In the interest of the patient
Convergence across the pharmaceutical and healthcare industries
IBM Institute for Business Value

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Convergence across the pharmaceutical and healthcare industries

By Heather Fraser, Ed Mounib and Sarah Payne

The pharmaceutical industry needs to develop better treatments and the healthcare industry to deliver better care. If they collaborate and share the data they separately collect, they will come closer to realizing these goals.

The pharmaceutical and healthcare industries are both going through a period of great turbulence. The pharmaceutical industry (Pharma) is seeking to replace the traditional blockbuster model of drug development with a new model that enables it to develop safer, more efficacious drugs, while the healthcare sector is struggling to cope with rapidly rising costs, inconsistent delivery and inadequate access in many countries. These pressures will bring the two industries closer together. Although some healthcare providers are quite skeptical about Pharma’s motivations, it is only by collaborating and sharing data that the two industries can “connect the dots” to realize the full value of the information they collect, provide better products and services, and ultimately improve patients’ health.

New technologies and research techniques will play a major role in enabling this convergence.¹ Common data standards and security-rich systems capable of preserving the confidentiality of personal data will likewise be essential, as will the active support of various stakeholders. These naturally include Pharma, its regulators, healthcare providers (i.e., doctors and other clinicians, as well as care-delivery organizations like hospitals and specialty clinics), healthcare payers (i.e., public or private health plans, employers and governments) and patients. But academic institutions, medical device and diagnostics companies, retail pharmacies, telecommunication (telecom) operators and so forth also have an important contribution to make. We shall explore the key issues arising from these changes, and our findings from a survey of attitudes toward convergence among medical researchers, pharmaceutical executives and healthcare providers, more fully in the following pages.
Two industries in transition
The blockbuster development model served Pharma well for many years; indeed, it was responsible for producing numerous billion-dollar brands. But the patents on many of these products are due to expire quite soon, putting a substantial portion of the industry’s revenues at risk. The “threshold of innovation” is simultaneously rising; healthcare payers, providers and patients increasingly insist that any new medicines Pharma makes must be safer, more efficacious and more cost-effective than rival drugs, both branded and generic – a challenge that is proving extremely difficult with a methodology that has changed very little in two decades.²

The limitations of the blockbuster model are clear from the fact it still takes nearly 13 years to produce a new drug and that 46 percent of all drugs fail in Phase III trials.³ Even worse, 50 percent of all drugs do not work for the patients for whom they are prescribed.⁴ And 11 major products with combined sales of more than US$8 billion have been pulled from the market for safety reasons in the past six years alone.⁵

The healthcare sector is under equal pressure, albeit for very different reasons. Five forces are collectively boosting costs and driving the need for better quality – globalization; consumerism; aging and overweight populations; diseases that are more expensive to treat and new medical technologies and treatments. Global competition is restricting public expenditure on healthcare and forcing a growing number of patients to seek treatment abroad. Consumer expectations are also rising, a trend that is likely to become even more pronounced as individuals foot a larger share of the bill for their healthcare and become more aware of the associated risks.

Demographic and epidemiological changes will compound these strains. The global population is getting older and more overweight, while many of the illnesses from which it suffers are getting more expensive to treat. Chronic diseases now account for 60 percent of all deaths, and consume as much as 75 percent of developed countries’ healthcare resources.⁶ A number of infectious diseases have also resurfaced, often in mutated, drug-resistant forms. Lastly, although we expect that new medical technologies like genomics and regenerative medicine will ultimately revolutionize the diagnosis and treatment of disease, they will also increase costs in the short term at least.⁷

Thus both the pharmaceutical and healthcare industries must transform themselves. Pharma needs to acquire a better understanding of the molecular characteristics of disease so that it can predict the safety and efficacy of new treatments more accurately. It needs to make treatments that are targeted at specific patient populations and capable of modifying or preventing disease, not just of alleviating the symptoms. And it needs to work with new product models, since most of these treatments are likely to be biologics, which possess
very different characteristics from the small molecules on which it cut its teeth.

Meanwhile, the healthcare industry needs to focus on maximizing the value it delivers, since healthcare payers will increasingly direct their dollars to the products and services that give them the most for their money. It needs to help people adopt healthier lifestyles and purchase healthcare services more wisely. And it needs to find better ways of delivering healthcare, as patients press for more effective provision of more effective treatments in more convenient locations.

The solution to many of these problems lies in more widespread and better use of information – and here the requirements of the two industries overlap (see Figure 1). If they are to develop a deeper understanding of disease, best clinical practice and health economics, they will have to collaborate with each other, as well as with academic researchers and other stakeholders, and fully utilize the vast amount of data they hold.

The convergence of the pharmaceutical and healthcare industries

The advantages of connecting the dots

Consider a hypothetical example of the flow of data that may be created when a patient visits his or her doctor. At present, the data are stored in many different formats and media in many different places, including primary care sites, academic medical research centers, hospitals, specialty clinics, surgeries and pharmacies. But if they were interconnected and interoperable, as in Figure 2, a number of benefits would accrue.

With access to more and richer information, medical researchers could investigate more complex issues; pharmaceutical and biotech companies could build a better understanding of disease mechanisms and clinical outcomes, and get better access to patients who may be good candidates for clinical trials; and the regulators could more accurately assess the drugs they review. Similarly, providers could deliver more evidence-based, standardized

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**FIGURE 1.**
The overlapping information requirements of pharmaceutical companies, healthcare providers and healthcare payers.

- **Pharma**
  - Understand disease and targets
  - Gain regulatory approval
  - Support ongoing marketing and monitor safety
  - Research
  - Clinical trials
  - Outcomes research
  - Patient tracking

- **Providers**
  - Develop and follow evidence-based guidelines
  - Optimize the patient’s lifelong continuum of care
  - Identify research subjects
  - For public payers, allocate resources to providers
  - Define payment/reimbursement levels (e.g., formularies)
  - Conduct case and disease management programs
  - Perform public health studies
  - Profile incentives for better outcomes and value (e.g., pay-for-performance programs)

- **Payers**
  - For public payers, allocate resources to providers
  - Define payment/reimbursement levels (e.g., formularies)
  - Conduct case and disease management programs
  - Perform public health studies
  - Profile incentives for better outcomes and value (e.g., pay-for-performance programs)

_Sources: IBM Institute for Business Value._
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...and costs, while governments, health insurers and employers could make more informed decisions about how to deploy limited resources.

In short, the integration and analysis of data extracted from thousands, if not hundreds of thousands, of patient records (including clinical data, medical images, lifestyle profiles and genetic analyses) with disciplines like genomics and proteomics promises to yield new insights. This new knowledge could transform the pharmacological and clinical treatment of some of the most challenging diseases, which would ultimately benefit patients because they would receive more personalized and more longitudinal preventive and therapeutic care (see Figure 3).

Disparate pockets of data, if combined, could yield tremendous benefit to Pharma, healthcare and, most importantly, the patient.

**Silos, standards and other obstacles**

However, the exchange of data in a reliable, authorized and sustainable fashion requires that all the parties collaborate to realize their respective goals, both individual and shared. And here there are a number of obstacles. For a start, most of the information held by pharmaceutical companies sits in functional silos. It is further subdivided by therapeutic area and project. The information held by medical researchers, clinical researchers, healthcare practitioners, pharmacists and the like is even more widely distributed. So it is often time-consuming and difficult to find data, let alone combine it for the purposes of conducting complex research.
FIGURE 3.
The same forces that are driving the need for convergence are creating changes for other stakeholders – those changes will help drive and enable convergence.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Responsibility</th>
<th>Expected benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>• Maintain an electronic personal health record (PHR) that is relevant and accurate</td>
<td>• Better health</td>
</tr>
<tr>
<td></td>
<td>• Give information from their PHR to healthcare providers to supplement the providers’ electronic health records (EHRs), enabling them to diagnose and treat patients more accurately</td>
<td>• Greater responsibility for, and control over, healthcare</td>
</tr>
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<td></td>
<td></td>
<td>• More convenient services and better, more forward-looking information about health conditions and risks</td>
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<tr>
<td></td>
<td></td>
<td>• Safer and more efficacious treatments</td>
</tr>
<tr>
<td>Pharma/ Biotech</td>
<td>• Capture research and trial data electronically</td>
<td>• Safer, more efficacious and more cost-effective medicines</td>
</tr>
<tr>
<td></td>
<td>• Aggregate and analyze biomedical, clinical and outcomes data</td>
<td>• Medicines targeted at patients with specific genetic and environmental variations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Premium pricing for innovation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improved public image</td>
</tr>
<tr>
<td>Healthcare providers</td>
<td>• Create and maintain interoperable EHRs</td>
<td>• Improved health status and outcomes by following evidence-based standards</td>
</tr>
<tr>
<td></td>
<td>• Develop and follow evidence-based, standardized processes and care plans</td>
<td>• Better use of resources</td>
</tr>
<tr>
<td>Healthcare payers</td>
<td>• Track outcomes to assess costs and quality and support disease management programs</td>
<td>• Targeted services across a broader spectrum of healthcare needs and delivery channels</td>
</tr>
<tr>
<td></td>
<td>• Reward providers that achieve better outcomes and value, and help less effective providers improve their performance</td>
<td>• Better value proposition for patients and providers</td>
</tr>
<tr>
<td></td>
<td>• Take a lifelong view of value</td>
<td>• Streamlined work processes</td>
</tr>
<tr>
<td></td>
<td>• Provide incentives for mitigating risks</td>
<td></td>
</tr>
<tr>
<td>Governments</td>
<td>• Be prepared to lead, educate and make tough decisions necessary to enable health information exchange</td>
<td>• Healthier population</td>
</tr>
<tr>
<td></td>
<td>• Emphasize value, accountability and alignment of incentives in health policies, regulations and laws</td>
<td>• More competitive economy</td>
</tr>
<tr>
<td></td>
<td>• Demand cost and quality transparency</td>
<td>• Better balance between short- and longer-term needs</td>
</tr>
<tr>
<td>Regulators</td>
<td>• Facilitate realtime review of submissions and ongoing safety monitoring</td>
<td>• Faster review of submissions and ongoing monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Better reviews through analysis of cross-industry data</td>
</tr>
<tr>
<td>Diagnostics and device manufacturers</td>
<td>• Combine drugs with diagnostics to identify responsive patients</td>
<td>• Faster time-to-market through earlier access to R&amp;D data</td>
</tr>
<tr>
<td></td>
<td>• Combine drugs with delivery mechanisms to optimize compliance and persistence</td>
<td>• Better targeting and monitoring of patients</td>
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<tr>
<td></td>
<td></td>
<td>• Premium pricing for innovation</td>
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<tr>
<td>Medical distributors</td>
<td>• Provide an information-based service</td>
<td>• Higher service levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lower costs</td>
</tr>
<tr>
<td>Retail pharmacies</td>
<td>• Play a larger role in safety monitoring</td>
<td>• Higher profile among health professionals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Improved value proposition for patients</td>
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<tr>
<td>Telecom providers</td>
<td>• Enable realtime, reliable and confidential exchange of health data</td>
<td>• Improved utilization of existing infrastructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• New market opportunities</td>
</tr>
</tbody>
</table>

Source: IBM Institute for Business Value.
Moreover, some of the data only exist on paper, and even when they are available in electronic format, they are often extremely hard to integrate because the clinical and technical standards required to link different data types are still immature. It is then very difficult to build the large datasets that are required to perform statistically robust simulations and formulate new hypotheses.

The regulations governing clinical trial data management have compounded these difficulties. A growing number of hospitals and primary-care practices use EHR systems, for example, but the data cannot be used directly for clinical research because they are too variable and the systems themselves are not compliant with the rules governing clinical data management. Conversely, the electronic data capture (EDC) systems run by pharmaceutical companies have not been designed to meet the needs of doctors, and cannot in any case be used as the sole source of trial data because the regulations stipulate that it is the responsibility of the investigator, not the sponsor, to manage the source data.

All electronic records containing confidential information must also be protected by security features and a substantial body of legislation has emerged to this effect. The European Union Data Protection Directive and U.S. Health Insurance Portability and Accountability Act (HIPAA) lay down strict conditions for using, transmitting and storing personal data, and safeguarding the privacy of patients.

The conflicting interests of different stakeholders are yet another barrier. Researchers typically dislike sharing data because they want to make sure that they get recognized for their efforts, while pharmaceutical companies, healthcare payers and healthcare professionals often have quite different priorities.

Pharmaceutical companies want to launch innovative drugs that meet their commercial objectives, healthcare professionals to give their patients the best available treatments and healthcare payers to optimize their healthcare expenditure. However, it is only possible to create an integrated electronic environment if the various stakeholders trust each other, are working toward a common vision and understand each other’s agendas.

Yet the advantages of convergence are such that it is well worth overcoming all these problems. Typically, the costs of collecting and using data are lower, and the quality of the information that is produced is superior, in an interoperable environment than in one that is not. Interoperability reduces the need to collect the same data in multiple databases, facilitates the re-use of data gathered in previous studies, and enables the use of analytical techniques like modeling and simulation. It thus enhances the quality of the research that can be performed because that research is based on more robust data drawn from a wider range of sources and subjected to more thorough scrutiny (see sidebar, Filling in the puzzle.)

Filling in the puzzle
The Translational Genomics Research Institute (TGen) in Phoenix, Arizona, is studying the genetic variations and changes that translate into disease. It uses a supercomputer capable of performing two trillion calculations per second to aggregate and analyze enormous quantities of genomic and clinical data from many different sources. Thanks to this computing horsepower, it can model complex biological systems and answer questions that once took years in a matter of days.

Overcoming the obstacles to data consolidation will require investment, collaboration and commitment across both industries.
**Technical and cultural solutions**

In fact, the technologies required to aggregate and analyze different data types from disparate sources already exist. One of the most efficient ways of linking a wide range of systems and tools, for example, is to use a “hub-and-spoke” structure to integrate separate databases. The data from each database are stripped of any sensitive details, replicated to the “hub,” formatted using common data standards, amalgamated and categorized. A service-oriented architecture (SOA) can then be used to deliver an agreed set of “services” for accessing and reusing the data. This approach has two great advantages: it enables users to access data independently of the computing platforms on which the systems are running; and it gives them the flexibility to build the range of services they need around a single version of the data.

Similarly, trusted virtual domains (TVDs) can help provide a more secure computing environment, which is vital for protecting private data like patient records. TVDs are still in their infancy, but in essence they use virtualization and overlay technologies to form a protective wrapper around each of the computing entities used to perform a service, regardless of the particular hardware, software or network configuration involved (see Figure 4). This design is intended to confine accidental or malicious damage within one domain and prevent its spread to other applications, either internal or external. It also provides a way of identifying different computing entities, authenticating them and auditing communications among them.

**FIGURE 4.**
The architecture underlying trusted virtual domains.

![Diagram showing trusted virtual domains](source: IBM Research)
Various initiatives are likewise afoot to develop and promote open standards across the pharmaceutical and healthcare industries. The Clinical Data Interchange Standards Consortium (CDISC) has, for example, created standards for exchanging animal data, human data and clinical data, while Health Level Seven (HL7) is developing a number of standards for hospital data. The Biomedical Research Integrated Domain Group (BRIDG) has also developed an overarching semantic model for harmonizing different standards and bridging the gap between biomedical research and healthcare.

Finally, a growing number of pharmaceutical executives and healthcare professionals are starting to recognize the need for greater interoperability – and the changes required to support it (see sidebar, Spanish success). Most organizations will have to improve their informatics, modeling, simulation and networking skills, for example. They will probably have to hire information scientists, business intelligence analysts and relationship managers, as well as work with third-party information brokers. They will also have to promote a data-sharing culture and train their staff to use the data, since having access to more information is only valuable when people can ask the right questions of it.

Of course it is far more difficult to change an organization’s culture than it is to change the underlying technological infrastructure, but many chief executives now recognize that outside sources are as important as internal sources in generating innovation. The most innovative organizations systematically encourage their staff to build strong working relationships, both internal and external, with people at different hierarchical levels and in different areas of business; they provide knowledge management systems to facilitate the sharing of information; and they promote informal channels for supporting collaboration.

**Spanish success**
Servicio Extremeño de Salud (SES) provides public healthcare services to the one million inhabitants of the Extremadura region of Spain. When the Spanish healthcare system was reorganized in 2002, SES found it was ill-equipped to handle the increase in its workload. Each hospital and medical center had its own IT system and database of patient records, but none of the data could be accessed elsewhere. So SES set up an integrated health information management system that stores all medical and administrative data in a central location and supports all its business processes. The new system connects almost 13,000 professionals and can handle nine million outpatient visits a year. It has already reduced SES’s administrative costs, given it greater financial control and released staff to spend more time with patients.

**Interoperable initiatives on either side of the fence**
At present, however, most of the efforts pharmaceutical companies and healthcare providers are making to create more interoperable environments are taking place on either side of the fence. A few notable exceptions exist, one such instance being CHORUS – a database of information on more than 6,000 U.S. patients with HIV. CHORUS was set up in 1997 specifically to serve the needs of both healthcare practitioners and researchers, with data generated during regular medical care also recorded anonymously for research. Siemens Medical Solutions and the Technical University of Munich are currently piloting a system that builds on this concept by transferring clinical data gathered at the point of care for use in clinical trials.
But these are indeed exceptions, for the research component has played a very secondary role in driving most of the EHR initiatives that are now underway. The United States is currently exploring the options for developing a national health information network, for example, after President George W. Bush called for widespread adoption of EHRs by 2014. The Center for Information Technology Leadership estimates that such a network could deliver annual savings of US$77.8 billion, mainly as a result of reducing redundancies among different services and the resources required to support multiple systems in multiple locations.

Similarly, the European Union has stipulated that each member state must complete a draft plan for implementing EHRs by the end of 2006, and several countries are already well down the path to full digitization (see sidebar, Denmark goes digital).

Baltic eHealth’s goal is even loftier: namely, to create a transnational healthcare network spanning Denmark, Sweden, Norway, Estonia and Lithuania. It is currently testing the infrastructure with two pilot projects: an eRadiology project linking various medical facilities in Svendborg, Tallinn and Vilnius; and an eUltrasound project linking two hospitals in Umeå and Tørdheim.

But laudable though these initiatives are, they do not go far enough. It is the convergence of medical research, pharmaceutical R&D and healthcare provision that arguably offers some of the greatest opportunities for improving human health.

The scope for convergence
A study recently conducted by the IBM Institute for Business Value shows that the scope for convergence is considerable. We interviewed 27 people from a number of different disciplines within AstraZeneca, the Karolinska Institute and Karolinska University Hospital to ascertain a better understanding of the current situation, the benefits of greater data exchange among medical research, pharmaceutical R&D and healthcare provision, and the barriers to implementation.

The vast majority of respondents said that there is very little, if any, integration of clinical research and patient healthcare data today, but all agreed that it was essential. They identified a number of key drivers, including the need to do better research; save time, money and resources; and get data more rapidly (see Figure 5). “It is no longer possible to have small research groups,” noted one interviewee. “We need centers of excellence that collaborate and share expertise and equipment.”

Interoperability within each industry is already happening, but we believe that the most significant benefits will come as Pharma and healthcare converge.
Respondents identified a number of changes they believe will be required to support greater interoperability. Sixty percent specified the exchange and integration of data, while 50 percent thought that data standards were vital. Twenty-seven percent identified ethical and legal concerns, management commitment and greater collaboration as key issues.

All the respondents also thought that greater interoperability would bring some significant benefits to their respective organizations (see Figure 6). Forty-one percent thought that it would improve the quality of research and/or education; and 22 percent that it would result in better collaboration. Nineteen percent thought that it would accelerate access to
information, reduce the time required to complete analyses and increase the chances of success in drug development.

However, they acknowledged that there are still some important hurdles to overcome. The biggest areas of concern were legal and ethical issues, the IT changes that would be required, lack of resources, the need to maintain patient confidentiality and challenges involved in establishing an efficient business model and getting top management’s commitment (see Figure 7).

**A framework for transformation**

So how should pharmaceutical companies and healthcare providers go about converging to build a “patient-centric information chain?” The first point to note is that this is a huge paradigm shift, since it involves crossing all sorts of boundaries. So it will require the full commitment of all the stakeholders. They will have to create a shared governance structure, define their individual roles and the benefits they can expect, assess how ready they are and agree on a strategy for going forward (see Figure 8).

Once they have established a ground plan, the various stakeholders will need to initiate a comprehensive communications program to win internal and external support. They will also need to establish a code of conduct and fill any gaps in their skills. They will simultaneously have to evaluate the readiness of their enabling technologies, eliminate any technological redundancies and inconsistencies, and safeguard their data – using a trusted third party to help them, where necessary. Finally, they will have to measure their performance, for only by tracking their progress will they get where they want to go.

| FIGURE 7. | The barriers to interoperability. |
| (Percent of respondents/Number of respondents) |

- **Legal and ethical factors**: 32% (8)
- **Changing the IT system**: 28% (7)
- **Time/costs/qualified resources**: 28% (7)
- **Maintaining patient confidentiality**: 28% (7)
- **Setting up an efficient business model and getting leadership commitment**: 28% (7)
- **Putting in place common data standards**: 24% (6)
- **Linking the different databases**: 20% (5)
- **Competition**: 20% (5)
- **Identifying the strategy for change (government)**: 16% (4)
- **Building relationships/trust**: 16% (4)
- **Lack of understanding of importance of interoperability**: 12% (3)
- **Issues over who owns the data and intellectual property**: 12% (3)
- **Time to put in place changes**: 8% (2)

*Note: Sum of all percentages exceeds 100 percent because respondents gave multiple answers. n = 27.*

*Source: IBM Institute for Business Value.*
Conclusion
The advances of the past decade – advances in biomedical, clinical, behavioral and computational research – have generated more opportunities for improving human health than ever before. And this is the one goal that pharmaceutical companies, medical researchers, healthcare professionals and healthcare payers indisputably share. But the only way in which they will be able to realize that goal is by working more closely together – heretical though this idea may seem to some. It is the insights generated from the synthesis and analysis of data from numerous different disciplines that will enable the biopharmaceutical industry to develop better treatments and the medical establishment to deliver better care.

FIGURE 8.
The actions required for convergence.

Governance and strategy
- Implement shared governance across the organizations for business and technical requirements
- Agree role for individual organizations within the converged environment
- Define and put in place performance metrics
- Set scope and strategy and put in place finance arrangements

Organization and people
- Set up a stakeholder management plan
- Implement communication strategy for players in the interoperable environment and the outside world
- Develop a change management program to reinforce culture of shared values and trust
- Put in place code of conduct to maintain confidentiality
- Conduct a skills assessment and train/recruit to fill the gap
- Set up relationship with trusted third party

Technology/infrastructure
- Store all records electronically
- Set up trusted virtual domains
- Work with trusted third party
- Architect systems for efficient extraction of data
- Implement security-rich systems that maintain patient confidentiality
- Enter data only once and offer customized single point of access for users

Processes
- Adopt an eClinical environment
- Align complimentary business processes
- Implement flexible processes
- Use consistent data standards

Source: IBM Institute for Business Value.
About the authors
Heather Fraser is a pharmacist with over 20 years of industry experience and has held positions within R&D, consultancy and community pharmacy. She is currently the global leader for the Life Sciences/Pharmaceuticals team at the IBM Institute for Business Value. Heather has published a variety of articles on pharmaceutical industry issues in publications such as Pharmaceutical Technology, GCP Journal, PharmaFocus Asia, Biopartnering Today and Drug Discovery and Development. She has also spoken at a number of industry conferences, including the DIA Annual World Conference. Heather can be contacted at hfraser@uk.ibm.com.

Ed Mounib is a senior consultant in the IBM Institute for Business Value’s Healthcare team. In this role, he develops and presents original, analytically-driven thought leadership and techniques to enable clients to realize business value. Prior to joining IBM, Ed held various posts in the healthcare and pharmaceutical industries, including corporate strategy, product planning, market intelligence and marketing. Ed has an MBA and Master of Public Health in epidemiology, as well as a first degree in biology. He is a coauthor of the IBM Institute for Business Value’s recent publication, “Healthcare 2015: Win-win or Lose-lose?” Ed can be contacted at ed.mounib@us.ibm.com.

Sarah Payne worked in the pharmaceutical industry for 20 years before becoming a consultant. Her primary expertise lies in clinical development strategy, performance management and process improvement. She has also acted as a subject matter expert on health economics and health policy. Sarah has published widely on respiratory medicine and health economics, spoken at various conferences, trained government reimbursement agencies and lectured on health outcomes at St. Bartholomew’s Hospital, London. Sarah’s qualifications include an MSc in health economics and an MBA. She is currently the leader of the Value Infusion: Life Sciences/Pharmaceuticals team at the IBM Institute for Business and can be contacted at sarah.payne@uk.ibm.com.

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References
1 By convergence we mean the act of coming together and uniting in a common interest or focus at an organizational level.
5 IBM Institute for Business Value analysis of publicly available information; Important products withdrawn on grounds of safety include Rezulin, Propulsid and Lotronex (2000); Trovan, Raplon and Baycol (2001); Serzone (2003); Vioxx (2004); and Palladone, Bextra and Adderall (2005).
7 For further information on these five drivers, please see the IBM Institute for Business Value publication, “Healthcare 2015: Win-win or Lose-lose?” (October 2006). Available at http://www-935.ibm.com/services/us/index.wss/ibvstudy/gbs/a1025936?cntxtId=a1000056
8 Interoperability is one component of convergence. It is the result of an agreement between or among systems to share information. That agreement includes not only what information is to be shared, but also what standard or standards will be used to accomplish this sharing.

Research by IBM shows that chief executives believe business partners and customers are two of the three most significant sources of new ideas, shortly behind employees. For further information, please see “Expanding the Innovation Horizon: The Global CEO Study 2006” (March 2006). Available at http://www.ibm.com/bcs/ceostudy


Our survey sample includes seven staff from the Karolinska University Hospital; nine from the Karolinska Institute; and 11 from AstraZeneca. The survey was completed in September 2006.