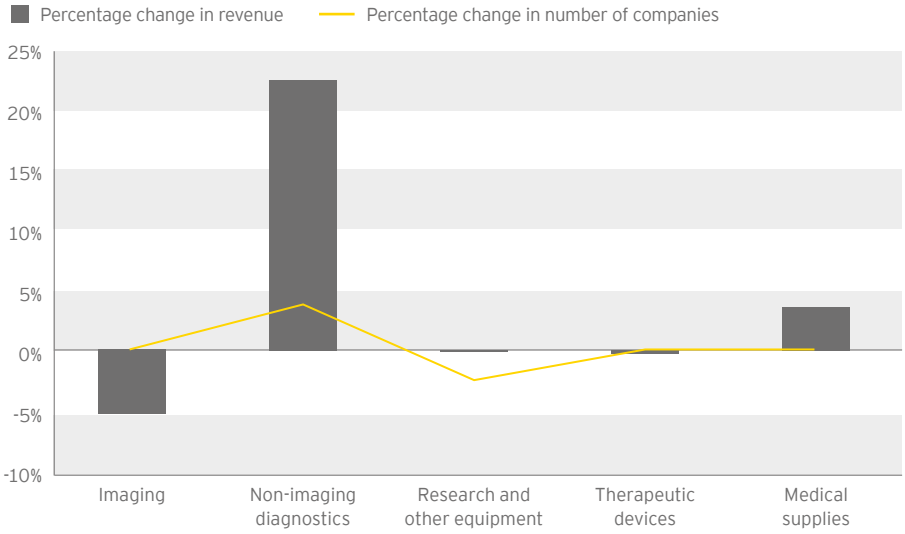
Pure-play revenue boost linked to M&A

One escape from those pressures, at least temporarily, may be scale. Boosted by 2014's megadeals, the largest pure-play medtechs outperformed the broader industry. Medtronic, Becton Dickinson and Zimmer Biomet each enjoyed greater than US$1 billion revenue growth. BD, which increased revenues 48%, led the charge in the best-performing non-imaging diagnostics segment, thanks to new revenues from medication management specialist CareFusion.

The BD gain offset revenue declines at Alere (5%) and bioMérieux (3%), the two next-largest non-imaging diagnostics plays. (In February 2016, Abbott said it would buy Alere for US$5.8 billion, further consolidating the point-of-care testing segment.)

The sector's revenue erosion can be traced in large part to the ongoing spate of divestitures at medtech conglomerates.

US and European revenue growth by product group: pure-plays, 2014–15



Data shown for pure-play companies only.

Source: EY, Capital IQ and company financial statement data.

Therapeutic device companies, which comprise 56% of the medtech industry, generated 63% of all revenue (US$122 billion) in 2015. Leading the pack, Medtronic revenue increased 42% (US$28.8 billion) with the addition of Covidien, overtaking J&J as the world's largest medtech company by revenue. Zimmer Biomet, created upon the completion of Zimmer's acquisition of fellow orthopedic specialist Biomet in June 2015, also reported a double-digit increase in revenue (28%) to US$6 billion.

Hill-Rom (up 18%) led the medical supplies category; the hospital equipment maker added US$302 million in revenue through a series of acquisitions highlighted by the US$2 billion takeover of Welch Allyn in September 2015. The infection prevention and surgical technology company Steris also posted impressive growth (up 14% to US$1.8 billion) thanks in part to surging revenue in its Healthcare Specialty Services division.

Not every revenue boost relied on M&A. Intuitive Surgical saw revenue rise 12% (US$251 million) as more surgical procedures were performed using its da Vinci Surgical System. Meanwhile, Illumina, continuing to ride a wave of interest from biopharmaceutical customers in sequencing instruments and consumables, jumped 19% (US$358 million), bucking a negative trend in the research and other equipment area. That segment, which comprises 18% of all medtech revenue, is dominated by Thermo Fisher Scientific. The diversified research and tools behemoth accounts for half of the segment's revenue. Its top line, which increased less than half a percent, was largely unchanged year over year.

The financial performance of GE Healthcare and Siemens Healthcare, which posted revenue declines of US$660 million (4%) and US$1.2 billion (8%), respectively, influenced the imaging subsector's weaker performance. During 2015, GE Healthcare saw revenue and profits fall, thanks to currency headwinds as well as lower prices within its Healthcare Systems group. Siemens completed the sales of its hearing aids and hospital information businesses — more examples of business model shifts affecting short-term performance.

Net income plummets

The precipitous US$2 billion drop in net income (to less than US$14 billion, the lowest total in five years) among pure-play medtechs was hardly confined to a handful of companies. Six medtechs posted net losses greater than US$100 million in 2015, and 10 medtechs saw net income drop more than US$100 million compared to the prior year. (In contrast, seven companies saw net income rise by more than the same amount.)

Halyard Health's net income fell US$453 million compared with 2014, when the company spun out of Kimberly-Clark. The company's bottom line suffered due to a 6% decline in revenue and a $474 million goodwill impairment charge, as well as spin-off-related expenses.

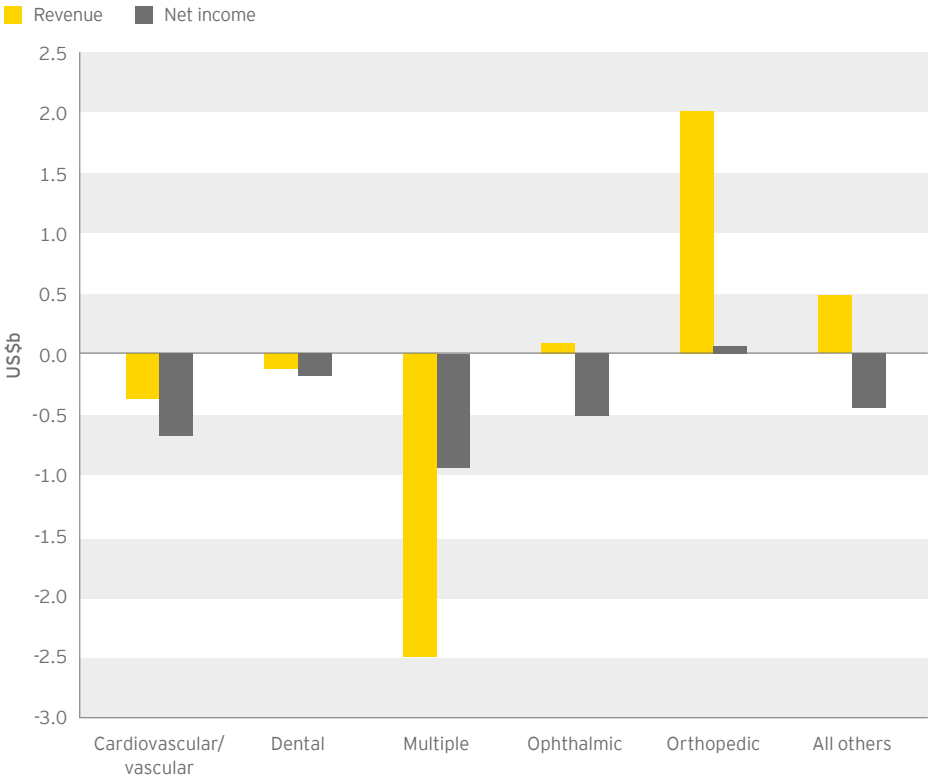
Therapeutic device plays featured prominently among those companies with sizeable net losses, in some cases due to the increased investment necessary to generate the comprehensive evidence needed by both regulators and payers to secure a solid product launch. For example, the oncology company Novocure contributed a net loss of US$112 million in 2015, the largest net loss among the year's crop of newly public companies. Novocure went public in October 2015, raising net proceeds of US$158 million to support the ongoing development and launch of its anti-tumor product. Novocure was hardly the only newly public company to post losses. In total, newly public medtechs contributed a net loss of $1.3 billion for 2015.

Other losses stemmed from the ongoing consolidation gripping the industry. Orthopedic specialist Wright Medical Group posted a net loss of nearly US$299 million, in part due to transaction costs associated with the company's US$3.3 billion acquisition of Tornier, a so-called tax inversion deal that closed in October 2015. Alphatec Spine's net loss of US$179 million, driven by goodwill and intangible asset impairment charges, also weighed on the US$24.4 billion orthopedic category.

Boston Scientific's US$239 million net loss, and multiple litigation- and restructuring-related charges, brought cardiovascular medtechs' net income down. The cardiovascular segment accounts for 15% of medtech revenue (US$18.5 billion) and was also negatively affected by the 2014 merger of Sorin and Cyberonics. (The two companies joined to become LivaNova, which is now classified as part of the multiple segment.)

Overall, the drop in net income might not be as pronounced as it first appears. Several one-time events at bigger medtechs may have disproportionately affected 2014's $16 billion in total net income, making the 2015 results look worse by comparison. For example, Edwards Lifesciences' bottom line dropped US$316 million, or 39%, thanks to a US$750 million payment it received in 2014 from Medtronic as part of a

Changes in US and European pure-play therapeutic device companies' revenue and net income by disease category, 2014–15



Data shown for pure-play companies only.

Source: EY, Capital IQ and company financial statement data.

litigation settlement. Likewise, a drop in net income at French ophthalmology specialist Essilor – the company was off US$392 million, or 32%, compared with 2014 – is largely due to one-time acquisition-related gains posted the previous year. Essilor dominates the ophthalmology category with about 80% of the group's US$9.5 billion in revenue.

Commercial leaders

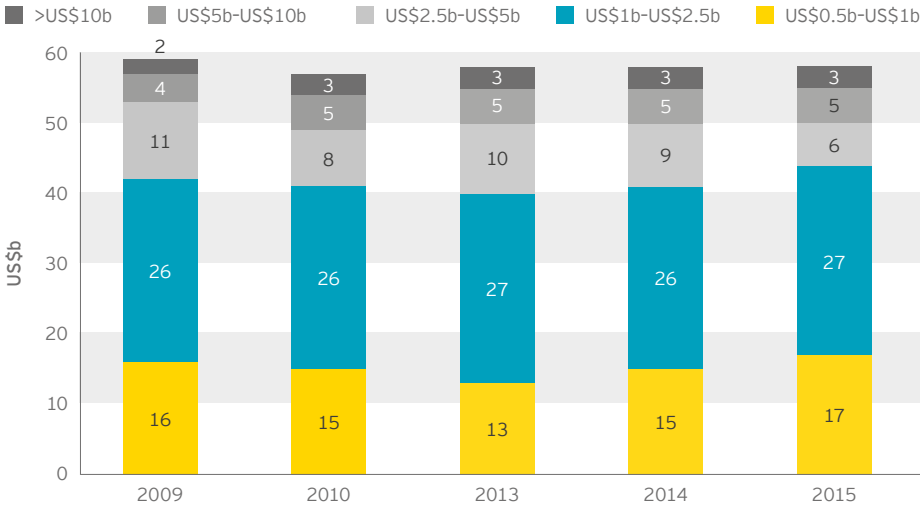
The number of commercial leaders in the medtech industry – those companies with more than US$500 million in annual revenue – has held remarkably steady in recent years. In 2015, the ranks of commercial medtech leaders remained fixed at 58, with four new members joining the group, three departing via acquisition and one falling below the sales threshold.

Vanishing from the list are CareFusion (acquired by BD) and Pall (acquired by Danaher). Thanks to a quirk of the calendar and the timing of Medtronic's acquisition of Covidien, the latter company was removed from both the 2015 and 2014 lists.

Össur, the Icelandic support and prosthetics maker that entered the cohort in 2014, saw its revenue drop 5% in 2015 to only US$483 million. Sorin has been replaced by its newer self, London-based LivaNova. Also joining the group in 2015 are three US medtechs: endoscopy player Cantel Medical's revenue rose 16% to US$561 million; the molecular diagnostics company Cepheid jumped 15% to US$539 million; and the musculoskeletal implants company Globus Medical, up 15% to US$537 million.

Medtech's commercial leaders are overwhelmingly US-based (41 of 58). As a group, commercial leaders account for US$176.2 billion of all pure-play medtech's US$194 billion revenue (about 91%).

US and European commercial leaders revenue, 2009–15



Commercial leaders are pure-play companies with revenues in excess of US$500 million.

Source: EY, Capital IQ and company financial statement data.

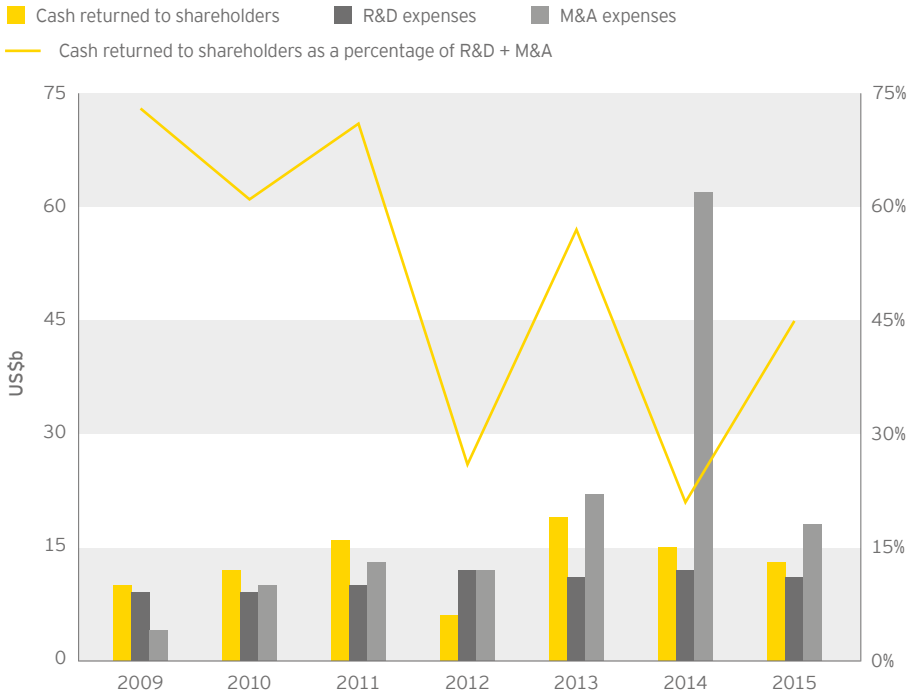
As a group, commercial leaders account for US$176.2 billion of all pure-play medtech's US$194 billion revenue (about 91%).

Capital allocation strategies

In 2015, medtech commercial leaders returned US$13 billion to shareholders via dividends and share buybacks, a second consecutive year of decline following 2013's record US$18.9 billion. Medtronic led the way, with more than US$1.3 billion in dividends and more than US$1.9 billion in share buybacks during the year. Stryker returned more than US$1.2 billion to shareholders (US$700 million in buybacks and US$521 million in dividends). Rounding out the top three, St. Jude Medical distributed US$322 million in dividends and spent US$500 million on share repurchases.

With fewer dollars being spent by medtech commercial leaders on acquisition targets during the 2015 calendar year, the ratio of cash returned to shareholders versus what companies invested — via M&A or R&D — to build their businesses rose significantly. In 2014, extraordinary M&A investments (dominated by the Medtronic/Covidien and BD/CareFusion deals) tilted the balance of spending toward long-term growth needs. In 2015, capital allocation appeared to return to a more typical balance between organic investment and returning cash to shareholders. But as revenue growth dwindles, companies must rethink their historical capital allocation practices, including prioritizing partnerships that enable access to technologies and services that represent a step change in patient care.

US and Europe medtech commercial leaders spending trend, 2009–15



Source: EY, Capital IQ and company financial statement data.

Since 2009, spending on M&A has increased most significantly, with a six-year CAGR of 26%. The six-year CAGR for buybacks and dividends is 5%, versus only 4% for R&D. Industry leaders' willingness to return more cash to shareholders than it spends on R&D may reflect a perceived lack of investment opportunities and seemingly does not bode well for the sector's long-term health.

In 2015, capital allocation appeared to return to a more typical balance between organic investment and returning cash to shareholders.

US medtechs ramp up R&D spend

Non-commercial leaders comprised the vast majority of medtechs in the US (222, or 84%) in 2015, and for the most part, their financial performance metrics held relatively steady year-on-year. Revenue remained constant at a cumulative US$13 billion, while market capitalization drifted slightly lower, off 4% to US$65 billion. By definition, these companies aren't big revenue generators – and the group's metrics can therefore suffer when its top companies, for instance, Cantel, Cepheid and Global Medical, graduate to commercial leader status. Newcomers added about US$5 billion in market capitalization, partially offsetting the nearly US$8 billion cumulative market cap loss of those three newly minted commercial leaders.

The 19 newly public medtechs that joined these ranks during 2015 managed to offset much of the revenue that newly graduated commercial leaders such as Cantel hoisted up to the big leagues. One big boost came from the California interventional cardiology company Penumbra, which went public in October 2015 and brought in US$186 million in 2015 revenue. Although this cohort isn't exclusively a growth club, it does include those next-generation medtechs attempting to achieve eventual profitability. Reaching that goal requires investment in innovation and the ability to bring new products to market, efforts which require a significant, ongoing commitment to R&D.

In 2015, US non-commercial leaders boosted R&D spending by more than half a billion dollars (17%) to US$2.6 billion. Put another way, while pure-play commercial leaders in the US and EU are spending about 12% of their revenue on R&D – as discussed, not nearly as much as they're returning to shareholders

US medtech at a glance, 2014–15
(US$b)

Public company data	2015	2014	% change	Non-commercial leaders as percentage of industry total
Total industry revenues	$208.8	$234.9	-11%	
Conglomerates	$81.7	$85.3	-4%	
Pure-play: commercial leaders	$114.1	$136.6	-16%	
Pure-play: non-commercial leaders				
Revenues	$13.0	$13.0	-0.1%	6%
R&D expense	$2.6	$2.2	17%	19%
SG&A expense	$7.5	$7.0	8%	14%
Net income (loss)	$(3.5)	$(2.4)	-42%	NA
Market capitalization	$65.2	$68.2	-4%	11%
Number of employees	52,600	46,600	13%	10%
Number of public companies	222	217	2%	84%

* Since the non-commercial leaders, in aggregate, posted a net loss in 2015, it is not applicable to calculate their net income as a percentage of the industry total.

Numbers may appear to be inconsistent due to rounding. Other than revenues, all numbers have been reported for non-commercial pure-plays. Market capitalization data is shown for 31 Dec 2015 and 31 Dec 2014.

Source: EY, Capital IQ and company financial statement data.

via dividends and buybacks — non-commercial leaders in the US are spending a full 20% of their revenue on R&D. The diabetes management company DexCom, for instance, doubled its R&D spend to US$138 million (34% of its 2015 revenue). Meanwhile, the newly public cohort added more than US$100 million more in R&D expenses (US$284 million) than the trio of new commercial leaders removed from the group (about US$167 million).

SG&A expenses similarly reflect the group's collective ambition to reach escape velocity: nearly 58% of the US non-commercial leaders' revenue was spent on SG&A (compared with about 35% from commercial leaders in the US and EU). Exact Sciences, for example, ramped up SG&A spend by US$72 million (102%) to support the launch of its colon cancer screening test Cologuard. Similarly, DexCom increased SG&A US$70 million

US public medtech cash index, 2013–15

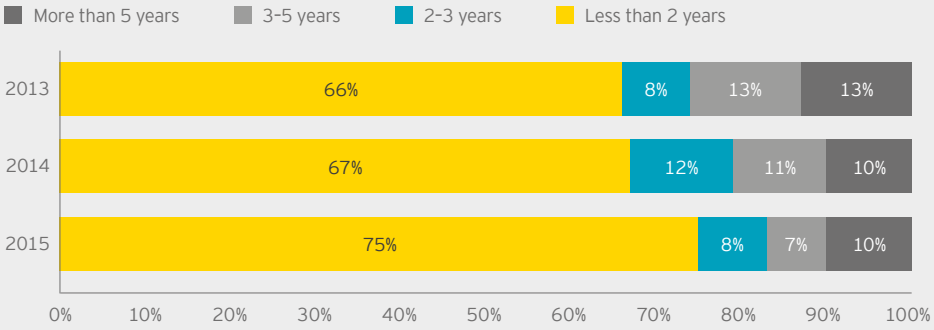


Chart excludes companies that are cash flow positive. Numbers may appear to be inconsistent due to rounding.

Source: EY, Capital IQ and company financial statement data.

Pure-play non-commercial leaders in the US are increasingly cash poor, reflecting a difficult funding environment for revenue-poor medtechs.

(54%) to boost commercial infrastructure. The company has notably been rewarded by the marketplace for its investments and the successes they represent. During 2015, DexCom's market cap surged US$2.4 billion to US$6.7 billion; the company at the end of 2015 boasted the largest market cap of all US non-commercial leaders.

Pure-play non-commercial leaders in the US are increasingly cash poor, reflecting a difficult funding environment for revenue-poor medtechs. Only a quarter of cash-flow-negative companies in that group have at least two years of cash reserves at current spending rates.

Select US medtech public non-commercial leaders by region, 2015

(US$m, % change over 2014)

Region	Revenue	Number of companies	Market capitalization 31 December 2015	R&D	Net income	Cash and cash equivalents	Total assets
Northern California	$2,427	35	$13,661	$639	-$735	$1,134	$3,931
	25%	30%	42%	44%	59%	73%	33%
Massachusetts	$2,243	31	$12,718	$487	-$522	$1,072	$3,345
	36%	11%	26%	21%	42%	29%	35%
Southern California	$2,069	29	$14,324	$521	-$728	$1,525	$3,373
	17%	7%	14%	35%	61%	23%	7%
Minnesota	$1,018	14	$5,156	$143	$25	$303	$1,705
	38%	17%	-4%	34%	-40%	-45%	25%
Texas	$1,016	9	$3,532	$106	$28	$373	$1,323
	5%	0%	11%	21%	-34%	46%	14%
Florida	$575	7	$683	$39	$13	$56	$721
	5%	0%	-7%	5%	-325%	49%	8%
New York	$555	16	$770	$56	-$54	$77	$1,038
	9%	0%	-29%	11%	-25%	-21%	-2%
Tennessee	$504	3	$2,606	$43	-$306	$153	$2,254
	33%	0%	80%	48%	2%	-36%	113%
Michigan	$350	2	$2,184	$10	$37	$67	$489
	14%	0%	15%	15%	18%	62%	15%
Ohio	$335	3	$1,793	$51	-$19	$81	$471
	12%	0%	18%	7%	12%	5%	36%

Data shown for non-commercial leader pure-play companies only.

Source: EY, Capital IQ and company financial statement data.

European investment lags

Revenue from Europe's non-commercial leaders inched up 2% during 2015. The group lost US$620 million in revenue via M&A due to prominent acquisitions such as Nikon's purchase of Optos and the Chinese private equity fund XIO's deal for Lumenis.

Fourteen newly public medtechs and the return of Össur to this group contributed roughly 15% (about US$720 million) to the non-commercial leaders' revenues.

But even as revenue grew — and as non-commercial leaders' collective market cap surged 43% thanks to the re-inclusion of Össur and enthusiasm for new public medtechs — investment by this cohort significantly lagged US peers. Despite a prominent uptick in R&D spending of 33% over 2014 levels, Europe's non-commercial leaders are still spending only about 12.7% of revenue on R&D, or US$615 million in total.

Newly public medtechs accounted for US$126 million (more than 20%) of that R&D total. Overall, only about a third of the group increased their R&D expenditure from 2014 to 2015. Novocure's US$44 million investment was the largest by a European non-commercial leader and, in absolute terms, wouldn't have cracked the top-10 stateside. The cancer company used the funds to advance multiple clinical studies of its Tumor Treating Fields therapy in various tumor settings.

European medtech at a glance, 2014–15

(US$b)

Public company data	2015	2014	% change	Non-commercial leaders as percentage of industry total
Total industry revenues	$128.5	$106.4	21%	
Conglomerates	$61.6	$66.4	-7%	
Pure-play: commercial leaders	$62.1	$35.4	75%	
Pure-play: non-commercial leaders				
Revenues	$4.7	$4.7	2%	4%
R&D expense	$0.6	$0.5	33%	27%
SG&A expense	$2.3	$2.0	12%	17%
Net income (loss)	$(0.7)	$(0.4)	-56%	NA
Market capitalization	$23.9	$16.6	43%	18%
Number of employees	23,600	13,100	80%	15%
Number of public companies	175	179	-2%	88%

Numbers may appear to be inconsistent due to rounding. Other than revenues, all numbers have been reported for non-commercial pure-plays. Market capitalization data is shown for 31 Dec 2015 and 31 Dec 2014.

Source: EY, Capital IQ and company financial statement data.

> Despite a prominent uptick in R&D spending over 2014 levels, Europe's non-commercial leaders are still spending only about 12.7% of revenue on R&D.

SG&A spend for the European non-commercial leaders group was also lower than the US cohort's, at about 48% of revenue.

As with US non-commercial leaders, in Europe a startling increase in companies with less than two years' worth of cash suggests troubled times ahead. Only 38% of those medtechs have at least two years' worth of cash to spend.

European public medtech cash index, 2013–15

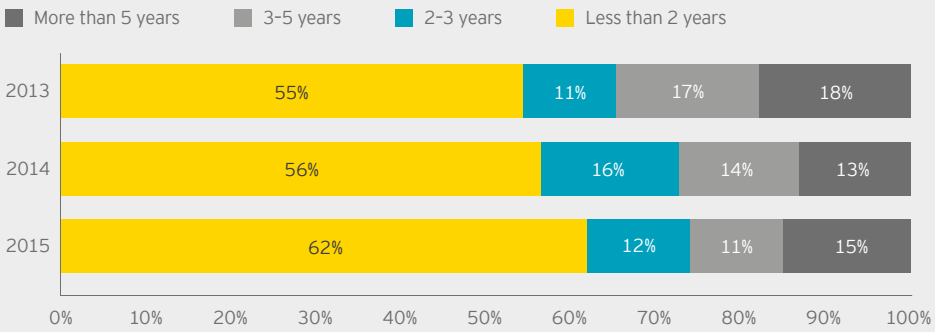


Chart excludes companies that are cash flow positive. Numbers may appear to be inconsistent due to rounding.

Source: EY, Capital IQ and company financial statement data.

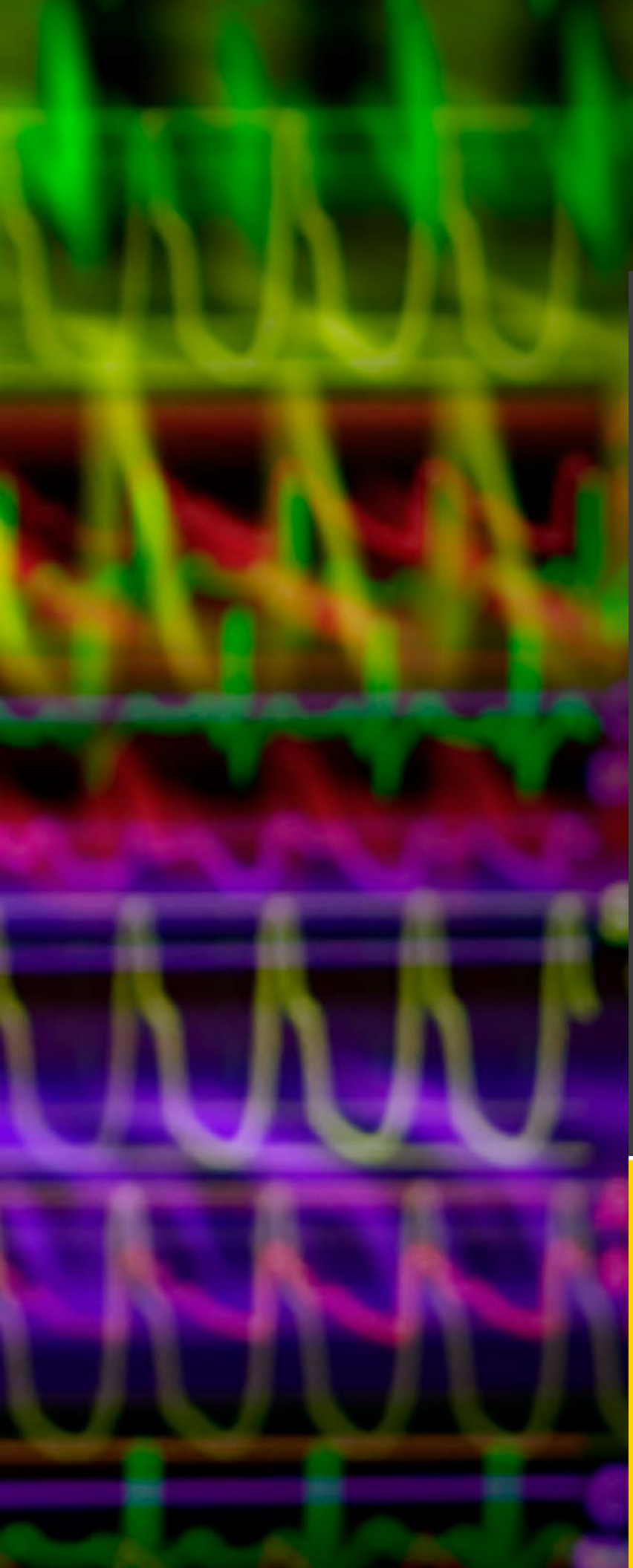
Select European medtech public non-commercial leaders by region, 2015

(US$m, % change over 2014)

Region	Revenue	Number of companies	Market capitalization 31 December 2015	R&D	Net income	Cash and cash equivalents	Total assets
Switzerland	$706	4	$2,715	$15	$39	$88	$735
	-2%	0%	35%	-65%	-16%	17%	-2%
France	$680	35	$5,431	$149	-$294	$451	$1,513
	34%	13%	43%	40%	20%	54%	62%
United Kingdom	$668	25	$2,952	$83	-$198	$395	$1,625
	21%	4%	3%	49%	125%	16%	37%
Iceland	$483	1	$1,619	$18	$51	$26	$653
	-5%	0%	20%	-5%	-14%	-10%	-4%
Sweden	$504	46	$2,883	$61	-$8	$230	$734
	0%	12%	0%	0%	0%	0%	0%
Israel	$436	26	$3,317	$138	-$273	$387	$1,014
	14%	8%	107%	47%	69%	59%	43%
Italy	$302	3	$232	$10	$15	$72	$397
	-8%	0%	20%	-	-32%	-32%	-11%
Denmark	$290	3	$1,539	$9	$24	$9	$345
	0%	0%	0%	0%	0%	0%	0%
Germany	$118	13	$362	$10	$8	$91	$234
	0%	30%	0%	0%	0%	0%	0%
Ireland	$103	3	$538	$38	-$39	$162	$439
	-7%	0%	-10%	243%	-58%	84%	35%

Non-commercial leaders are companies with less than US$500 million revenue. Only pure-play companies are included in this analysis.

Source: EY, Capital IQ and company financial statement data.



Financial performance

Key messages

- Financial metrics, particularly shrinking revenues and net incomes, point to an industry in transition. One of the most startling statistics: the increase in non-commercial leaders in both the US and Europe that have less than two years of cash on hand.
- Despite the medtech industry's lackluster financial performance, total market capitalization for the sector outperformed the broader market for three reasons: a slower historic rise in its market capitalization compared with other industries, expected continuation of the strong M&A climate and additional clarity on important medtech regulations.
- Total revenue for the medtech sector contracted 1.2%, driven by underperforming conglomerates that continue to look for divestment opportunities. Pure-play medtechs grew revenue modestly (2.3%), using M&A to strengthen top-line sales.
- Medtech commercial leaders are prioritizing short-term investor needs over future growth, returning US$13 billion to shareholders via dividends and share buybacks in 2015. For the third year in a row, commercial leaders returned more cash to shareholders than they spent on R&D.

Questions for medtech companies to consider

- **As regulatory burdens increase, is your portfolio optimized for the risks?**
- **Is your capital deployed optimally for growth?**
- **In a world focused on short-term priorities, are you underinvesting in the long term?**

Financing

VC shines in a weaker year

At only US$20.4 billion, total US and European medtech financing during the 12 months ending 30 June 2016 fell to the lowest level since 2010–11. The year-on-year 60% drop stands in sharp contrast to the US$51 billion raised in 2014–15. That record total, however, was inflated by nearly US$42 billion in debt financing raised mostly to pay for a small handful of megadeals.

In contrast, the 2015–16 period featured a dearth of large debt deals and an abrupt narrowing, if not closing, of the window for medtech IPOs. Follow-on funding has recently become scarce as well, with only US$500 million of the year's respectable US$2.5 billion total flowing in the first half of 2016.

A lack of early stage venture funding marred the sunny financing picture of 2014–15. In 2015–16, early stage venture funding rebounded, providing a reason for optimism even as the public markets grew more skeptical of medtech's growth opportunities.

During the year, medtech venture financing grew by more than 10% to nearly US$5.6 billion. That venture total remains a worryingly minor slice of both health care venture capital and venture capital overall, as other corners of the health care universe have typically offered investors better returns. But it's the greatest amount medtech has raised since at least 2004, as far back as we've compiled data for *Pulse*. Moreover, the healthy total eases slightly the uncertainty facing the early-stage medtech innovation ecosystem.

The absence of medtechs in the debt financing market did not signal a weak M&A environment; the industry continued to enjoy a healthy takeover scene during the 2015–16 period. Less expensive bolt-on deals were the model du jour this past year as medtechs continued to execute on their business model transformations. But those deals hardly require the massive debt issues that accompany megadeals greater than US$10 billion. (See "M&A: Full steam ahead.")

The healthy venture financing total eases slightly the uncertainty facing the early-stage medtech innovation ecosystem.

Capital raised in the US and Europe by year

(US$m)

Type	7/2006-6/2007	7/2007-6/2008	7/2008-6/2009	7/2009-6/2010	7/2010-6/2011	7/2011-6/2012	7/2012-6/2013	7/2013-6/2014	7/2014-6/2015	7/2015-6/2016
Venture	$5,387	$5,282	$4,712	$4,996	$4,123	$4,705	$4,354	$4,806	$5,078	$5,592
IPO	$1,295	$1,282	$17	$353	$820	$436	$205	$1,465	$2,298	$590
Follow-on and other	$2,120	$2,120	$1,550	$1,906	$1,613	$1,050	$4,218	$1,982	$2,453	$2,562
Debt	$4,266	$4,236	$6,425	$13,344	$11,780	$19,987	$22,025	$19,761	$41,601	$11,670
Total	**$13,068**	**$12,920**	**$12,704**	**$20,599**	**$18,336**	**$26,177**	**$30,801**	**$28,014**	**$51,431**	**$20,414**

Numbers may appear to be inconsistent because of rounding. Private investments in public equity (PIPEs) included in "follow-on and other."

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

Debt deals and IPOs vanish

The absence of large debt financings during 2015–16 occurred despite the continued availability of cheap capital. A handful of companies did take advantage of the current market conditions. About 60% of the year's debt was raised by only two companies: the orthopedics bellwether Stryker and the research and tools developer Thermo Fisher Scientific. Stryker tapped the debt markets to secure US$4.3 billion in capital, which it used mainly to finance its acquisitions of Sage Products and Physio-Control International. Thermo Fisher, meanwhile, raised US$2.3 billion, largely to pay holders of previously issued debt that matures in 2016. Four other companies raised sizeable debt rounds during 2015–16: NuVasive and Mölnlycke Holding each raised US$550 million and C.R. Bard and St. Jude Medical each raised US$500 million.

Excluding debt, medtech companies raised more than US$8.7 billion in financing in 2015–16. That total represents an 11% fall from last year's record high, but it is not an outlier. In fact, the previous nine-year non-debt financing average is only US$7.8 billion.

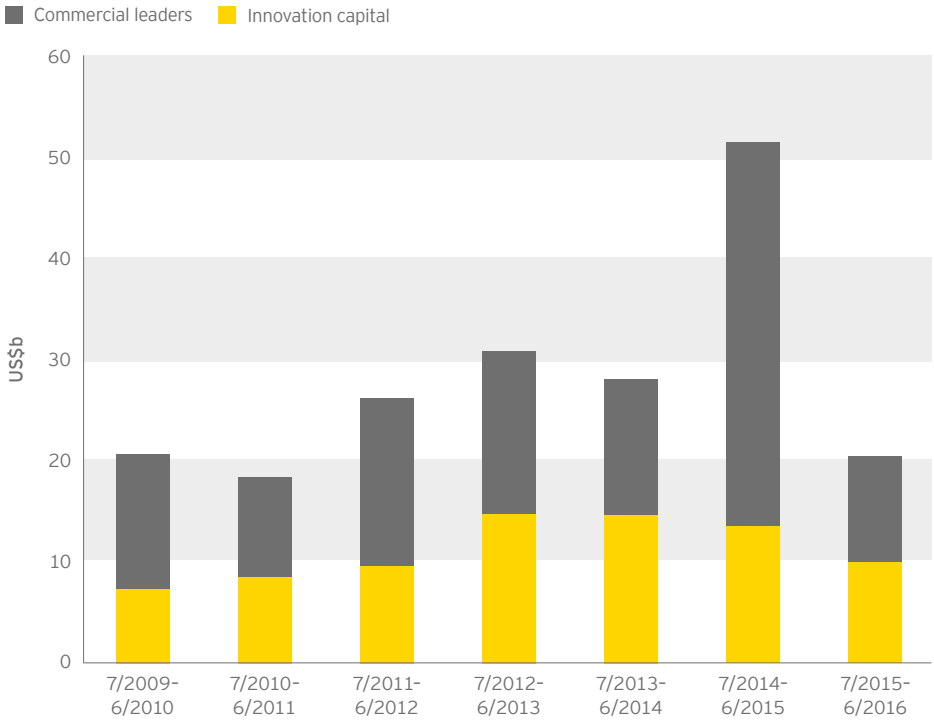
The year's drop in non-debt financing was caused by a steep decline in medtech IPOs. Total IPO proceeds raised in 2015-16 fell 74% from the prior 12 months.

Novocure and Penumbra led the way, getting out while the getting was still relatively good. Brain cancer-focused Novocure grossed an impressive US$165 million in its October 2015 debut and stroke specialist Penumbra brought in US$138 million in its September IPO. In all, more than 80% of 2015–16's IPO total was raised in 2015.

The lower IPO total also dragged down the total amount of innovation capital raised by medtechs during 2015–16.

Innovation capital is defined as financing raised by non-commercial leaders, those companies with less than US$500 million in annual revenue. At less than US$10 billion, innovation capital reached a four-year low for the 12 months ending 30 June 2016, retreating to 2011–12 levels. Without the previous years' large debt offerings, commercial leaders raised only US$10.4 billion, a six-year low.

Innovation capital falls for third year in a row



Innovation capital is the amount of equity capital raised by companies with revenues of less than US$500 million.

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

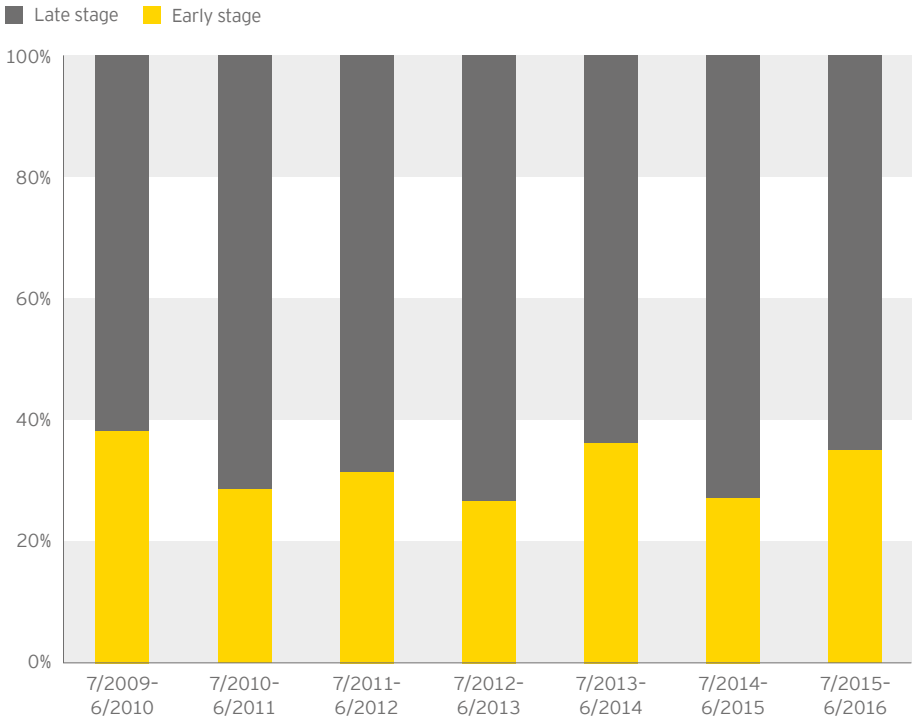
Venture financing: Industry's bright spot

Although financing numbers were down in the aggregate, the record US$5.6 billion raised in medtech venture capital is cause for guarded optimism in an industry where a persistent lack of early-stage funding has threatened to stunt the growth of a sustainable innovation ecosystem.

The 2015–16 total is medtech's third consecutive annual boost in venture capital financing. Six companies raised rounds of US$100 million or more, versus four during the prior year. Sixteen medtechs raised rounds of US$50 million or more, on par with the prior period. Crossover funds and private equity groups remained active in later-stage medtech funding rounds, and — as we saw in 2014–15 — corporate venture groups are increasingly stepping up to fill the gap in early-stage medtech venture financing.

In August 2015, proton therapy system maker Mevion Medical Systems raised the largest venture round of 2015–16, pulling in US$200 million in a round led by China-based HOPU Investments and YuanMing Capital. The capital infusion came only a week after the Massachusetts company shelved plans for an IPO, illustrating the gulf that emerged in 2016 between public and private investor attitudes to early-stage medtechs. Mevion plans to use the funds to accelerate its international expansion. As part of the investment, the company and its lead investors will form a joint venture to bring the company's proton therapy technology to China.

Investment in early-stage US and European medtechs inches upward



Source: EY, Dow Jones VentureSource and Capital IQ.

Early-stage venture funding was particularly buoyant in 2015–16, with first and second rounds comprising US$1.8 billion in cumulative venture funding, or about 34% of the total. That's an eight-year high in absolute dollar terms and a 38% jump over 2014–15's US$1.3 billion in early-stage venture funding.

Meanwhile, the US$3.6 billion in late-stage venture funding represents the largest bolus of financing for medtechs in at least a decade. (Note US$200 million of the venture funding was unclassified as either early- or late-stage.)

Companies developing devices or diagnostics in the cancer arena were of great interest to medtech investors in 2015–16. Among the prominent Series A early-stage rounds were two deals to fund companies developing tests to detect asymptomatic cancers via circulating tumor DNA. The US$100 million raised by Grail Bio, the Illumina spin-out backed by Arch Venture Partners, Sutter Hill Ventures, and billionaire investors Jeff Bezos and Bill Gates, topped the chart. Grail is still majority-owned by the sequencing giant. The UK-based clinical cancer genomics play Inivata, meanwhile,

raised US$45 million to fund its own platform. That start-up's backers include Johnson & Johnson.

Other noteworthy financings include RefleXion Medical's US$46 million Series B and Codiak BioSciences' two venture raises totaling more than US$90 million. A cancer radiotherapy start-up, RefleXion Medical is backed by, among others, Pfizer Ventures, the corporate venture arm of the biopharma giant. Codiak BioSciences, which is probably better known as a biotech but is included in *Pulse* for its diagnostic ambitions, will use its combined venture financing to unravel the new field of exosome biology.

These financings illustrate two key trends. First, biopharma players, which require better tools to improve disease detection and patient segmentation, continue to catalyze investment in medtech's molecular diagnostics and research and tools subsectors. Second, corporate and strategic investors remain critical funders of early-stage medtechs and are a key reason for the surging dollar totals described above.

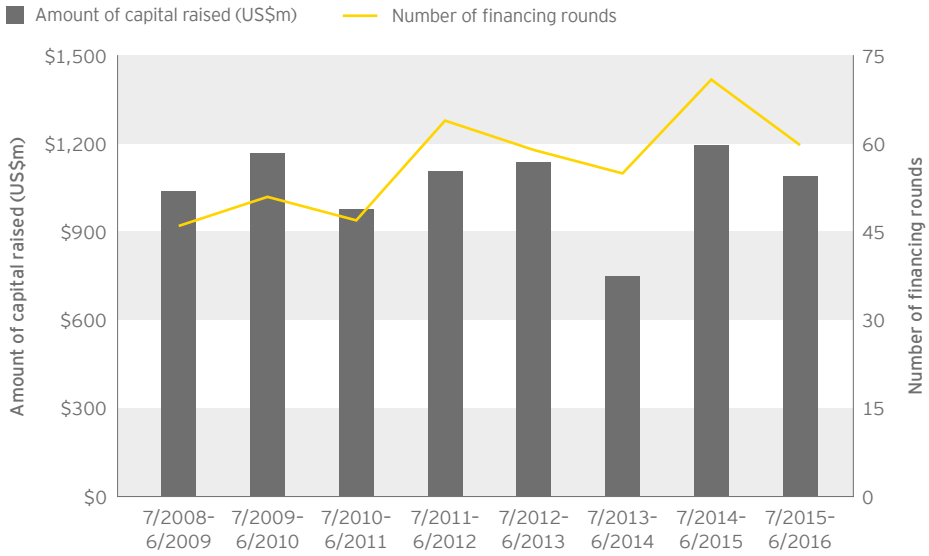
This is particularly true in the medtech services segment and in high-risk medtech white space areas. Strategics' interest in the latter was underscored in August 2016 by the creation of Galvani Bioelectronics, a joint venture between GlaxoSmithKline and Verily (the life sciences business of tech giant Alphabet). With an investment of more than US$700 million for the venture's first seven years, the goal is to develop miniaturized implantable devices to modify electric signals in the nervous system that may be misfiring in a variety of diseases. (See the accompanying perspective, "Galvanizing innovation in medtech – and biopharma," by Galvani's Kris Famm.)

Those early-stage strategic investments help account for the boost in corporate venture capital that we have seen over the past two years. In addition to Inivata, for example, J&J also invested in the early rounds of Stanford neuroscience spin-out Cala Health, alongside GSK's Action Potential Venture Capital, and heart-failure start-up V-Wave. (Note that the GSK/Verily investment in Galvani is not reflected in this year's totals because it occurred after the 30 June 2016 close date for our analysis.)

Traditional medtechs have also participated via strategic investments: Greatbatch Medical contributed to heart-failure start-up Cardionomic's US$20 million Series A, and Medtronic participated in Earlens Corporation's US$51 million Series C, for example.

That strategic investors continue to fill the gap in funding left by traditional VCs since the financial crisis is not new. In 2015–16, financing rounds totaling nearly US$1.1 billion included at least one strategic or corporate investor. But activity seems to have plateaued. The growth in total medtech venture investment during

VC rounds of US medtech companies with participation of corporate venture investors, by year



Source: EY, Capital IQ, BioCentury and Dow Jones VentureSource.

the past year has instead benefited from participation by private equity groups and crossover funds, such as OrbiMed, Deerfield and relative newcomer Woodford Investment Management.

One likely reason for any uptick in participation from crossover investors is the weak IPO market of 2015–16. Had the IPO window remained open, crossovers' cash might have simply been funneled into a different financing bucket.

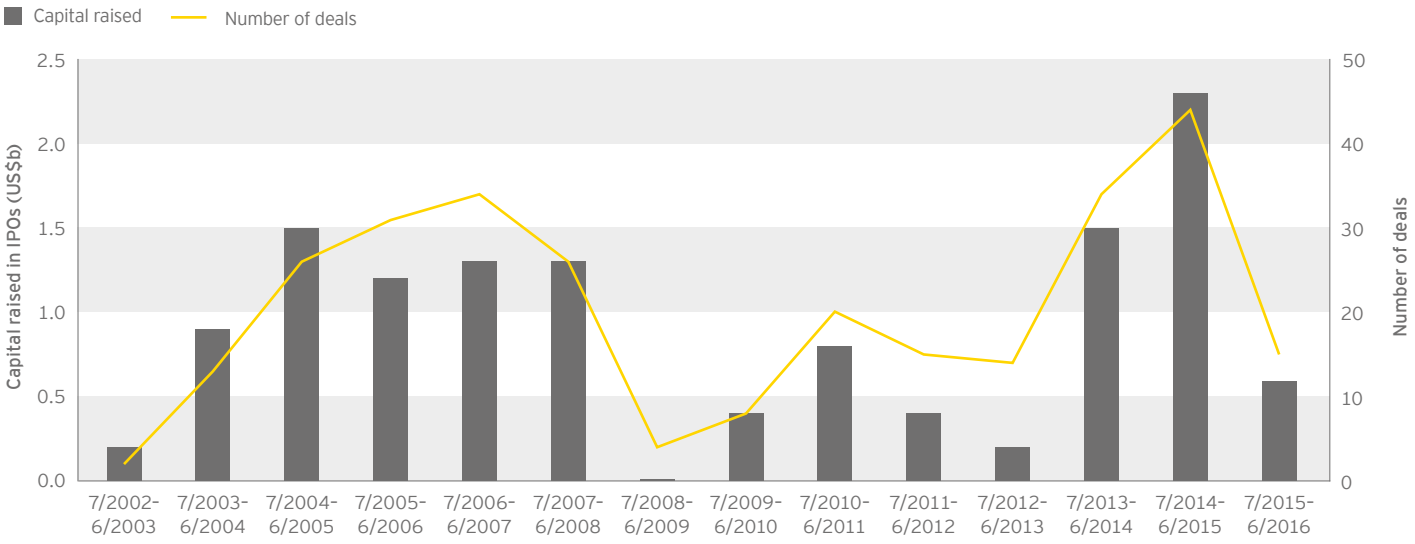
IPO well runs dry

In terms of both dollars and volume, medtech IPO activity shrank considerably from 2014–15 to 2015–16. Medtechs raised just US$590 million in total IPO financing in the 12 months ending 30 June 2016, and the number of completed IPO offerings fell 66% year-over-year. The average IPO gross was also down from 2014–15, from US$63.6 million to US$39.3 million. IPO proceeds for US-based medtechs fell 87%, to US$235 million, trailing Europe's (down 22% to US$355 million) for only the second time in the past decade. That said, Europe's biggest IPO splashes, such as Novocure's US$165 million, were raised on the US NASDAQ exchange. Once again, the lion's share of IPO capital continues to be raised in the US.

The data suggest medtech has likely entered the "bust" part of health care IPOs' notorious boom-and-bust cycle. This shift is hardly surprising; the bull-run of 2013-15 resulted in 78 new medtech public listings valued at nearly US$4 billion. After such a heady climate, it's fair to say medtech IPOs were overdue for some kind of normalization. Note, there has been a similar decline in the number and dollar value of biotech IPOs as well. In contrast to biotechs,

The data suggest medtech has likely entered the "bust" part of health care IPOs' notorious boom-and-bust cycle.

US and European IPOs by year



Source: EY, Capital IQ, BioCentury and Dow Jones VentureSource.

which during the most recent window were able to go public on mid- or even early-stage clinical data, medtechs have typically had to wait until they were generating revenue from product sales to garner public market interest. With so many revenue-generating medtechs hitting the public market over the past two years, another reason for the decline in IPOs in 2015–16 is that there just aren't as many waiting in the wings.

Novocure's US$165 million haul in October 2015 was the year's largest medtech IPO, though its shares were priced at US$22 apiece, below the expected US$23-US$24 range. Those proceeds will be used to support the Jersey-based cancer company's Optune glioblastoma treatment. The largest IPO from a US company came from neurovascular device maker Penumbra, which raised US$138 million in its September 2015 debut. Penumbra was the only medtech to price its IPO above its anticipated range during the 2015–16 period.

Novocure and Penumbra contributed significantly to the US$402 million raised across 10 IPOs from therapeutic device companies. Non-imaging diagnostics companies combined for four IPOs, raising a cumulative US$113 million, led by glucose monitoring medtech Senseonics' US$45 million March 2016 offering.

The medtechs that were able to go public during 2015–16 have tended to reward their investors. As of 31 August 2016, 10 of the 15 medtechs were trading up since their IPOs, some of them much higher. As a group, the newly public companies were up 86%. Penumbra shares have rocketed 135% since its September 2015 IPO, adding more than US$1.1 billion to the company's market cap on the back of strong revenue growth for its interventional therapies. Advanced Accelerator Applications has likewise more than doubled, boosting its market cap to nearly US$1.4 billion, also thanks to strong revenue growth. Two smaller Swedish medtechs, Immunovia and Invent Medic, which make, respectively, cancer diagnostics and women's health products, are each up more than 400% since their debuts, but remain relatively small (less than US$200 million) in terms of market value. Not every company saw its share price increase following an IPO. As of August 2016, Novocure's shares had declined 65% in a volatile market.

US and European IPOs, July 2015–June 2016

Company	Ticker	Country	Product type (disease)	Gross raised (US$m)	IPO pricing range
Novocure	NVCR	Israel	Therapeutic devices (oncology)	$165	Below
Penumbra	PEN	US – Northern California	Therapeutic devices (multiple)	$138	Above
Advanced Accelerator Applications	AAAP	France	Imaging	$75	Within
Senseonics	SENH	US – Maryland	Non-imaging diagnostics	$45	Within
Curetis	CURE	Germany	Non-imaging diagnostics	$44	Within
Cellnovo	CLNV	United Kingdom	Therapeutic devices (non-disease-specific)	$35	Within
Pulse Biosciences	PLSE	US – Northern California	Therapeutic devices (multiple)	$20	Within
Oncimmune	ONC	United Kingdom	Non-imaging diagnostics	$17	Within
Viveve Medical	VIVE	US – Northern California	Therapeutic devices (women's health)	$16	Within
Sensus Healthcare	SRTSU	US – Florida	Therapeutic devices (oncology)	$11	Below
Biocorp Production	ALCOR	France	Therapeutic devices (non-disease-specific)	$10	Within
Immunovia	IMMNOV	Sweden	Non-imaging diagnostics	$7	Within
PAVmed	PAVMU	US – New York	Therapeutic devices (multiple)	$5	Within
Invent Medic	IMS	Sweden	Therapeutic devices (urology/pelvic)	$1	Within
QuickCool	QUICK	Sweden	Therapeutic devices (neurology)	$1	Within

Source: EY, BMO Capital Markets, Capital IQ, BioCentury and Dow Jones VentureSource.

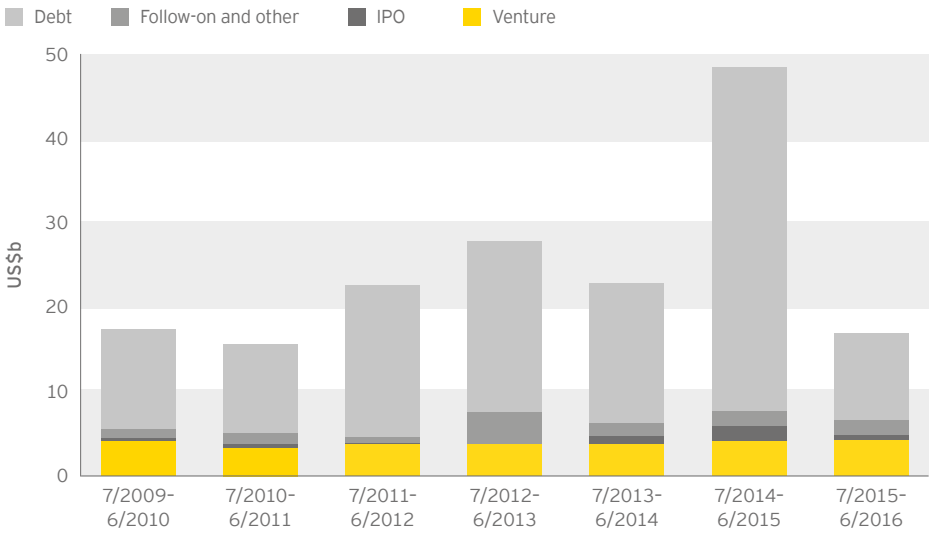
Debt, IPO deals drive US pullback

US medtechs raised US$16.9 billion in capital for the 12 months ending 30 June 2016, off significantly from the prior year's US$48.5 billion. Slight gains in follow-on financing (up 6% to US$1.8 billion) and venture (up 8% to US$4.4 billion) weren't enough to offset declines in debt and IPO offerings as total US medtech financing fell below US$20 billion for the first time since the 12 months ending 30 June 2011. Still, excluding debt, total US medtech financing reached US$6.4 billion in 2015–16. That is in line with the average for the past decade.

At more than US$4.4 billion, US venture capital financing surpassed its previous 10-year average (nearly US$4.0 billion), enjoying the best performance since the financial crisis of 2008–09. Though there were fewer deals in 2015–16 compared with the prior period (down 10% to 418), average deal size increased by 13% to US$10.5 million, the highest average in the past seven years.

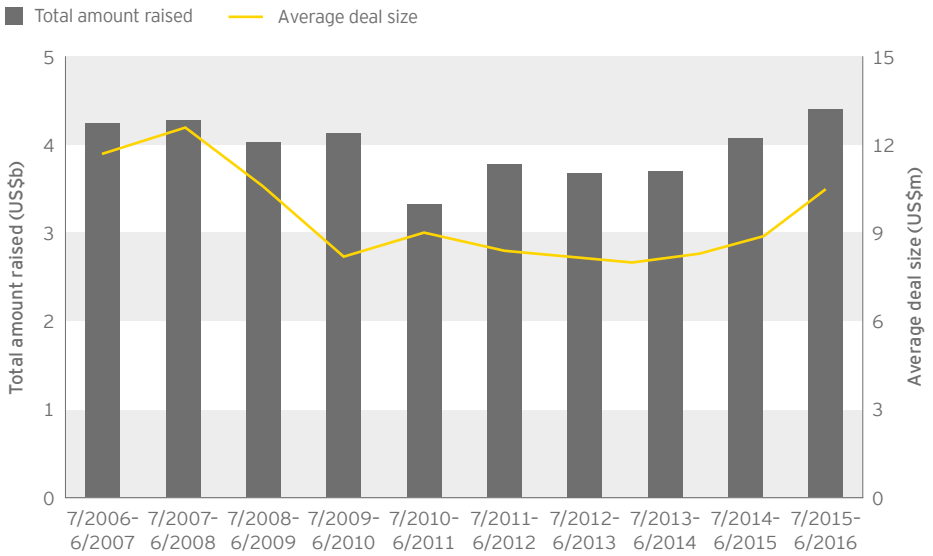
Total US medtech financing fell below US$20 billion for the first time since the 12 months ending 30 June 2011.

US financings by year



Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

US venture capital by year



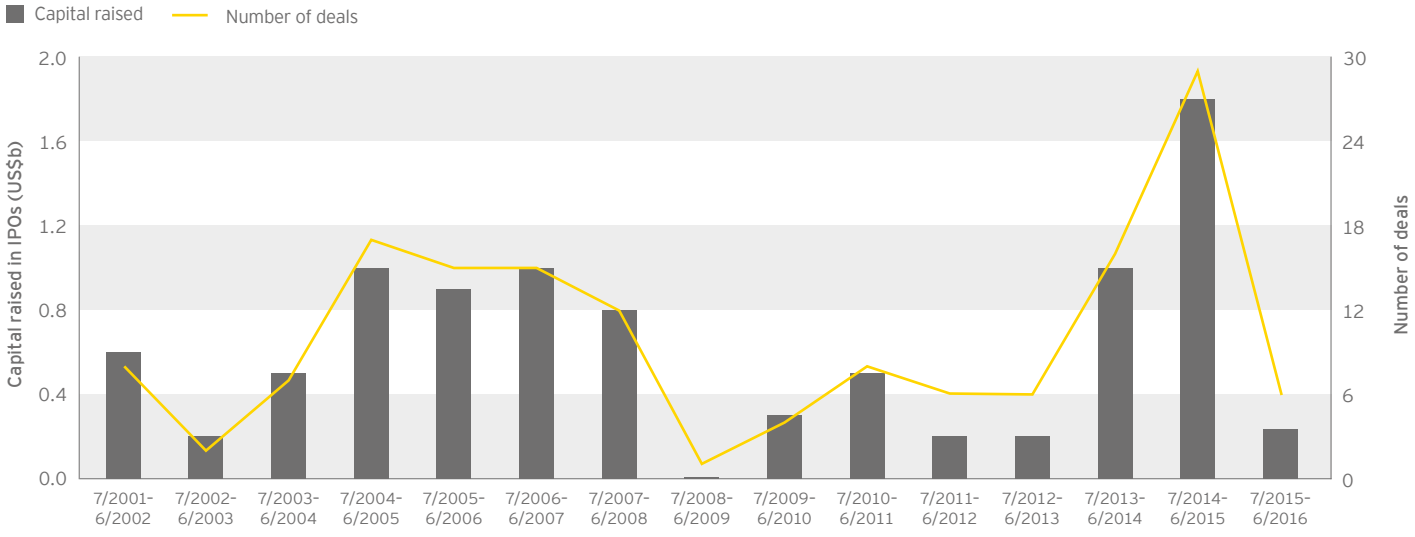
Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

Top US venture rounds, July 2015–June 2016

Company	Region	Product type (disease)	Gross raised (US$m)	Quarter	Round type
Mevion Medical Systems	Massachusetts	Therapeutic devices (oncology)	$200	Q3 2015	Late stage
Auris Surgical Robotics	Northern California	Therapeutic devices (ophthalmic)	$150	Q3 2015	Late stage
Guardant Health	Northern California	Non-imaging diagnostics	$100	Q4 2015	Late stage
Grail Bio	Northern California	Non-imaging diagnostics	$100	Q4 2015	Early stage
Acutus Medical	Southern California	Imaging	$75	Q1 2016	Late stage
DiaTech Oncology	Tennessee	Non-imaging diagnostics	$75	Q4 2015	Late stage
Codiak Biosciences	Massachusetts	Non-imaging diagnostics	$61	Q1 2016	Early stage
Silk Road Medical	Northern California	Therapeutic devices (cardiovascular/vascular)	$57	Q4 2015	Late stage
TransMedics	Massachusetts	Other	$51	Q2 2016	Late stage
EarLens	Northern California	Audiology	$51	Q2 2016	Late stage
Proteus Digital Health	Northern California	Other	$50	Q2 2016	Late stage
Cohera Medical	North Carolina	Therapeutic devices (dermatology)	$50	Q4 2015	Late stage
Singulex	Northern California	Non-imaging diagnostics	$50	Q2 2016	Late stage
EndoGastric Solutions	Washington	Therapeutic devices (gastrointestinal)	$50	Q4 2015	Late stage
Livongo Health	Northern California	Non-imaging diagnostics	$50	Q2 2016	Late stage

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

US IPOs by year



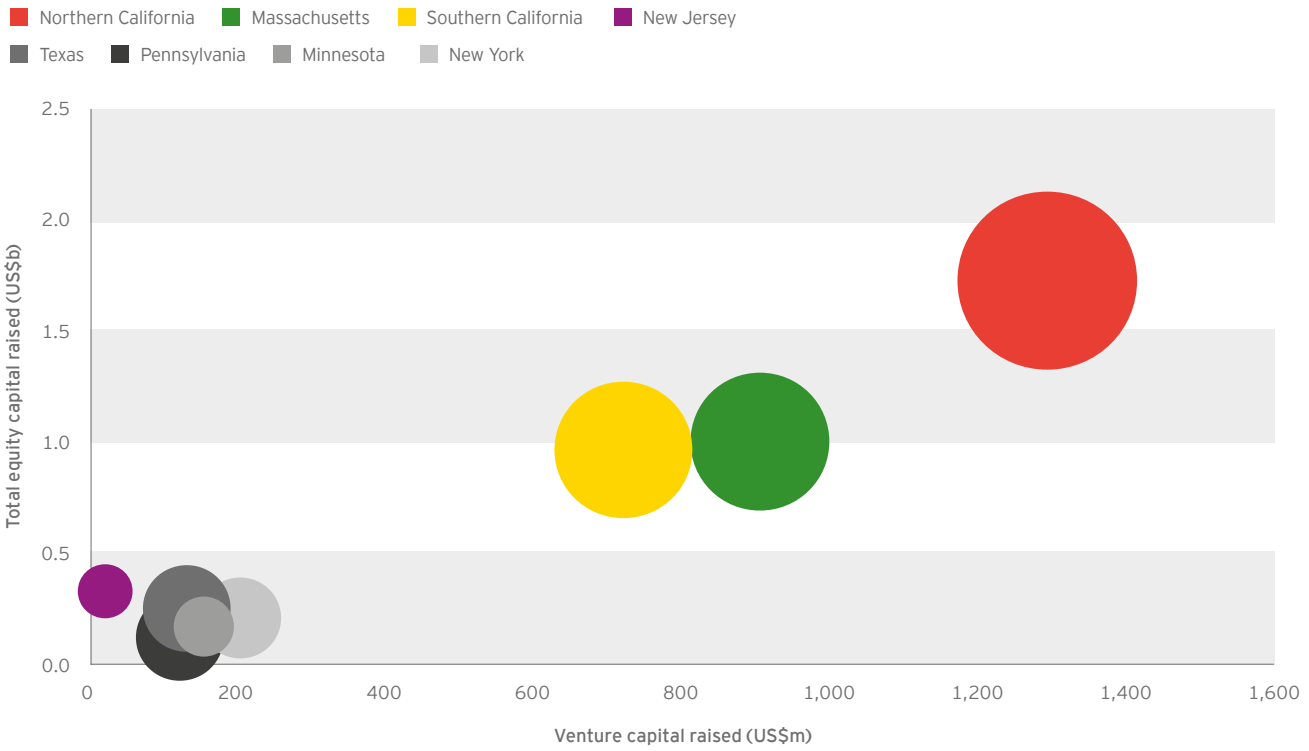
Source: EY, Capital IQ, BioCentury and Dow Jones VentureSource.

Therapeutic device medtechs accounted for 53% of all US venture funding, or US$2.2 billion. That total was driven by late-stage venture rounds from Mevion Medical Systems (US$200 million) and Auris Surgical Robotics (US$150 million). Non-imaging diagnostics companies raised US$1.1 billion in venture funding, or 25% of the US total. The US$100 million Series D from liquid biopsy play Guardant Health topped that category, once again demonstrating how development of tools for biopharma endeavors is driving certain medtech financing categories.

In 2015-16, medtech's biggest innovation centers continued to dominate the financing scene. Taken together, Northern California, Southern California and Massachusetts accounted for 77% of the non-debt financing and 81% of the venture capital raised during the 12 months ending 30 June 2016.

Northern California, Southern California and Massachusetts accounted for 77% of the non-debt financing.

Capital raised by leading US regions excluding debt, July 2015–June 2016



Size of bubbles shows relative number of financings per region.

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

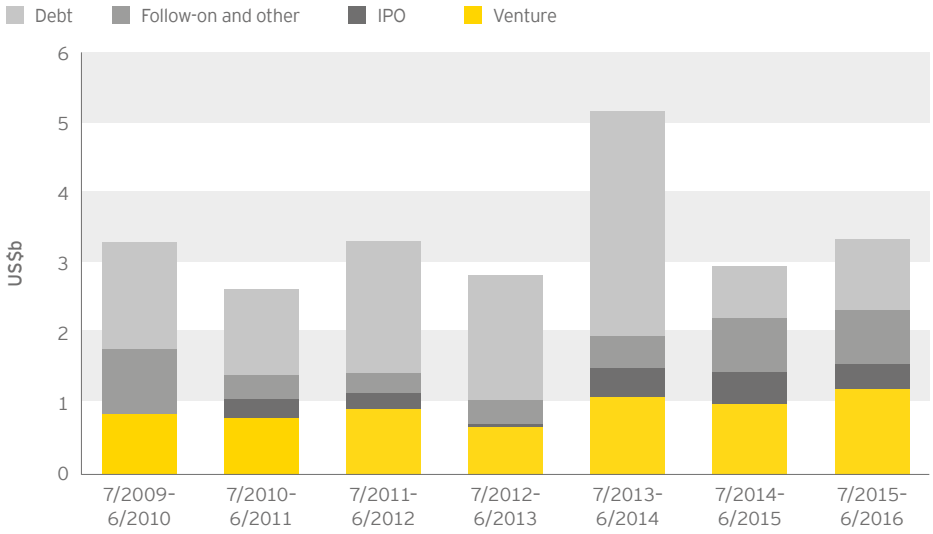
A good year for European medtech financing

Europe's medtechs enjoyed a 12% gain in overall financing for the 2015–16 period, with increases in debt financing and venture driving the overall uptick off of a much smaller financing base than exists in the US.

European medtechs raised US$1.2 billion in venture capital in 2015–16. That total is considerably less than what US-based medtechs raised. However, it represents 18% year-on-year growth and European medtechs' best venture total in the past decade.

The total value of European debt deals, led by wound-care and surgical products manufacturer Mölnlycke Holding's US$550 million round, spiked 37% to US$1 billion, enough to offset the loss of IPO financing (down 22% to US$355 million across nine deals). As was the case in the US, the vast majority of the 12-month follow-on financing total, roughly three-quarters, was raised during 2015.

European medtech financings by year



Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

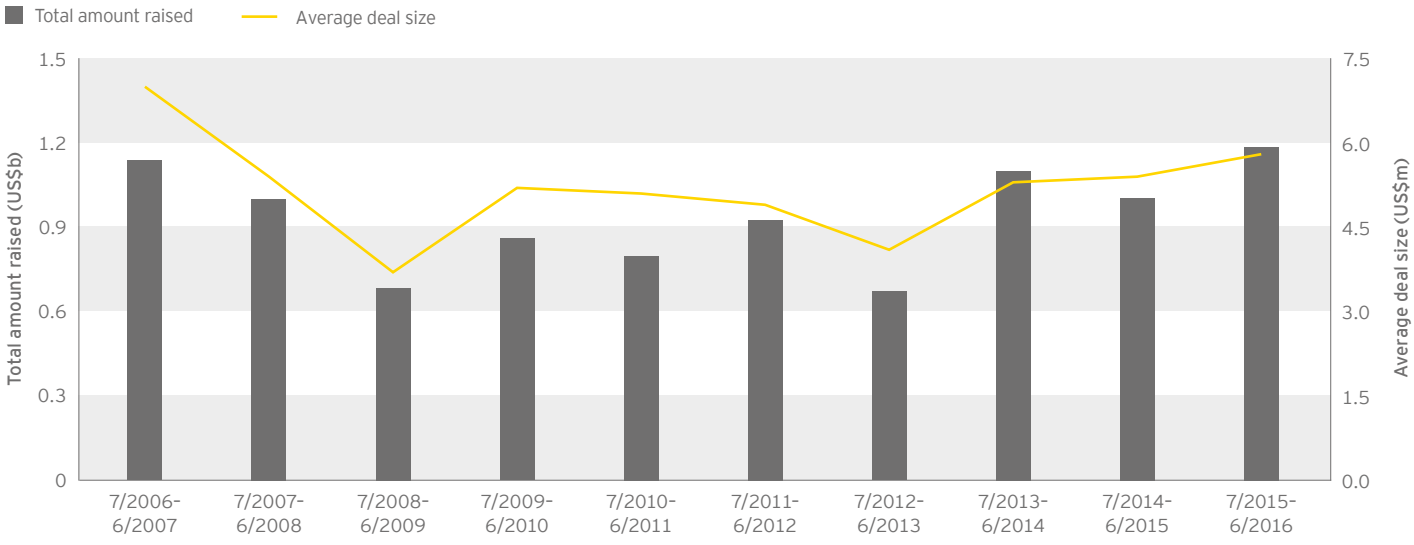
Europe's medtechs enjoyed a 12% gain in overall financing for the 2015-16 period.

Top European venture rounds, July 2015–June 2016

Company	Country	Product type (disease)	Gross raised (US$m)	Quarter
Oxford Nanopore Technologies	UK	Research and other equipment	$107	Q3 2015
CeQur	Switzerland	Therapeutic devices (hematology/renal)	$100	Q3 2015
Inivata	UK	Non-imaging diagnostics	$45	Q1 2016
Biom'Up	France	Therapeutic devices (multiple)	$35	Q3 2015
G-Therapeutics	Switzerland	Therapeutic devices (neurology)	$29	Q2 2016
Retina Implant	Germany	Therapeutic devices (ophthalmic)	$29	Q1 2016
V Wave	Israel	Therapeutic devices (cardiovascular/vascular)	$28	Q1 2016
EIMindA	Israel	Imaging	$28	Q4 2015
Eye Tech Care	France	Therapeutic devices (ophthalmic)	$28	Q1 2016
STAT – Diagnostica	Spain	Non-imaging diagnostics	$28	Q2 2016
Blue Earth Diagnostics	UK	Imaging	$28	Q3 2015
LifeBond	Israel	Therapeutic devices (multiple)	$27	Q3 2015
JenaValve Technology	Germany	Therapeutic devices (cardiovascular/vascular)	$27	Q3 2015
EarlySense	Israel	Non-imaging diagnostics	$25	Q2 2016
Ornim Medical	Israel	Imaging	$25	Q4 2015

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

Venture financing in Europe was very strong



Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.

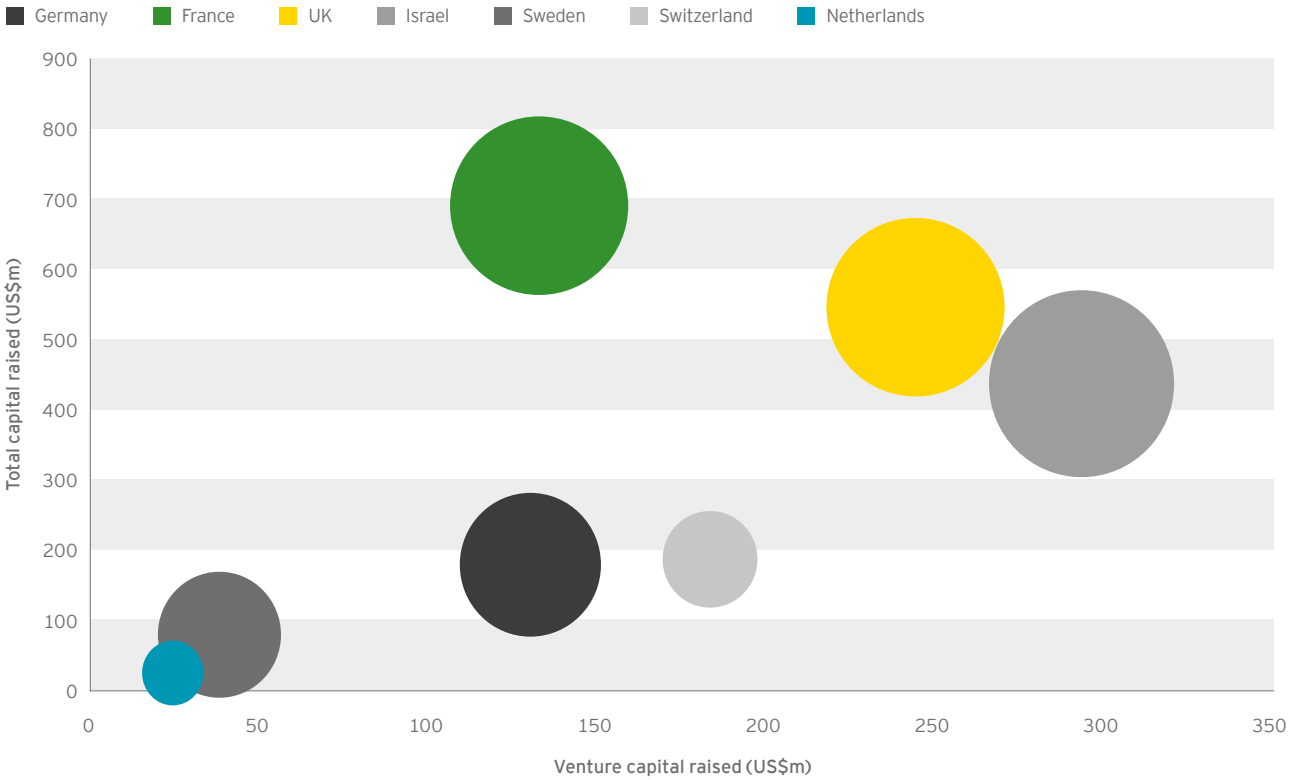
Among EU venture rounds, Oxford Nanopore Technologies' July 2015 US$107 million round topped the chart – as the company has in the past three years (a US$58 million round in 2014 and US$63 million in 2013 were also the most lucrative deals in their respective years). The gene sequencing technology developer has raised about US$400 million in venture capital since 2005 and counts sequencing pioneer Illumina among its investors. CeQur, a Swiss developer of insulin infusion technologies, raised US$100 million in its September 2015 Series C to lead all EU therapeutic device deals.

Excluding debt, France and the United Kingdom attracted the most equity investment of the European nations in 2015–16, raising US$690 million and US$548 million respectively.

Israel rounded out the top three, as medtechs in that country pulled in around US$430 million.

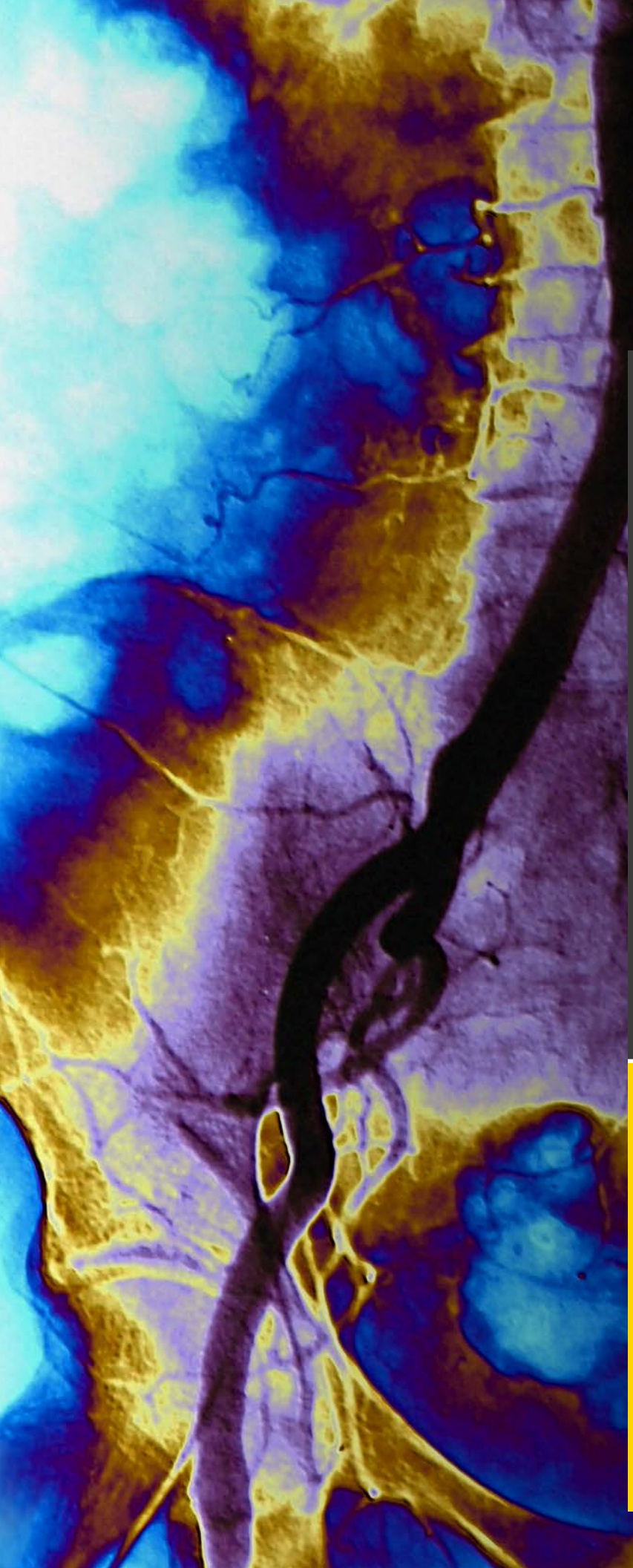
Going forward, it will be interesting to see whether the June 2016 vote by the British populace to leave the EU significantly affects the financing climate of UK-based medtechs.

Capital raised by leading European countries excluding debt, July 2015–June 2016



Size of bubbles shows relative number of financings per region.

Source: EY, BMO Capital Markets, Dow Jones VentureSource and Capital IQ.



Financing

Key messages

- In aggregate, the financing of US and European medtechs fell 60% year-on-year due to a dearth of large debt deals and a scarcity of IPOs.
- The public markets became less receptive to medtechs in 2016; from 1 January 2016 to 30 June 2016, medtechs pulled in just 20% of the 2015-16 dollar totals in the IPO and follow-on financing categories.
- A year-on-year double-digit increase in total venture financing is a reason for guarded optimism about the future of medtech innovation, especially as funding for early-stage medtechs reached an eight-year high.
- Private equity groups and crossover investors helped drive the growth in total medtech venture financing; strategic investors also played an important role, but the data suggest their activity has plateaued.

Questions for medtech companies to consider

- **What investments should you prioritize to reach the next value inflection point?**
- **Can you articulate a shareholder value creation story?**
- **Have you derisked your financing strategy by securing multiple pools of capital?**
- **As fundraising via public markets grows more challenging, how will you use alliances to bolster your capital agenda?**

Mergers and acquisitions

Full steam ahead

Highlighted by a single megadeal — Abbott's US$30.7 billion acquisition of St. Jude Medical — the year that ended 30 June 2016 featured a pronounced uptick over the prior 12 months in merger and acquisition activity and deal value. In aggregate, medtech M&A reached nearly US$80 billion.

Changing business models, particularly the need to pursue efficiencies of scale and the ability to offer comprehensive patient solutions in an increasingly price-sensitive marketplace, have helped drive the dealmaking agenda. A changing regulatory landscape, particularly in Europe, may also contribute to the ongoing health of the M&A market. Companies grappling with compliance issues sparked by new regulations may opt to exit certain markets and double down in others.

This past year failed to top the previous total M&A record set in 2013–14, a year that included Medtronic's blockbuster takeover of Covidien. Importantly, however, 2015–16 featured the third consecutive uptick in the total value of non-megadeals. Deals valued at less than US$10 billion reached an aggregate total of US$46.5 billion, eclipsing the previous high set in 2011–12 and establishing a new record for the sector.

The total number of M&A deals with announced terms also reached a record high, with 2015–16's 213 deals nearly 37% above the prior year's 156. Average deal values for non-megadeals held relatively steady, dropping to US$220 million from the prior year's US$230 million. Recent acquisitions, including Danaher's US$4 billion acquisition of molecular diagnostics company Cepheid, suggest the M&A momentum is likely to continue into 2017.

The continued rise in the value of non-megadeal M&A is intriguing. Those deals involved a wider-than-usual array of acquirers, signaling the emergence of a new set of mid-tier consolidators that may ratchet up competition for new technologies. A weaker capital markets environment also may be implicated in the boost, as the supply of innovation capital retreated to a level not seen since June 2012.

Driven by a still-strong environment for bolt-on deals, total M&A in 2015–16 grew 27% over the prior period, even as deals valued at or above US$1 billion fell from 14 in 2014–15 to 11 in 2015–16. The overwhelming majority of the M&A in medtech was generated in the US, as the sector's leading geography accounted for an astounding 91% of all deals (by seller location).

As part of industry's overall capital allocation strategy, M&A has more than held its own over the past few years. Even as M&A ebbed during the calendar year 2015 (when zero megadeals were inked), companies in the medtech sector spent more money on M&A than on share buybacks and dividend payments combined. Meanwhile, R&D spending continued to grow by single digits and occupied a familiar third place in terms of how medtechs spend their hard-earned cash.

In other words, growth by acquisition is still medtech's go-to strategy, one that shows no sign of changing in the near term. Indeed, in 2015–16, the rise of the serial acquirer was a notable trend: at least nine medtechs struck at least four acquisitions

M&A in the US and Europe by year

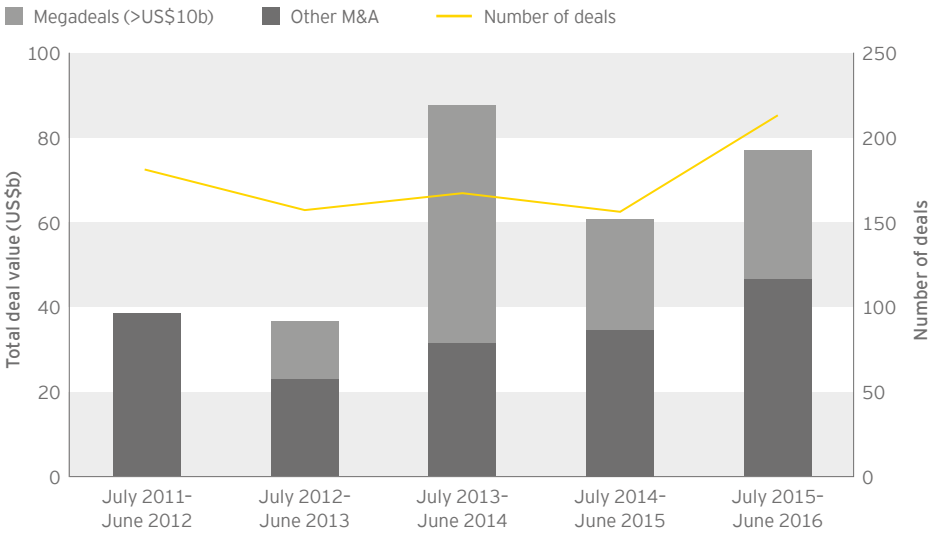


Chart includes deals with values disclosed.

Source: EY, Capital IQ and Thomson ONE.

apiece, as companies including Cooper Surgical, Medtronic, Stryker and Essilor pursued aggressive deal strategies.

The prolific dealmaker Medtronic alone announced 12 acquisitions during the year ending 30 June 2016 – three more than the nine acquisitions the company inked the prior year. As the pure-play medtech giant digests its Covidien megadeal, it has turned toward smaller, bolt-on buys to fill portfolio gaps in the renal and vascular areas. The six deals with disclosed terms amounted to US$2.3 billion in aggregate potential acquisition payments. The Irish company's biggest deal of the year was its US$1.1 billion acquisition of Massachusetts-based ventricular assist device maker HeartWare International.

In addition to HeartWare, Medtronic bought four companies developing products for ischemic stroke and/or aneurysm: Medina Medical (US$150 million), Twelve (US$408 million), Lazarus Effect (US$100 million) and Aptus Endosystems (US$115 million). Medtronic also received an option to buy Arsenal AAA, another aneurysm repair player.

> Growth by acquisition is still medtech's go-to strategy, one that shows no sign of changing in the near term.

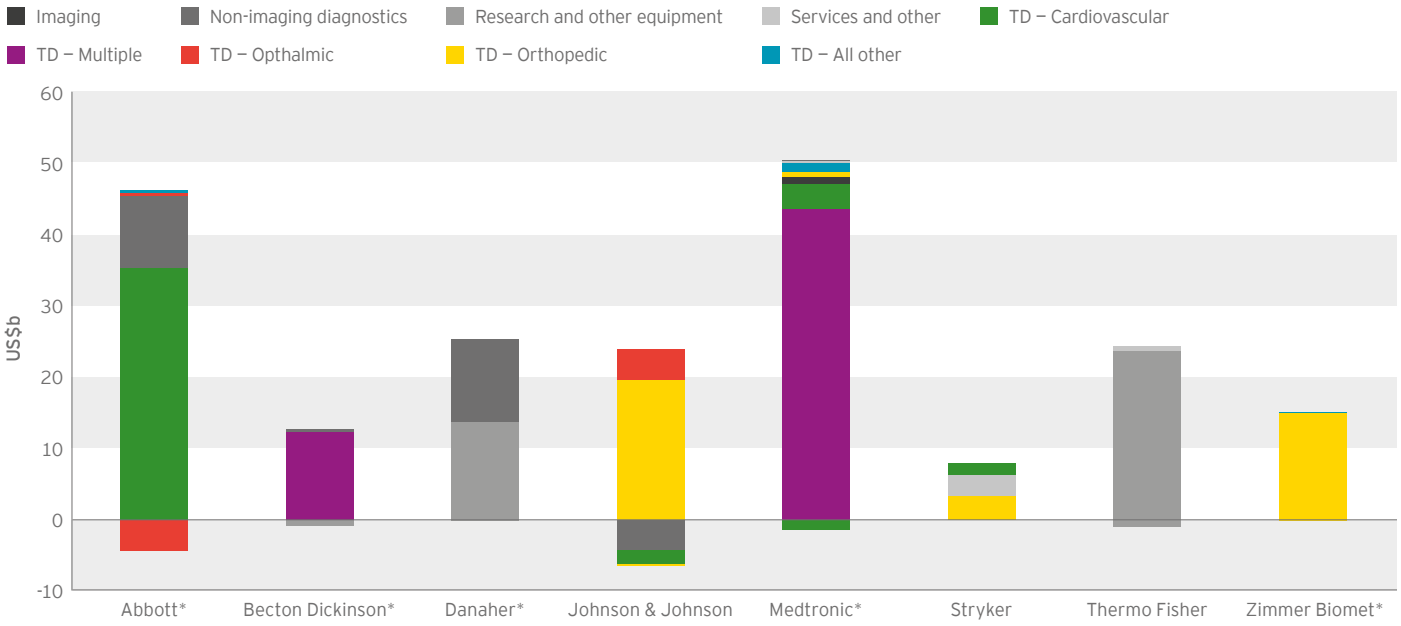
Selected M&A, July 2015–June 2016

Acquiring company	Location	Acquired company	Location	Value (US$m)
Abbott Laboratories	US – Illinois	St. Jude Medical	US – Minnesota	$30,700*
Abbott Laboratories	US – Illinois	Alere	US – Massachusetts	$8,400*
Dentsply International	US – Pennsylvania	Sirona Dental Systems	US – New York	$5,520
Thermo Fisher Scientific	US – Massachusetts	FEI	US – Oregon	$4,200
St. Jude Medical	US – Minnesota	Thoratec	US – California	$3,400
Stryker	US – Michigan	Sage Products	US – Illinois	$2,775
Greatbatch	US – New York	Lake Region Medical	US – Massachusetts	$1,730
Thermo Fisher Scientific	US – Massachusetts	Affymetrix	US – California	$1,300
Stryker	US – Michigan	Physio-Control	US – Washington	$1,280
Medtronic	Ireland	HeartWare International	US – Massachusetts	$1,100
Zimmer Biomet	US – Indiana	LDR Holding	US – Texas	$1,100
Sonova Holding	Switzerland	AudioNova	Netherlands	$950
TE Connectivity	Switzerland	Creganna Tactx Medical	Ireland	$895
ResMed	US – California	Brightree	US – Georgia	$800
Medtronic	Ireland	Twelve	US – California	$458

* Announced acquisitions that have not closed as of 30 September 2016.

Source: EY, Capital IQ and Thomson ONE.

Portfolio optimization by selected medtechs, January 2011–September 2016



*Figures include previous M&As of companies that were later acquired: Abbott (Alere and St. Jude Medical), Becton Dickinson (CareFusion), Danaher (Beckman Coulter), Medtronic (Covidien) and Zimmer Biomet (Biomet).

The therapeutic device (TD) category was further subdivided by therapeutic area. TD – Multiple refers to deals that covered multiple therapeutic areas. TD – All other refers to a deal in a therapeutic area other than cardiovascular, ophthalmic or orthopedic.

Source: EY, Capital IQ and Thomson ONE.

Abbott was far and away the year's highest-spending dealmaker, boosting the prominence of the cardiovascular therapeutic device category. The conglomerate's acquisition of cardiology therapeutic device manufacturer St. Jude alone represented about 40% of the year's US$77.2 billion in M&A.

Combined, Abbott's three 2015–16 deals accounted for more than half of the entire sector's M&A total.

With St. Jude, Abbott has undertaken its largest-ever acquisition. The deal will give the combined companies a top spot in a broad swath of cardiovascular device markets when it is eventually approved by regulators. In addition, St. Jude itself bulked up prior to its acquisition by Abbott, acquiring heart failure specialist Thoratec for US$3.4 billion in July 2015.

Scaling up

The search for scale was evident in the year's remaining big acquisitions, continuing a trend that has been in place for the past several years. The US$5.5 billion merger of Dentsply and Sirona combines the former's dental consumables business with the latter's dental technology and equipment business. The resulting leader in dental products — now Dentsply Sirona — continued to grow by acquisition, buying MIS Implants Technologies for US$375 million. That June 2016 deal adds dental implants to the company's growing product portfolio.

Thermo Fisher Scientific and Stryker each inked two top-10 acquisitions during 2015–16. Thermo Fisher absorbed electron microscopy specialist FEI for US$4.2 billion just two months after completing the acquisition of the genetic analysis company Affymetrix for US$1.3 billion. Thermo Fisher was already the dominant player in the research equipment space thanks in part to its 2014 acquisition of Life Technologies for US$15 billion.

Stryker was also an active acquirer, purchasing seven companies during the year ending 30 June 2016. Stryker's big buy was the US$2.8 billion acquisition of private-equity-owned Sage Products, which gives Stryker a suite of hospital-based products to prevent infections. In a second acquisition of a PE-backed company, Stryker also acquired the external defibrillator and related equipment manufacturer Physio-Control International for US$1.28 billion.

PE groups cashed in several more times during the 2015–16 period. One of the year's biggest PE exits was Greatbatch's US$1.7 billion acquisition of Lake Region medical, a manufacturing and engineering outsourcing company owned by Bain Capital and Kohlberg Kravis Roberts. (Lake Region itself was the combination of two manufacturing specialists: the PE-owned Accellent bought closely held cardiology- and endovascular-focused Lake Region in early 2014 and adopted the latter's name.)

The PE exodus from medtech will likely continue as large investors see better growth opportunities elsewhere in the life sciences and beyond. Digital health and health care services, notably, are generating increasing interest. Expect to see PE interest in contract research and contract manufacturing companies increase as well given industry dynamics and the current need for capital efficiency.

US and European M&A by type of buyer (excluding megadeals)

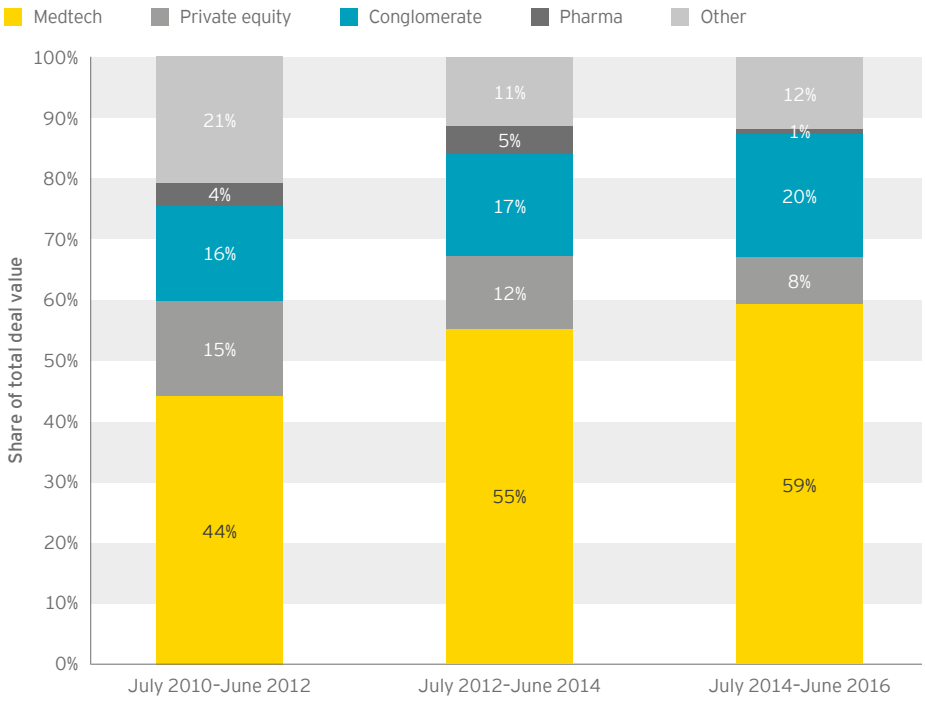


Chart excludes megadeals.

Source: EY, Capital IQ and Thomson ONE.

This interest would mirror the spike in attention PE companies have given to biopharma CROs recently.

PE firms may be selling medtech companies, but the data amassed over the past several years suggest fewer are active buyers of medical technologies. During the two-year period that ended 30 June 2016, PE buyers represented less than 8% of all non-megadeal deal flow. From July 2010 through June 2012, PE buyers accounted for more than 15% of that same subset of medtech deals.

Pharma companies are also less likely to participate in traditional medtech M&A than in years prior. During the most recent two-year period, less than 1% of total non-megadeal value came from pharma buyers, compared with nearly 4% from July 2010 to June 2012. That's not to say pharma companies are completely disinterested in medtech: GlaxoSmithKline's partnership with Verily (the life sciences arm of Alphabet) in August 2016 to establish Galvani Bioelectronics points to therapeutics companies' interest in potentially disruptive medtech applications in the pharma world.

In reality, the most likely acquirers of smaller medtech companies in 2016 are traditional medtechs themselves. This trend reflects pharma-driven conglomerates' appetite for higher-growth segments such as therapeutics and their willingness to divest slower-growing medtech businesses. It also reflects the emergence of a medtech middle class with the capital to chase ever-larger buyout targets. During the 2014–16 two-year period, 14 different medtechs made deals valued north of US$1 billion. During the 2010–12 period, only five medtech companies struck those rich deals.

Over the past couple of years, public capital has been relatively available, providing medtech sellers with an alternative to M&A. This better-than-average financing environment has meant fewer medtech acquisitions have featured milestone payments. That trend continued in 2015–16, despite the cooler capital environment. Even as the number of deals with disclosed terms skyrocketed during 2015–16 (up 37% to 213), the number of structured deals remained almost flat. During the 12 months that ended 30 June 2016, there were 31 deals with up-front and milestone payments (15% of all deals with disclosed terms), in contrast to 27 during the prior year (17% of deals with disclosed terms).

The total value of those milestone payments also decreased year-on-year, from about US$1.1 billion to about US$863 million, though there was a slight uptick in payments tied to milestones as a percentage of those structured deals (from 15% to 19%).

In the past two years, the capital available to the medtech industry's buyout targets has changed the complexion of the sector's structured M&A. Sellers have either maintained the ability to negotiate better deal terms or tapped the public markets for liquidity. Should capital

Over the past couple of years, public capital has been relatively available, providing medtech sellers with an alternative to M&A.

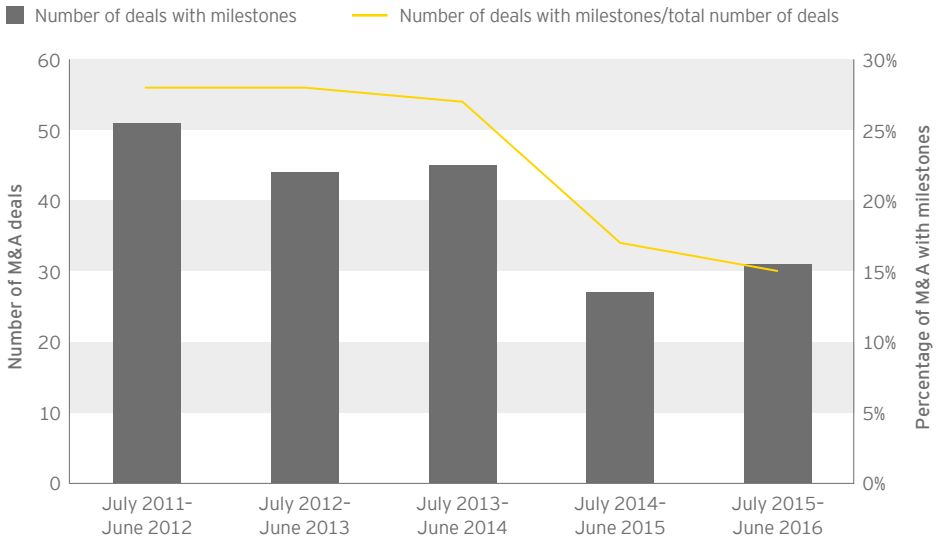
become scarce for companies wishing to go public — and this year's financing picture suggests we have already moved in that direction — the structured deal is likely to re-emerge as a key trend. As recently as 2011, the total value of deal milestones equaled US$2.6 billion. Put another way, five years ago, about twice as many M&A deals with disclosed terms included milestone payments. And the value of those milestone payments was nearly half of those deals' cumulative value.

Despite recent trends, milestone-heavy deals *were* struck during 2015–16. Roche Diagnostics' acquisition of privately held GeneWeave BioSciences cost the Swiss giant US$190 million up front, and the small company's investors could receive an additional US$235 million in product-related milestone payments. That may seem like a lot — in fact, it's the largest milestone total among deals struck during our 2015–16 time frame and represents the lion's share of the deal's total value. But GeneWeave, which boasted a sought-after rapid infectious-disease testing platform, was only founded in 2010, and at the time of its acquisition, it had raised just US$25 million from its venture capital investors, giving GeneWeave's backers a nearly 8x pre-milestone return on the deal.

US medtechs dominate deal flow

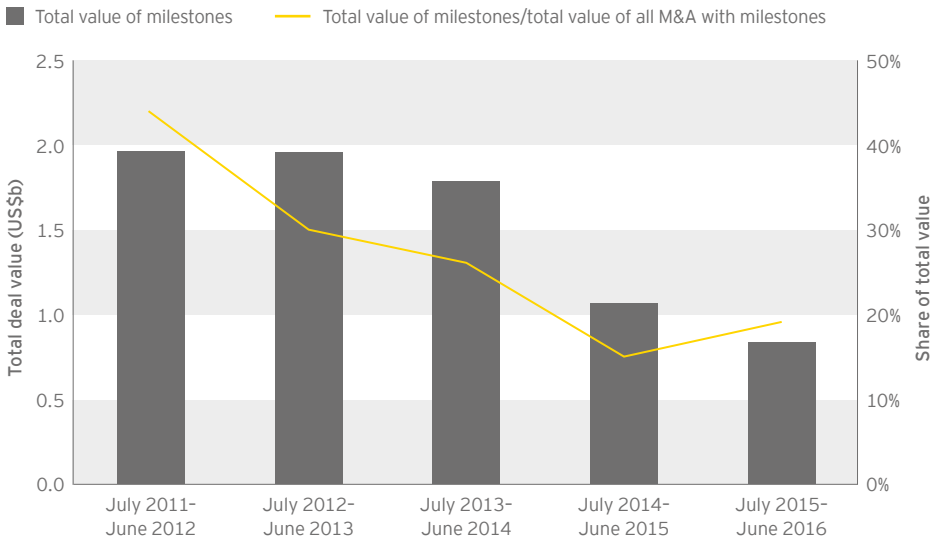
US medtechs dominated the overall industry deal flow in 2015–16, accounting for more than 90% of the aggregate M&A value in 2015–16. (As a reminder, we

Milestone payments in US and European medtech M&A by year



Source: EY, Capital IQ and Thomson ONE.

Milestone share in US and European medtech M&A by year



Source: EY, Capital IQ and Thomson ONE.

categorize deals geographically based on the seller's location, not the buyer's.) Abbott's acquisitiveness certainly contributed, but excluding the St. Jude megadeal, US medtech M&A soared to a record US$39 billion, a 252% year-on-year increase.

Average deal size in the US increased 82% to US$420 million and the number of deals nearly doubled to 94. Every medtech deal worth more than US$1 billion worldwide involved the acquisition of a US-based company. This stands in contrast to last year's decline in both the number of US deals and the total US deal value, as well as last year's average deal value decline. The rebound during 2015–16 can be partially chalked up to 2014–15's particularly buoyant capital markets, which may have kept buyers on the sidelines, wary of inflated valuations, and sellers holding out for better offers. As the M&A market normalized, medtech sellers' expectations also normalized and deal flow surged back.

Fewer options in Europe

European M&A total deal value fell markedly from last year's total, even as the number of acquisitions continued to rise (up 36% to 72). In fact, total deal value fell below US$5 billion, to US$3.9 billion, the lowest total since 2008–09. There were no deals worth more than US$1 billion: Sonova Holding's acquisition of AudioNova for US$950 million combined the two hearing specialists and topped the European charts.

US M&A by year

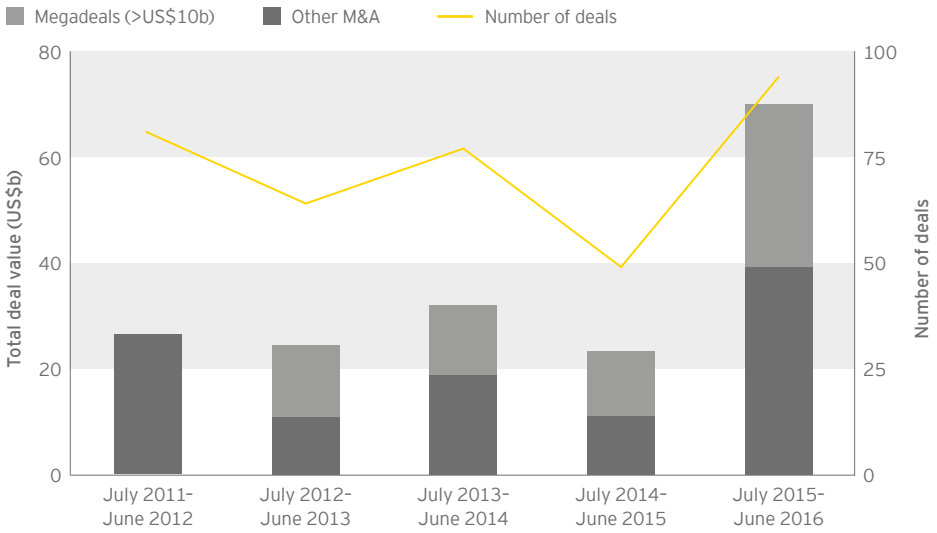


Chart includes deals with values disclosed.
Source: EY, Capital IQ and Thomson ONE.

European M&A by year

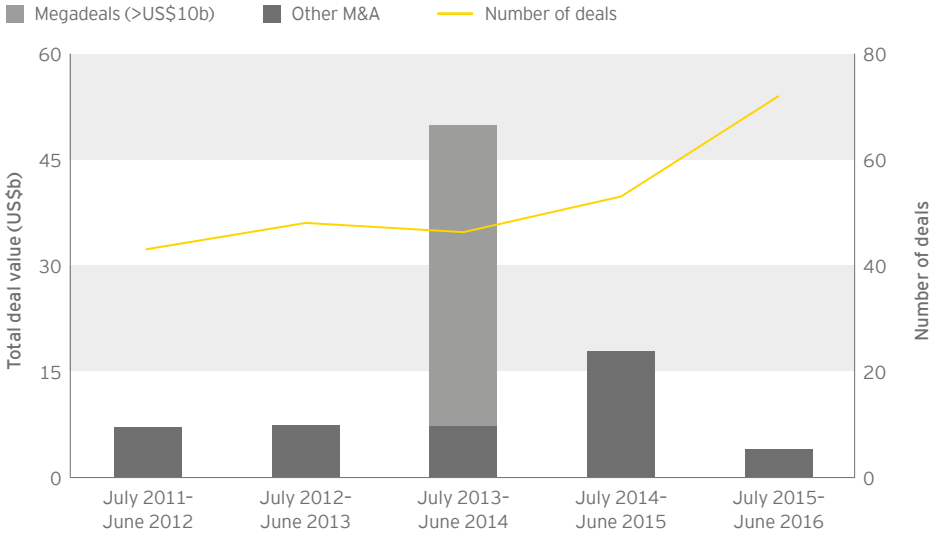


Chart includes deals with values disclosed.
Source: EY, Capital IQ and Thomson ONE.

The reason for this geographic disparity lies partly in the prolonged period of under-investment in Europe's medtech ecosystem. As a result, there are many fewer acquirable medtechs in Europe than in the US, leaving buyers with fewer options. The companies that originate there also tend to be smaller, resulting in lower deal values.

The rise of the Chinese buyer

Western companies are likewise buying few medtechs in China, thanks in large part to regulatory obstacles and the uncertain pace of health care reform in what may eventually be a massive medtech market. But buyers based in China, unencumbered by those concerns, are increasingly leaving their mark on the global medtech M&A landscape.

During the 2015–16 period, Chinese companies acquired 15 medtechs based in the US or EU, more than double last year's six and nearly double the previous record of eight set in 2012–13. China buyers acquired 26 medtechs in other geographies (mainly in emerging markets such as Brazil, India, Russia, Korea and China itself). The cumulative disclosed value of these deals is nearly US$2.1 billion, an increase of about 10% over the prior period. Given current trends, this record is likely to be topped in 2016–17.

By far the largest deal in 2015–16 involving a China-based buyer was CITIC Private Equity Funds Management's acquisition of Singapore's Biosensors International for US$817 million. The private equity group, an arm of Chinese financial conglomerate CITIC, had acquired a minority stake in the stent maker in 2013, in a deal valued at US$312 million. Another biosensor specialist, Sinocare, acquired the diagnostics companies Nipro Diagnostics (US$273 million) and PTS Diagnostics (US$200 million) for the second- and third-largest deals of the year by China-based acquirers.

M&A of medtechs with buyers from Asia-Pacific

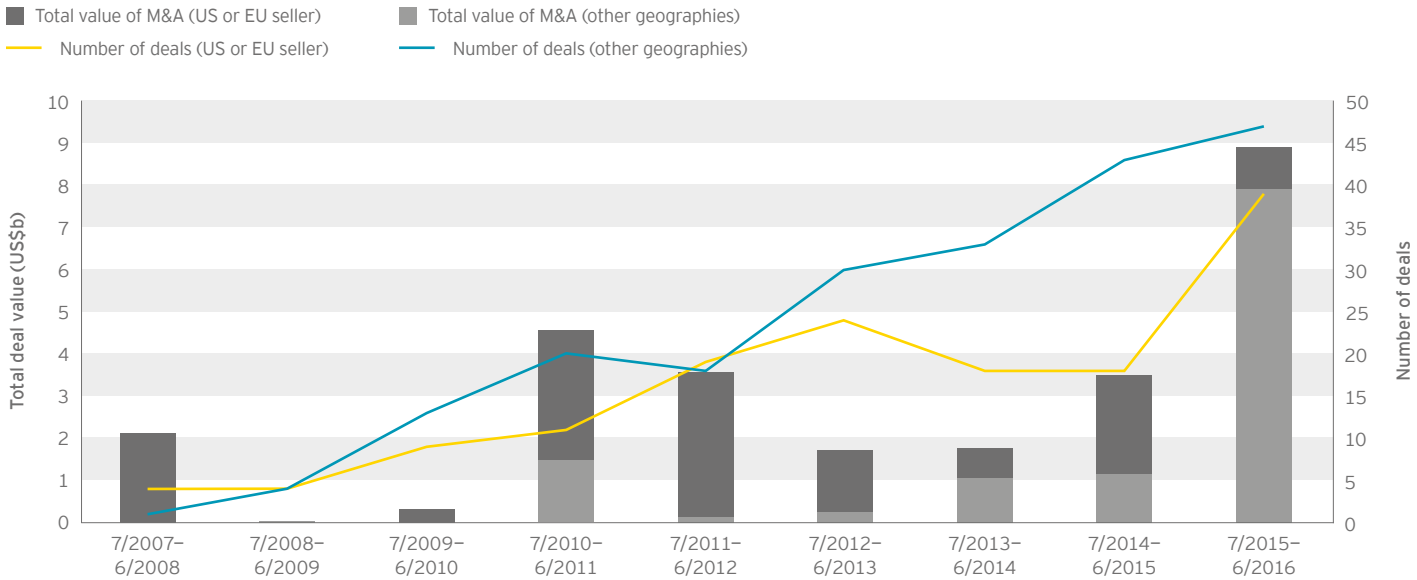


Chart includes all deals (including the deals without disclosed value) where buyer is from the APAC region and either the buyer or seller company is medtech.

Source: EY, Capital IQ and Thomson ONE.

Mergers and acquisitions

Key messages

- Multiple forces drove a strong medtech dealmaking climate in 2015–16, as the total M&A value for US and EU-based medtechs reached nearly US$80 billion.
- An uptick in non-megadeals, which are valued at less than US$10 billion, underpinned the healthy takeover market, as medtech acquirers continued to search for bolt-on targets.
- The universe of medtech buyers continued to shift in 2015–16 as private equity looked for higher-growth opportunities outside the sector.
- US medtechs dominated the dealmaking flow in 2015–16, accounting for more than 90% of the aggregate M&A value.

Questions for medtech companies to consider

- **As therapeutic focus becomes more important, do you have the depth to compete in your targeted categories?**
- **Do you have the dealmaking firepower you need to grow?**
- **Is divesting a product or business your fastest route to value creation?**

Scope of this report

Defining medical technology

Except as otherwise noted, medical technology (medtech) companies are defined for this report as companies that primarily design and manufacture medical technology equipment and supplies and are headquartered within the United States or Europe. For the purposes of this report, we have placed Israel's data and analysis within the European market. The "global" data represent combined metrics from US and European medtechs. Our definition of medtech is wide-ranging and includes medical device, diagnostic, drug delivery and analytical/life sciences tool companies, but excludes distributors and service providers, such as contract research organizations or contract manufacturing organizations.

By any measure, medical technology is an extraordinarily diverse industry. While developing a consistent and meaningful classification system is important, it is anything but straightforward. Existing taxonomies sometimes segregate companies into scores of thinly populated categories, making it difficult to identify and analyze industry trends. Furthermore, they tend to combine categories based on products (such as imaging or tools) with those based on diseases targeted by those products (such as cardiovascular or oncology), which makes it harder to analyze trends consistently across either dimension. To address some of these challenges, we have categorized medtech companies across both dimensions — products and diseases targeted.

All publicly traded medtech companies were classified as belonging to one of five broad product groups:

- **Imaging:** companies developing products used to diagnose or monitor conditions via imaging technologies, including products, such as MRI machines, computed tomography (CT) and X-ray imaging equipment, and optical biopsy systems
- **Non-imaging diagnostics:** companies developing products used to diagnose or monitor conditions via non-imaging technologies, which can include patient monitoring and in vitro testing equipment
- **Research and other equipment:** companies developing equipment used for research or other purposes, including analytical and life sciences tools, specialized laboratory equipment and furniture
- **Therapeutic devices:** companies developing products used to treat patients, including therapeutic medical devices, tools or drug delivery/infusion technologies
- **Other:** companies developing products that do not fit in any of the above categories were classified in this segment

In addition to product groups, this report tracks conglomerate companies that derive a significant part of their revenues from medical technologies. While a conglomerate medtech division's technology could technically fall into one of the product groups listed above (e.g., GE Healthcare into "imaging" and Allergan into "therapeutic devices"), all conglomerate data are kept separate from that of the non-conglomerates. This is due to the fact that while conglomerates report revenues for their medtech divisions, they typically do not report other financial results for their medtech divisions, such as research and development spending or net income.

Conglomerate companies

United States

- 3M: Health Care
- Abbott: Diagnostic and Vascular Care
- Agilent Technologies: Life Sciences and Applied Markets
- Allergan: Medical Devices
- Baxter International: Fluid Systems, Renal and Surgical Care
- Corning: Life Sciences
- Danaher: Life Sciences & Diagnostics and Dental
- GE Healthcare
- IDEX: Health & Science Technologies
- Johnson & Johnson: Medical Devices & Diagnostics
- Pfizer: Infusion Systems

Europe

- Agfa HealthCare
- Bayer: Radiology
- Carl Zeiss Meditec
- DSM: Medical
- Dräger: Medical
- Eckert & Ziegler: Medizintechnik
- Fresenius: Medical Devices
- GN Store Nord: GN ReSound
- Halma: Medical
- Jenoptik: Medical Technology
- Merck KGaA: EMD Millipore
- Novartis: Alcon Surgical
- Philips Healthcare
- Quantel Medical
- Roche Diagnostics
- Sanofi: Genzyme Biosurgery
- Semperit: Sempermed
- Siemens Healthcare
- Smiths Medical

Acknowledgments

Project leadership

Ellen Licking, EY Life Sciences Senior Analyst, was the managing editor for *Pulse of the industry*. Taking a hands-on approach, she was responsible for content development, including the creation of the guest articles and data analysis.

Chris Morrison, Contributing Writer, was the report's lead author. He was responsible for writing the three *Industry performance* articles and the *Year in review* article.

Jason Hillenbach was the report's project manager. He was responsible for the entire content and quality of this publication, including the supervision of the data analysis team and collaborating on the design and marketing of the report.

Ellen and Jason would like to recognize the contributions to the editorial content made by the following individuals: **John Babitt**, **Glen Giovannetti**, **Pamela Spence** and **Arda Ural**.

Data analysis

Rajni Sadana organized all of the research, collection and analysis of the report's data. She was assisted by **Niharika Agarwal**, **Richa Arun** and **Stavita Bali**.

Jason Hillenbach, **Kim Medland** and **Rajni Sadana** conducted fact-checking and quality review of the numbers presented throughout the publication.

Editing assistance

Russell Colton was the publication's copy editor and proofreader. His patience, hard work and attention to detail were unparalleled.

Design

Mike Fine was the lead designer for this project. This publication would not look the way it does without his creativity.

PR and marketing

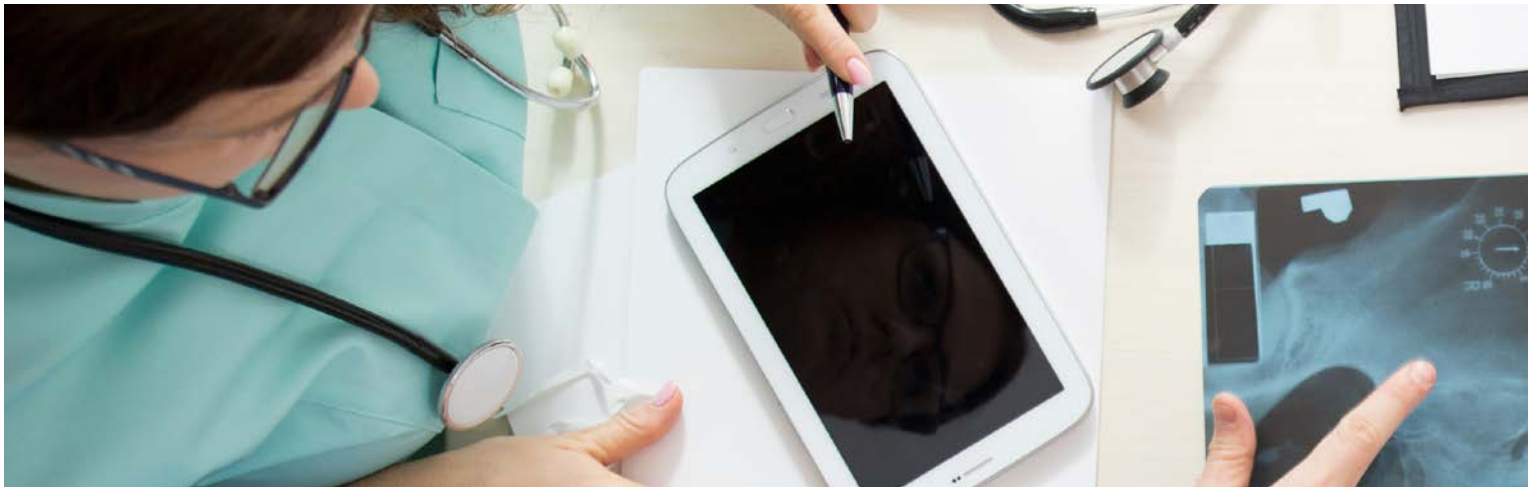
Jo White, **Katie Costello** and **Hannah Murphy** led the marketing and public relations efforts related to the report for EY.

Global medical technology contacts

Global Life Sciences Industry Leader		Pamela Spence	pspence2@uk.ey.com	+44 207 951 3523
Global Life Sciences Assurance Leader		Tobias Schlebusch	tobias.schlebusch@de.ey.com	+49 211 9352 10351
Global Life Sciences Advisory Leader		Kim Ramko	kim.ramko@ey.com	+1 615 252 8249
Global Life Sciences Tax Leader		Mitch Cohen	mitchell.cohen@ey.com	+1 203 674 3244
Global Life Sciences Transaction Advisory Services Leader		Jeff Greene	jeffrey.greene@ey.com	+1 212 773 6500
Australia	**Melbourne**	Denise Brotherton	denise.brotherton@au.ey.com	+61 3 9288 8758
	Sydney	Gamini Martinus	gamini.martinus@au.ey.com	+61 2 9248 4702
Austria	**Vienna**	Erich Lehner	erich.lehner@at.ey.com	+43 1 21170 1152
Belgium	**Brussels**	Lucien De Busscher	lucien.de.busscher@be.ey.com	+32 2 774 6441
Brazil	**São Paulo**	Frank de Meijer	frank-de.meijer@br.ey.com	+55 11 2573 3383
Canada	**Montréal**	Sylvain Boucher	sylvain.boucher@ca.ey.com	+1 514 874 4393
		Lara Iob	lara.iob@ca.ey.com	+1 514 879 6514
	Toronto	Mario Piccinin	mario.piccinin@ca.ey.com	+1 416 932 6231
	Vancouver	Nicole Poirier	nicole.poirier@ca.ey.com	+1 604 891 8342
Czech Republic	**Prague**	Petr Knap	petr.knap@cz.ey.com	+420 225 335 582
Denmark	**Copenhagen**	Christian Johansen	christian-s.johansen@dk.ey.com	+45 5158 2548
France	**Paris**	George Fife	george.fife@fr.ey.com	+33 6 7599 7571
		Virginie Lefebvre-Dutilleul	virginie.lefebvre-dutilleul@ey-avocats.com	+33 1 55 61 10 62
Germany	**Cologne**	Gerd Stürz	gerd.w.stuerz@de.ey.com	+49 211 9352 18622
	Mannheim	Siegfried Bialojan	siegfried.bialojan@de.ey.com	+49 621 4208 11405
Greater China	**Shanghai**	Titus Bongart	titus.bongart@cn.ey.com	+86 21 22282884
		Felix Fei	felix.fei@cn.ey.com	+86 21 22282586
India	**Mumbai**	V. Krishnakumar	krishnakumar.v@in.ey.com	+91 22 6192 0950
		Hitesh Sharma	hitesh.sharma@in.ey.com	+91 22 6192 0950
		Sriram Shrinivasan	sriram.shrinivasan@in.ey.com	+91 22 6192 0000
Ireland	**Dublin**	Aidan Meagher	aidan.meagher@ie.ey.com	+353 1221 1139
Israel	**Tel Aviv**	Eyal Ben-Yaakov	eyal.benyaakov@il.ey.com	+972 3 623 2512
Italy	**Rome**	Antonio Irione	antonio.irione@it.ey.com	+39 06 6755715
Japan	**Tokyo**	Hironao Yazaki	yazaki-hrn@shinnihon.or.jp	+81 3 3503 2165
		Patrick Flochel	flochel-ptrck@shinnihon.or.jp	+81 3 3503 1542
Netherlands	**Amsterdam**	Dick Hoogenberg	dick.hoogenberg@nl.ey.com	+31 88 40 71419
New Zealand	**Auckland**	Jon Hooper	jon.hooper@nz.ey.com	+64 9 300 8124
Norway	**Trondheim/Oslo**	Willy Eidissen	willy.eidissen@no.ey.com	+47 918 63 845
Poland	**Warsaw**	Mariusz Witalis	mariusz.witalis@pl.ey.com	+48 225 577950

Russia	**Moscow**	Dmitry Khalilov	dmitry.khalilov@ru.ey.com	+7 495 755 9757
Singapore	**Singapore**	Sabine Dettwiler	sabine.dettwiler@sg.ey.com	+65 9028 5228
		Rick Fonte	richard.fonte@sg.ey.com	+65 6309 8105
South Africa	**Johannesburg**	Warren Kinnear	warren.kinnear@za.ey.com	+27 11 772 3576
Sweden	**Uppsala**	Staffan Folin	staffan.folin@se.ey.com	+46 8 5205 9359
Switzerland	**Basel**	Jürg Zürcher	juerg.zuercher@ch.ey.com	+41 58 286 84 03
United Kingdom	**Bristol**	Matt Ward	mward@uk.ey.com	+44 11 7981 2100
	Cambridge	Cathy Taylor	ctaylor@uk.ey.com	+44 12 2355 7090
		Rachel Wilden	rwilden@uk.ey.com	+44 12 2355 7096
	Edinburgh	Mark Harvey	mharvey2@uk.ey.com	+44 13 1777 2294
		Jonathan Lloyd-Hirst	jlloydhirst@uk.ey.com	+44 13 1777 2475
	London/Reading	David MacMurchy	dmacmurchy@uk.ey.com	+44 20 7951 8947
		Daniel Mathews	dmathews1@uk.ey.com	+44 20 7197 9375
		Ian Oliver	ioliver@uk.ey.com	+44 11 8928 1197
United States	**Boston**	Kevin Casey	kevin.casey1@ey.com	+1 617 585 1817
		Michael Donovan	michael.donovan1@ey.com	+1 617 585 1957
	Chicago	Jerry DeVault	jerry.devault@ey.com	+1 312 879 6518
		James Welch	james.welch@ey.com	+1 312 879 3827
	Houston	Carole Faig	carole.faig@ey.com	+1 713 750 1535
	Minneapolis	William Miller	william.miller@ey.com	+1 612 371 6984
		Stephen Stenbeck	stephen.stenbeck@ey.com	+1 612 371 6994
	New York/New Jersey	John Babitt	john.babitt@ey.com	+1 212 773 0912
		Orlan Boston	orlan.boston@ey.com	+1 212 773 2269
	Orange County	Kim Letch	kim.letch@ey.com	+1 949 437 0244
	Philadelphia	Howard Brooks	howard.brooks@ey.com	+1 215 448 5115
		Steve Simpson	stephen.simpson@ey.com	+1 215 448 5309
	Raleigh	Mark Baxter	mark.baxter@ey.com	+1 919 981 2966
	Redwood Shores	Chris Nolet	chris.nolet@ey.com	+1 650 802 4504
		Rich Ramko	richard.ramko@ey.com	+1 650 802 4518
	San Diego	Dan Kleeburg	daniel.kleeburg@ey.com	+1 858 535 7209

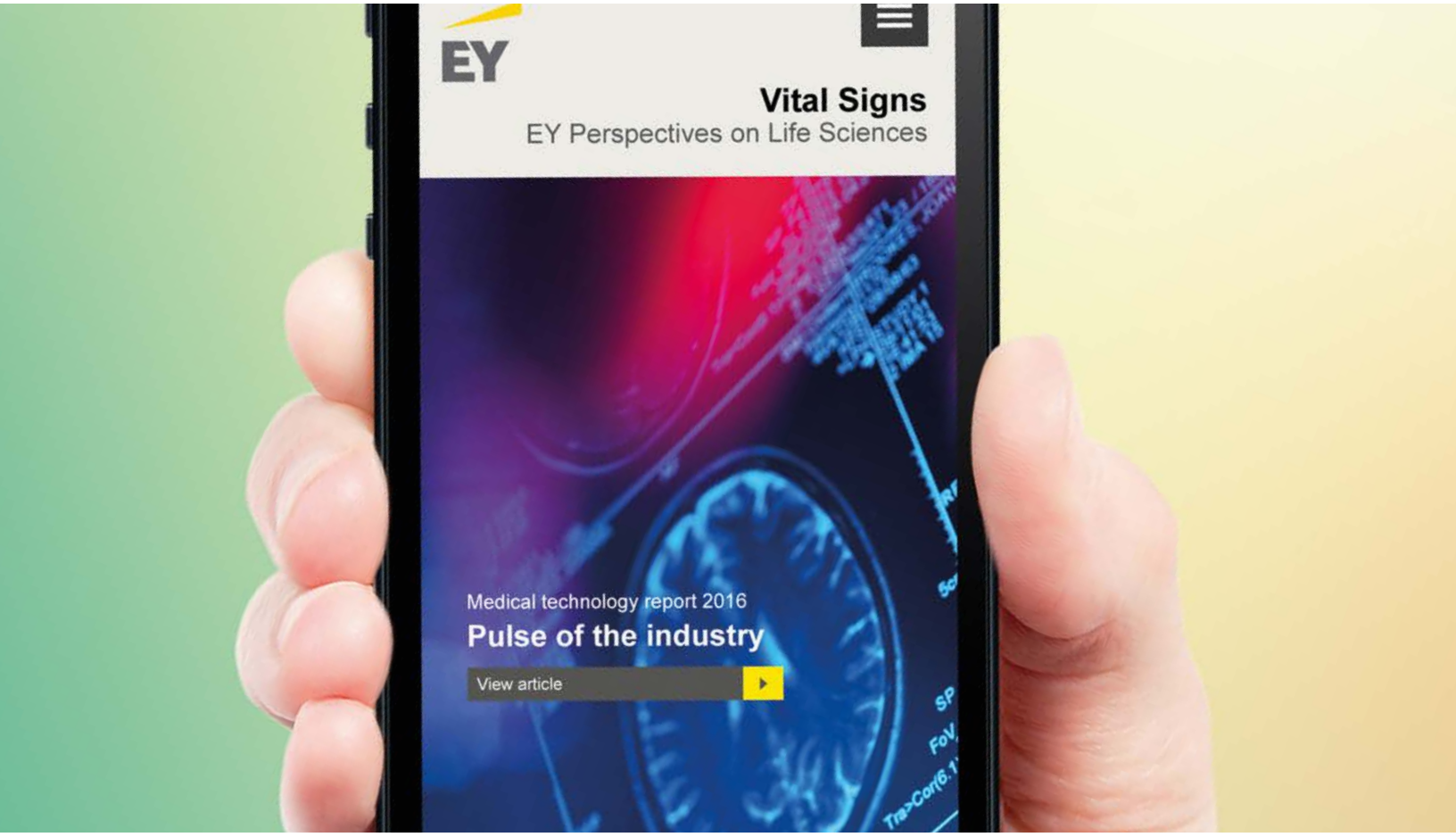
Data exhibit index



Notes

Notes

A mobile-friendly site for life sciences executives



Have you visited EY's Vital Signs?

For one-stop access to EY's breadth of materials published on the life sciences industry – **reports, research, articles, guest perspectives, blog posts, presentations, infographics, surveys, charts and analysis** – visit Vital Signs (**ey.com/vitalsigns**).

Browse the easy-to-use navigation to quickly find the **latest insights and perspectives on the topics most important to pharmaceutical, biotech, medtech and specialty pharma companies**.

While visiting Vital Signs, click on **subscribe** to receive once-a-week email alerts (eAlerts) when new publications are posted on Vital Signs.

ey.com/vitalsigns

EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

How EY's Global Life Sciences Sector can help your business
Life sciences companies — from emerging start-ups to multinational enterprises — face new challenges in a rapidly changing health care ecosystem. Payers and regulators are increasing scrutiny and accelerating the transition to value and outcomes. Big data and patient-empowering technologies are driving new approaches and enabling transparency and consumerism. Players from other sectors are entering health care, making collaborations increasingly complex. These trends challenge every aspect of the life sciences business model, from R&D to marketing.

Our Global Life Sciences Sector brings together a worldwide network — more than 7,000 sector-focused assurance, tax, transaction and advisory professionals — to anticipate trends, identify their implications and develop points of view on responding to critical issues. We can help you navigate your way forward and achieve success in the new ecosystem.

EYG no. 03280-164Gbl

ED None

In line with EY's commitment to minimize its impact on the environment, this document has been printed on paper with a high recycled content.

ey.com/pulse