



Advanced analytics fuel tomorrow's commercial strategy for drugs and devices

March 2019

Table of contents

The heart of the matter.....	2
Adoption of advanced analytics is beginning to transform the healthcare ecosystem	7
Lack of properly skilled talent among the biggest barriers to advancing analytics in pharma	10
High-quality data is needed to power high-quality analytics and insights.....	12
Recommendations	14
Conclusion.....	16
About this research.....	17
About the PwC network.....	17
About PwC's Health Research Institute.....	17
Endnotes.....	18
Acknowledgments.....	20

The heart of the matter

The pace of innovation and discovery now exceeds many companies' ability – across industries – to transform their go to market strategies and capabilities. Nowhere has this proven more true than in the pharma and life sciences industry where the pace of the healthcare marketplace is becoming increasingly dynamic, challenging the orientation of traditional commercial capabilities. Moving forward, pharmaceutical and life sciences companies that want to not only keep pace with the market, but predict future changes and market requirements will increasingly rely on advanced analytics to underpin their go to market strategies and commercial capabilities.

Advanced analytics in the pharmaceutical and life sciences industry – including tools such as artificial intelligence (AI), machine learning and data mining – has the potential to transform the commercial function. Process automation and data-driven, predictive insights, have the ability to dramatically change how executives make strategic decisions and manage financial performance across all commercial areas. While some organizations have begun to advance their analytic capabilities, the level of sophistication varies substantially from one company to the next. This variability is driven by challenges in moving a company culture to one that embraces advanced analytics, recruits and develops the right analytic talent, and invests to cultivate an integrated data environment to support advanced analytic methodologies and tools.

Companies at the higher levels of analytics maturity have identified a working model for analytics, and have succeeded in the race for talent, with support from a corporate culture that embraces data-driven insights and decision-making, and incentivizes workers to learn new skills. Assembling the right mix of technology, data, and skills can lead to stronger revenue growth and improved operational performance in the commercial function. For a single product, an advanced analytics capability could—depending on the type of product and lifecycle stage—deliver “at least a 10 percent net impact from a top- and bottom-line perspective,” said Sai Jasti, GlaxoSmithKline’s (GSK’s) chief data officer, US commercial pharmaceuticals, in an interview with PwC’s Health Research Institute (HRI).

Other industries, such as transportation, retail and consumer packaged goods, have demonstrated success in using advanced analytics to translate consumer preferences and behavior into top-line growth (see Figure 1). BMW, for example, uses predictive analytics to anticipate vehicle maintenance issues, warn drivers about those issues and communicate with third-party mechanics. Amazon has used advanced analytics to increase sales and profit margins, while decreasing delivery time and costs. Amazon's anticipatory shipping model, for example, uses big data to predict the products customers might purchase, when they may buy them and where on the website or app they are most likely to buy them.¹

Figure 1. Other industries have developed analytic solutions that can be deployed by pharmaceutical and life sciences companies

Industry/Company: Use of analytics	Challenge	How they use analytics	Benefits	Potential use in pharma / life sciences
Airlines/Delta: Uses predictive analytics to differentiate its operational performance	Ensure proper aircraft maintenance, on-time departures and quality control in order to improve customer experience and differentiate from other airline companies	Real-time performance monitoring to reduce mechanical issues resulting in flight delays or cancellations Providing passenger information to flight attendants en route Prioritizing engine problems and other faults through analysis of database of fault codes	Maintenance-related cancellations have dropped by 98% from 2010 to 2016 ² Flight attendants receive information about individual passengers to improve experience ³ Delta monitors more than 1,800 engines—from its own fleet as well as those for third-party customers	Creating a robust data environment for advanced analytics can provide the foundational elements necessary to apply machine learning methodologies to customer target selection, management and engagement
Entertainment/ Netflix: Uses analytics to determine which programs individual customers want to watch	Give customers a better experience and develop shows with the highest likelihood of success	Customer data helps Netflix determine which programs will be of interest to viewers A predictive recommendation system influences 80% of the content viewers watch on Netflix ⁴	Finding the next hit series (such as “House of Cards”) that will drive revenue growth Personalized video ranker Personalized video trending for customers based on viewing history	Using chatbots to engage patients or healthcare providers (HCPs) with customized content that is driven by an AI and a machine learning platform can anticipate patient or HCP needs and preferences over time, dramatically improving engagement and the customer experience

Automotive/BMW: Uses data and analytics to boost maintenance and improve customer service ⁵	Identify maintenance and performance issues before they arise	Predictive analytics help anticipate maintenance issues and communicate them to third-party mechanics	Alerts drivers to potential problems and shares information with mechanics, helping avoid accidents	Predictive analytics can streamline and automate sales and commercial processes, allowing for real-time assessment and strategic decision-making on a prescriptive basis, rather than a traditional descriptive assessment based on historic performance
	Reduce lead times and lower costs	Laser-marking body parts makes them traceable all the time	Lower number of scrapped parts and reduced downtime for fault analysis	
		Predictive maintenance for body shop robots, welding tools and driver systems	Reduce or avoid unplanned system downtime	
Retail/Walmart: Uses big-data analytics to get a real-time view of the workflow in the pharmacy, distribution centers and throughout physical stores and e-commerce ⁶	Enhance and customize the shopping experience to more effectively compete in the e-commerce space	Simulations enabled by big data help Walmart to optimize staffing at pharmacies and checkouts and across the stores	More efficient Walmart pharmacies	Advanced analytics deployed for resource management in the commercial function can proactively identify leading and lagging resource commitments. Access to real-time insights into operational efficiencies – and inefficiencies – would give executive decision-makers new tools for managing and improving the performance of the commercial function, optimizing sales, general and administrative (SGA) investment
		Advanced analytics help optimize distribution by tracking number of steps from the dock to the store, and the number of times an item is being touched during shipping	Improved store checkout	
		Identifies customer preferences and shopping patterns, segments customers, anticipates what customers may buy and when they might buy it	More effective management of supply chain	
			Optimized product assortment	
			Personalized shopping experience	
			Amazon's biggest competitor in e-commerce	

The pharmaceutical and life sciences industry and its peers across the healthcare value chain lag behind these industries, and face unique challenges in attracting the right talent, changing company culture to trust analytics-driven insights and building a data ecosystem that enables the use of new tools and technologies for decision-making, according to executives interviewed by HRI. To overcome challenges associated with the adoption of advanced analytics, a company should first understand the six components needed to create or mature advanced analytics capabilities (see Figure 2).

Figure 2: Six keys to building analytics maturity



Source: PwC

To achieve analytics maturity, pharmaceutical and life sciences companies should start by identifying the right model, which could be an internal, organic model, a hybrid model that leverages an external set of managed services, or a fully outsourced model. Regardless of which model is chosen, companies should also look to define the specific business areas that advanced analytics can address and set expectations for return on investment. Some organizations, for example, may have strong technology and infrastructure, but lack adequate business processes to integrate and optimize the use of analytics. Outside of the commercial function, biopharmaceutical companies are recognizing the need to develop an integrated R&D operations capability that consolidates data and information for better, more effective decision-making.⁷

Business leaders increasingly need data-driven business insights to succeed, across commercial functions.⁸ Real-time customer data in healthcare, however, can be elusive. Medical claims data, for example, may arrive months old, often in digital unfriendly formats, such as PDF. “It makes our job more challenging than tech firms that do business over the internet,” said Matt Aubin, vice president, business analytics and insights, at the biopharmaceutical company Avanir Pharmaceuticals / Otsuka Pharmaceutical Co., Ltd. “Business questions today may take months to answer,” Aubin told HRI. “When cloud-based platforms and tools are used, the speed to insight is significantly reduced, driving competitive advantage.”

Increasing the speed of insight generation to inform decision-making is critical, given the rapid pace of change in the healthcare market. The exponential increase in data creation and aggregation by healthcare stakeholders is putting new pressure on pharmaceutical and life sciences companies. For example, health insurers and pharmacy benefit managers (PBMs) are becoming more aggressive in reducing healthcare costs, using patient data and technology to restrict drug coverage.⁹ The Trump administration is also considering new policies that could bring downward pressure on prices and prescribing, such as including drug list prices in television ads, penalizing drug price increases in protected Medicare Part D drug classes and tying Medicare Part B drugs to international prices.¹⁰

Getting ahead of these changes, and new financial models such as value-based contracting or product subscription services, requires the rapid adoption of advanced analytics.¹¹ Companies that embrace the Fourth Industrial Revolution, which merges human talent with technological capabilities, can take advantage of cost-efficient, tech-powered alternatives to current processes, and recognize new opportunities to leverage data-driven insights for improved business performance.

Organizations that fall behind in the development of an advanced analytics capability risk being surpassed by competitors. HRI survey data and interviews with biopharmaceutical executives underscore the need for executive leadership to embrace analytics and a flexible, data-driven strategy that delivers fast access to insights. To get there, they will need the right skills, data environment and talent in order to transition from a static and reactive commercial strategy to a predictive and dynamic approach toward customer engagement and business management.

Adoption of advanced analytics is beginning to transform the healthcare ecosystem

Some drug and device companies have had early wins in deploying analytics to drive commercial excellence. At Novartis, the use of analytics for sales force effectiveness—a strategy that helps focus efforts on highly profitable customers—drove six years of continued growth by improving physician targeting and identifying “success principles” of top-performing sales force members.¹² At Roche, sales force effectiveness resulted in a market share increase of three percent in 18 months, aided by a supportive executive culture and increased focus on data and analytics.¹³ Although many pharma companies are establishing analytics centers of excellence and have achieved a varying degree of success with these technologies, the capabilities gap is still wide between pharma and organizations from other industries, such as Walmart or Netflix.

Other stakeholders in the healthcare system are capitalizing on the explosion of available patient data collected in electronic health records, a result of meaningful use requirements. Providers, payers and new entrants are ahead of the curve compared to traditional drug and device companies in the implementation of big data, machine learning and predictive analytics into their commercial strategy. In 2018, 87 percent of provider executives and 83 percent of health insurance executives said they currently use predictive analytics, or plan to in the next five years, according to a Society of Actuaries survey.¹⁴ Hospitals in France, for example, are actively using big data and machine-learning tools to predict admission rates, leading to a more efficient allocation of resources—in staffing among others—and improved patient outcomes.¹⁵

In the insurance sector, US-based Kaiser Permanente is using electronic medical records systems that can trigger warnings when a patient is due for a medical exam or send notifications when a prescription has been filled—an indication the patient is following doctor’s orders. Patients who received automated medication reminders refilled their prescriptions at a 14 percent higher rate than patients who did not receive the reminders.¹⁶

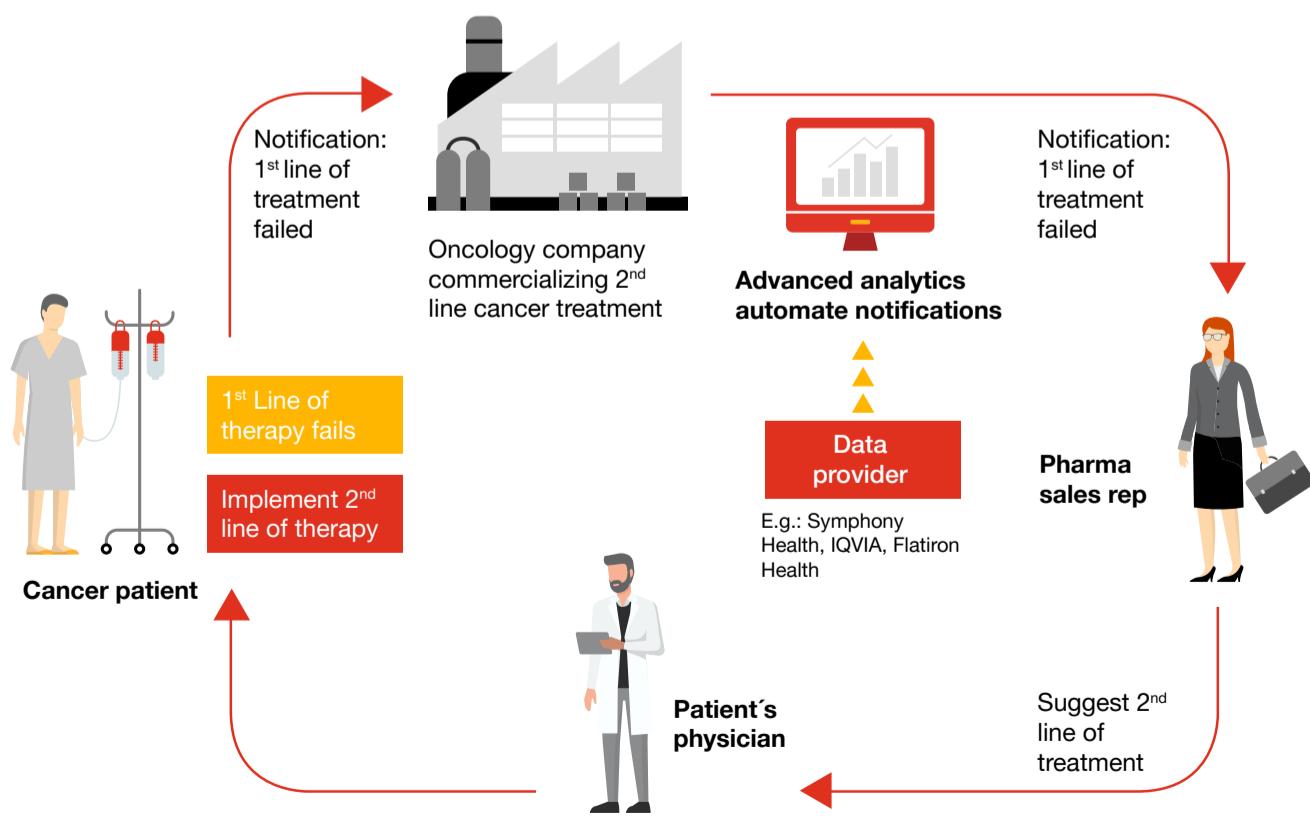
The time is right for drug and device companies to follow the lead of these organizations and adopt a data-driven commercial strategy to drive operational excellence and successfully compete in an environment defined by high-speed change. Adopting chatbots specific to the needs of core consumers is one way pharma companies can enhance the patient and physician experience. HealthTap, an interactive health company, developed a Facebook Messenger chatbot that allows patients to quickly find out what

they may be suffering from and how to treat it. If the chatbot cannot answer the question, consumers can submit it to more than 100,000 doctors globally with a guaranteed answer within 24 hours.¹⁷

Consider a hypothetical oncology company commercializing a second line of treatment that decides to offer a chatbot to answer questions of patients with a particular type of cancer. Over time, the oncology company can learn a lot about its consumers based on questions they ask. This information can feed into a machine-learning tool that segments patients based on the risk of failing a first line of therapy. Similar to the way Delta uses specific codes to anticipate engine issues, a database of questions or a sequence of questions can be established to identify these high-risk patients. Once patients with a high risk of failing a first line of treatment have been identified, nearby pharma sales representatives could receive a notification and start a conversation about a second line of treatment with a patient's physicians, even before the first line of treatment has failed.

Simultaneously, the oncology company also can partner with cancer hospitals, academic medical centers and other providers in this space, and use advanced analytics to automate notifications for patients at the time they fail the first line of treatment. If the company does not have a strong data-driven commercial model, a third-party data provider, such as IQVIA, Symphony Health or Flatiron Health, can be engaged to provide the clinical data needed for the analytics function (see Figure 3).

Figure 3: How an oncology company could use advanced analytics to boost commercial opportunities for a second-line treatment for cancer patients



Source: PwC Health Research Institute

To get to an advanced analytics commercial application, such as the oncology example described above, pharmaceutical and life sciences companies will need to make strides in each of the six analytics maturity areas. Strong data integration, quality and security is needed to surface the triggers that feed into an alert system. Technology and infrastructure is needed to connect appropriate commercial staff into the system. Company culture and the right people are needed to pivot away from legacy commercial strategies and processes. Governance and organizational structures will need to change, in order to support and facilitate new applications of advanced analytics, and to effectively monitor results.

Organizations that successfully improve analytics maturity will move closer to patients as well, by anticipating behaviors and hurdles to positive health outcomes. Analysis and insights gathered from real-world evidence, such as prescription fills and patient outcomes, combined with patient and physician profiles, can help to facilitate value-based contracts or subscription payments based on patient outcomes or financial performance.¹⁸ In an HRI survey, 82 percent of provider executives said they believe that data sharing with pharmaceutical companies will be important in the future.¹⁹

As new technologies, tools and data sets enter the analytics environment over time, drug and device makers learn more about what is happening in the market and why it's happening. The "why" is especially important—understanding unique customer behaviors leads to additional insights and a greater ability to predict which investment options will deliver the largest return. The effectiveness of this approach has been demonstrated by companies in other sectors. Pharmaceutical and life sciences companies, however, must overcome challenges with sourcing talent and skills, as well as creating a culture and data environment that facilitates advanced analytics and fast access to insights.

Lack of properly skilled talent among the biggest barriers to advancing analytics in pharma

Over the past three years, pharmaceutical executives surveyed by HRI consistently identified the lack of properly skilled talent as the largest existing impediment to advancing analytics in the pharma industry. In PwC's 2018 Global CEO survey, 38 percent of executive respondents said they're extremely concerned that a lack of key skills could pose a threat to business growth, and another 38 percent said they were extremely concerned about the speed of technological change.²⁰

Some companies such as GSK are developing internal career paths and focusing on upskilling their own talent to advance analytics capabilities. "Talent acquisition is actually less of a challenge than getting the right talent interested, and keeping them engaged in working for a pharmaceutical company," said Jasti at GSK.

Vipin Gopal, chief data and analytics officer at Eli Lilly and Company, said talent with deep experience in new technologies, such as AI and machine learning, can apply their skillset in many industry verticals. Arguably, such talent is in scarce supply compared with specific industry knowledge and expertise. "From a problem solving perspective, I believe it's easier to teach the healthcare domain to an expert in AI or machine learning, instead of the other way around," said Gopal. A recent PwC survey of US consumers found that 75 percent of US workers are willing to learn new skills or completely retrain in order to remain employable.²¹

Some of the leading pharmaceutical companies have hired chief information officers or chief data officers from other industries. Sanofi hired its chief information officer from Coca-Cola, while GSK staffed the same position from Walmart. A majority of pharmaceutical companies, however, filled those positions internally. Despite this relatively new executive role in pharmaceutical and life sciences—and the hiring of executives who bring experience from other industries—a lack of bench talent and the depth needed to support an advanced analytics function remains a primary challenge.

Aubin at Avanir/Otsuka underscored the need for analytics experts to address specific business issues. "What we need are people that understand the business, and can translate analytics into actionable insights that can be recommended to decision-makers in the C-suite, or leaders in brand teams or market access groups," said Aubin. "Data and advanced analytics must be able to identify meaningful opportunities, and also business problems and how to solve them."

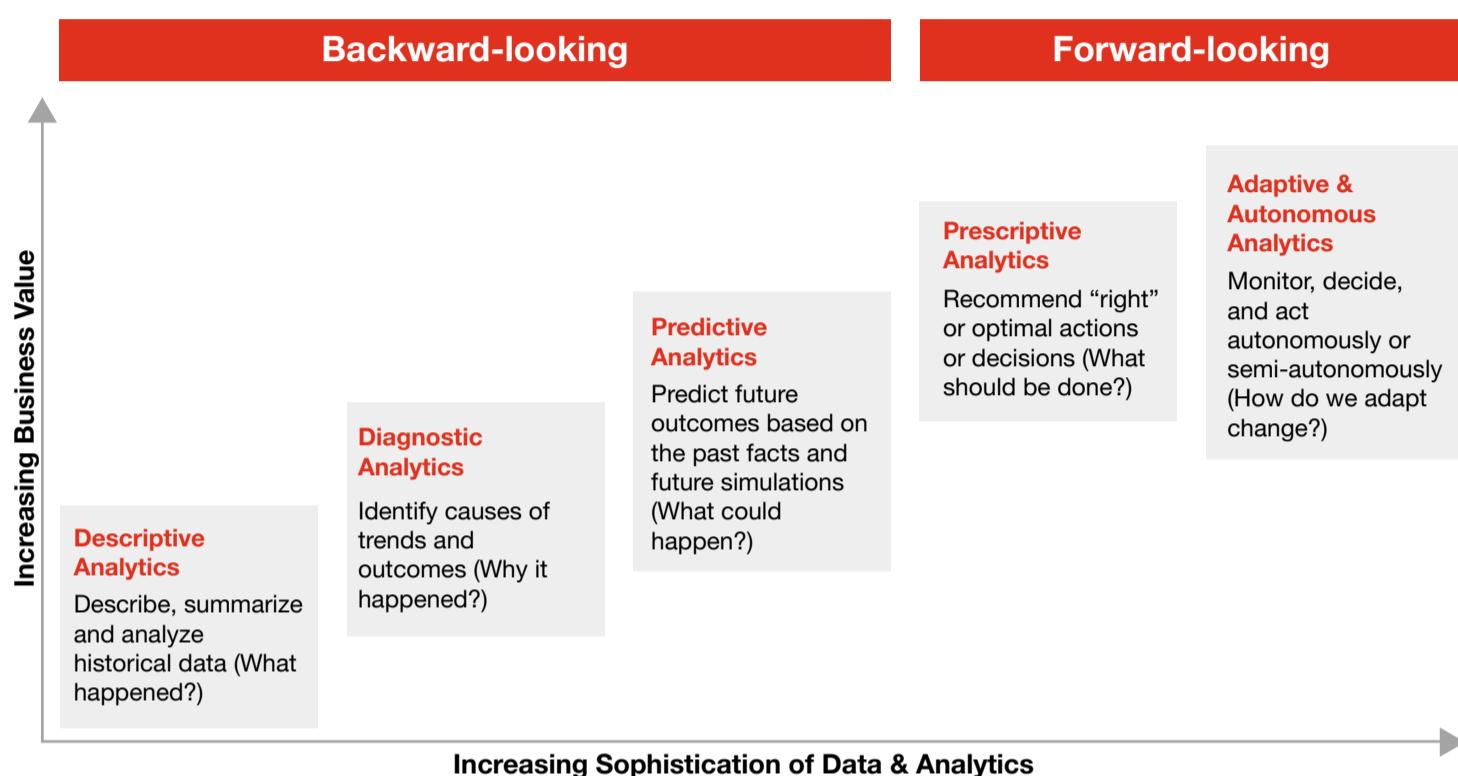
High-quality data is needed to power high-quality analytics and insights

Drug and device companies that want to maximize the value of their data assets with analytics must have access to high-quality data, such as physician data that can be integrated seamlessly with tools (like chatbots) used by sales forces and marketing executives. The first step toward building an advanced analytics capability is to integrate data assets already available in different corners of the commercial function. Combining syndicated market research with specialty pharmacy data in a single data environment helped lead biopharmaceutical company Eisai Co., Ltd. to new insights and improve the value of the data sets, Leo Adams, Eisai's director of commercial analytics, told HRI. "Bringing that data together has been extraordinarily helpful in understanding what the data can really do—for example, tracking patients and the duration of therapy over time," said Adams.

Companies also need to understand the end customer—the patient—on a deeper level. "I think the journey for the healthcare ecosystem toward digital solutions is going to help to bring the industry closer to the patient," said Gopal. "You can look at claims, or other limited data that is accessible from an individual perspective, but that only tells us a small part of the patient story." A digital solution used by a patient, said Gopal, tells a much deeper story about patterns of medication use and lifestyle choices, which in turn can help to create new personalized solutions for that patient. However, access to high-quality, patient-level data is limited for most companies, due in part to privacy laws and indirect access to patients. Thirty-three percent of pharmaceutical executives surveyed by HRI said the use of electronic health records by providers has had a positive effect on their businesses.²²

Differing product portfolios, corporate cultures and experiences with data integration and governance have led to divergent capabilities across the pharmaceutical and life sciences industries. Much like the differences in advanced analytics maturity, some organizations have gone further than others in creating a robust data environment capable of generating predictive insights and real-time reporting. While many pharmaceutical companies have access to market volume data (e.g., prescription claims data), specialty pharmacy data, market research, sales force data (e.g., customer details, product sampling), qualitative physician surveys and advertising data collected from media agencies, these data sets are often not fully integrated. That lack of integration inhibits the use of advanced analytics to generate predictive, prescriptive or cognitive analytic insights (see Figure 4).

Figure 4: Pharmaceutical and life sciences companies need high-quality data to fuel advanced, forward-looking analytics



Source: PwC

At GSK, Jasti is focused on integrating internal data and other purchased, third-party data sets from companies such as IQVIA and Symphony Health, and identifying the remaining customer data gaps. Bridging those gaps in physician behavior and the patient journey is where the biggest opportunities exist, said Jasti. Enormous amounts of data are being generated throughout the healthcare ecosystem—in electronic health records, by insurers and PBMs, and by patients themselves—but no single stakeholder has the complete picture.²³

Data sharing between healthcare sectors also can improve the customer relationship between drugmakers and health systems. Pharmaceutical companies such as Takeda and Amgen are investing in patient data collection and analytic services to improve interactions between physicians and patients, with the ultimate goal of improving outcomes.²⁴ As data becomes more accessible across the healthcare ecosystem, commercial analytics will become a critical tool for generating business insights and predicting market change. But the insights will only be as good as the data feeding into the analytics system.

Recommendations

Our research and interviews with industry executives have elucidated four core actions that companies should take to succeed in a rapidly shifting healthcare marketplace, by creating an advanced analytics capability that can maximize commercial resources for revenue growth and operational efficiency:



Explore and aggregate currently accessible data sources.

Siloed data continues to prevent pharmaceutical and life sciences companies from extracting the maximum amount of value from data. “As an industry, broad visibility into what data we have is limited, and even when we know what we have, accessing it isn’t always easy,” said Lilly’s Gopal. Thirty-five percent of the skills workers will need will change by 2020, and the required skills will continue to evolve, according to the World Economic Forum.²⁵ Drug and device companies should introduce digital and analytic training programs to current employees to increase workforce digital IQ.



Adopt analytics and technologies used in other industries.

The collection and use of consumer data has dramatically improved revenue growth in other industry sectors. Drug and device makers should consider bringing in new talent with experience using technology, data and analytics to generate insights. Organizations should also evaluate new technologies in the context of specific business problems to get the most out of investments. Executives interviewed by HRI suggested that advanced analytics could improve their organizations’ financial performance by 10 percent or more. Focusing on specific business issues and sourcing the technologies and talent that can address those issues will help pharmaceutical and life sciences companies move toward the broader adoption of advanced analytics at an enterprise level.



Find a partner to overcome challenges associated with cost, time and talent. While many of the largest pharmaceutical companies have organically grown their advanced analytics function over time, midtier and smaller manufacturers need to catch up quickly in order to compete. A hybrid or fully outsourced model for analytics may help these organizations catch up with, or leapfrog, their competitors. Organizations should evaluate the pros and cons of each model type according to individual needs and experience (see Figure 5).

Figure 5: Three primary models can help pharmaceutical and life sciences companies create an advanced analytics capability.

Commercial Analytics			
Model type	Description	Advantages	Disadvantages
In-house	<p>Building data and analytics capabilities internally from ground zero</p>	<p>Develop a company culture around data-driven commercial strategy</p> <p>Brings digital and analytic skills in-house over time</p> <p>Control over costs in the long run</p> <p>Opportunity for talent training and career path opportunities</p>	<p>Requires a lot of upfront investment, including:</p> <ul style="list-style-type: none"> ■ Qualified talent hiring, from leadership to bench support ■ State-of-the-art technology <p>Slow start-up time</p> <p>Lack of flexibility: Resources, technology and other assets are more difficult to remove or replace</p>
Hybrid	<p>Partnering with a third-party organization to outsource some of the analytics</p> <p>Continue leveraging own strengths and capabilities where appropriate</p>	<p>Leverage internal strengths and capabilities</p> <p>Skilled talent readily available where needed</p> <p>Better management of advanced analytics from the start</p> <p>Flexibility: resources not needed can be easily discarded or reallocated</p>	<p>Dependent on third-party organization</p> <p>Less control over costs of outsourced analytical capabilities</p> <p>Loss of expertise or lack of development of expertise in outsourced analytical capabilities</p>
Outsourced	<p>Partnering with a third-party organization to outsource the whole spectrum of analytics</p>	<p>Financial benefits: free cash flow to invest in other areas; report as expense on the balance sheet</p> <p>Properly skilled talent immediately available</p> <p>State-of-the art technology available immediately</p>	<p>Fully dependent on the third- party organization for analytics and insights</p> <p>Lack of internal talent development and workforce upskilling</p> <p>Need to closely manage service agreement and alignment with internal objectives</p>

Identify ways to augment traditional marketing and sales processes with analytics.

Advanced analytics may not be able to replace traditional sales forces—yet—but it can enhance the sales function by improving physician targeting, speeding up sales and marketing reporting and decision-making, and creating better customer experiences. For companies with consumer or established product portfolios, analytics can save money and increase sales by maximizing the reach and effectiveness of sales forces, or by customizing and automating content and outreach to individual customers searching online for healthcare products.

Conclusion

Creating an advanced analytics capability for faster decision-making, improved physician targeting and customer engagement, and ultimately, a stronger financial performance will be crucial to future success. Pharmaceutical and life sciences companies should put processes in place to promote and incentivize digital upskilling in the workforce, source the right talent and create a culture that supports—and trusts—data-driven insights for decision-making across the commercial organization. Companies that cling to traditional decision-making processes and static commercial strategies risk being left behind.



About this research

PwC's Health Research Institute conducted interviews with industry executives working in commercial roles at pharmaceutical companies and analyzed PwC data, including 2018 surveys of 500 provider executives, 1,293 global CEOs, 141 pharmaceutical and life sciences executives (Digital IQ survey) and 1,500 US consumers. HRI also reviewed insights and case examples from industries beyond healthcare.

About the PwC network

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 158 countries with over 250,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com

About PwC's Health Research Institute

PwC's HRI provides new intelligence, perspectives and analysis on trends affecting all health-related industries. HRI helps executive decision-makers navigate change through primary research and collaborative exchange. Our views are shaped by a network of professionals with executive and day-to-day experience in the health industry. HRI research is independent and not sponsored by businesses, government or other institutions.

Endnotes

- 1 Christine Mitchell, "Amazon patents 'anticipatory shipping' of items their data says you'll buy," Harvard Business School, April 11, 2015, <https://www.hbs.edu/openforum/openforum.hbs.org/goto/challenge/understand-digital-transformation-of-business/amazon-patents-anticipatory-shipping-of-items-their-data-says-you-ll-buy/comments-section.html>.
- 2 Lee Ann Shay, "Delta's predictive analytics drives on-time performance improvements," MRO Network, Oct. 27, 2017, <https://www.mro-network.com/airlines/delta-s-predictive-analytics-drives-time-performance-improvements>.
- 3 Delta, "Delta leverages 'big data' to drive thoughtful customer service in sky," May 18, 2017, <https://news.delta.com/delta-leverages-big-data-drive-thoughtful-customer-service-sky>.
- 4 Inside Big Data, "How Netflix uses big data to drive success," Jan. 20, 2018, <https://insidebigdata.com/2018/01/20/netflix-uses-big-data-drive-success/>.
- 5 BMW press release, "Smart Data Analytics: BMW Group relies on intelligent use of production data for efficient processes and premium quality," Aug. 31, 2017, <https://www.press.bmwgroup.com/global/article/detail/T0273931EN/smart-data-analytics:-bmw-group-relies-on-intelligent-use-of-production-data-for-efficient-processes-and-premium-quality?language=en>.
- 6 Walmart, "Five ways Walmart uses big data to help customers," Aug. 7, 2017, <https://blog.walmart.com/innovation/20170807/5-ways-walmart-uses-big-data-to-help-customers>.
- 7 PwC, "A recipe for success: Creating an information advantage through a sustainable R&D operations ecosystem," January 2019, <https://www.pwc.com/us/en/industries/health-services/pdf/pwc-pls-r-d-operations-ecosystem.pdf>.
- 8 FDA, "Novel drug approvals for 2018," accessed Dec. 7, 2018, <https://www.fda.gov/Drugs/DevelopmentApprovalProcess/DrugInnovation/ucm592464.htm>.
- 9 Optum, "Data and AI transform pharmacy care services," accessed Dec. 19, 2018, <https://www.optum.com/resources/library/data-and-ai.html?s=Transforming%20Power%20AI>.
- 10 PwC Health Research Institute, "Trump administration proposes changing Medicare Part B drug reimbursement," Nov. 2, 2018, <https://www.pwc.com/us/en/industries/health-industries/library/administration-proposes-changing-part-b-11-2-18.html>.
- 11 PwC Health Research Institute, "Launching into value: Pharma's quest to align drug prices with outcomes," September 2017, <https://www.pwc.com/us/en/industries/health-industries/library/value-based-drug-pricing.html>.
- 12 Linda Banks, "How to drive commercial excellence through analytics: Lessons from two leading pharmacos," Pharmaphorum, Jan. 6, 2015, <https://pharmaphorum.com/views-and-analysis/how-to-drive-commercial-excellence-through-analytics-lessons-from-two-leading-pharmacos/>.
- 13 Banks, Linda, "How to drive commercial excellence through analytics: lessons from two leading pharmacos," Pharmaphorum, January 6, 2015, <https://pharmaphorum.com/views-and-analysis/how-to-drive-commercial-excellence-through-analytics-lessons-from-two-leading-pharmacos/>.
- 14 Society of Actuaries, "2018 Predictive Analytics in Healthcare Trend Forecast," September 2018, <https://www.soa.org/about/2018-pa-health-care-trends.pdf>.
- 15 Bernard Marr, "Big data in healthcare: Paris hospitals predict admission rates using machine learning," Forbes, Dec. 13, 2016, <https://www.forbes.com/sites/bernardmarr/2016/12/13/big-data-in-healthcare-paris-hospitals-predict-admission-rates-using-machine-learning/#1f7e786779a2>.
- 16 Rena Brar Prayaga, Erwin Jeong, et al., "Improving refill adherence in Medicare patients with tailored and interactive mobile text messaging: Pilot study," JMIR Mhealth Uhealth, Jan. 30, 2018, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5811648/>.
- 17 Adita Pai, "HealthTap creates chatbot for Facebook's Messenger app," MobiHealthNews, April 14, 2016, <https://www.mobihealthnews.com/content/healthtap-creates-chat-bot-facebooks-messenger-app>.

- 18 PwC Health Research Institute, "Launching into value: Pharma's quest to align drug prices with outcomes," September 2017, <https://www.pwc.com/us/en/industries/health-industries/library/value-based-drug-pricing.html>.
- 19 PwC Health Research Institute, "Top health industry issues of 2018," December 2017, <https://www.pwc.com/us/en/industries/health-industries/top-health-industry-issues/real-world-evidence.html>.
- 20 PwC 2018 Global CEO Survey, "The Anxious Optimist in the Corner Office," <https://www.pwc.com/mx/es/publicaciones/c2g/2018-01-22-global-ceo-survey-2018.pdf>.
- 21 PwC, "Workforce of the future: The views of 10,000 workers," (Q – To what extent do you agree that 'I am ready to learn new skills or to completely retrain in order to remain employable in the future?'), 2017, <https://www.pwc.com/gx/en/services/people-organisation/workforce-of-the-future/workforce-of-future-appendix.pdf>.
- 22 PwC Health Research Institute, pharmaceutical executive survey, July 2017, <https://www.pwc.com/us/en/health-industries/health-research-institute/publications/assets/value-based-drug-pricing.pdf>.
- 23 PwC Health Research Institute, "Customer experience in the New Health Economy: The data cure," February 2018, <https://www.pwc.com/us/en/industries/health-industries/health-research-institute/customer-experience.html>.
- 24 PwC Health Research Institute, "Making collaborations work: Pharma companies invest in new relationships with health systems," November 2016, <https://www.pwc.com/us/en/industries/health-industries/library/making-collaborations-work.html>.
- 25 World Economic Forum, "Skill, re-skill and re-skill again. How to keep up with the future of work," July 31, 2017, <https://www.weforum.org/agenda/2017/07/skill-reskill-prepare-for-future-of-work/>.

Acknowledgments

Matthew Aubin

Vice President, Business Analytics and Insights
Avanir Pharmaceuticals /
Otsuka Pharmaceutical Co., Ltd.

Vipin Gopal

Chief Data and Analytics Officer
Eli Lilly and Company

Sai Jasti

Chief Data Officer
GlaxoSmithKline

Leo Adams

Director of Commercial Analytics

PwC Health Research Institute

Kelly Barnes

Partner
US Health Industries and Global Health Industries Consulting Leader
kelly.a.barnes@pwc.com

Benjamin Isgur

Health Research Institute Leader
benjamin.isgur@pwc.com

Sarah Haflett

Director
sarah.e.haflett@pwc.com

Trine Tsouderos

Director
trine.k.tsouderos@pwc.com

Ben Comer

Senior Manager
benjamin.comer@pwc.com

Alexander Gaffney

Senior Manager
alexander.r.gaffney@pwc.com

Jason Ranville

Senior Manager
jason.ranville@pwc.com

Ingrid Stiver

Senior Manager
ingrid.stiver@pwc.com

Kate Hanlon

Manager
hanlon.kate@pwc.com

Andrew Drelick

Senior Associate
andrew.drelick@pwc.com

Krutika Hosur

Senior Associate
krutika.hosur@pwc.com

HRI Report Advisory Team

Josh Pagliaro

Partner

Christian Bowers

Partner

Greg Rotz

Partner

Aklilu Tedla

Director

Rohit Aggarwal

Director

Other contributors

Lesley Bakker

Meredith Berger

Laura Dally

Jamie Mumford

Nicole Ulrick

Colleen Donato

Christopher Tepler

Gabriela Franca

**To have deeper conversations about
how this subject may affect your
business, please contact:**

Kelly Barnes

Partner, US Health Industries and Global Health
Industries Consulting Leader
kelly.a.barnes@pwc.com
214 754 5172

Karen Young

Partner, US Pharmaceutical and Life Sciences Leader
karen.c.young@pwc.com
973 236 5648

Doug Strang

Global Pharmaceutical & Life Sciences Advisory
Leader
dstrang@pwc.com
215 840 5548

Benjamin Isgur

Health Research Institute Leader
benjamin.isgur@pwc.com
214 754 5091

pwc.com/hri

pwc.com/us/en/industries/pharma-life-sciences.html

This publication has been prepared for general guidance on matters of interest only, and does not constitute professional advice. You should not act upon the information contained in this publication without obtaining specific professional advice. No representation or warranty (express or implied) is given as to the accuracy or completeness of the information contained in this publication, and, to the extent permitted by law, PricewaterhouseCoopers LLP, its members, employees and agents do not accept or assume any liability, responsibility or duty of care for any consequences of you or anyone else acting, or refraining to act, in reliance on the information contained in this publication or for any decision based on it.