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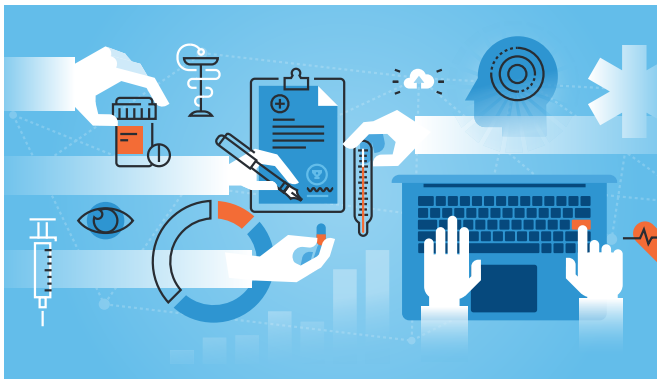
SMAC: Better together

Improving health care efficiency with social, mobile, analytics, and cloud technologies

Executive summary

Social, mobile, analytics, and cloud (SMAC) technologies hold great potential to help health care organizations reduce costs, streamline inefficiencies, improve quality, and demonstrate value. Experience with SMAC in industries such as entertainment, consumer goods, and banking shows that while each of these technologies can generate benefits independently, they are even better together — joint application can improve business processes dramatically. In health care, this may translate to increased efficiency and lower costs.



A 2014 survey of health information technology (IT) leaders found that the US health systems could in aggregate save a total of $23.4 billion in 2016 by implementing SMAC (11 percent of the savings from social media, 16 percent from mobile, 21 percent from analytics, and 20 percent from cloud).[1]

To better understand the opportunities and challenges of using SMAC in health care, Deloitte spoke to industry experts and conducted secondary research. We identified four operational areas where SMAC technologies, singly or collectively, could be impactful.

- **Next-generation supply chain:** After deploying radio frequency identification (RFID) tags to track medical and surgical supplies, 240-bed Concord Hospital in New Hampshire was able to reduce its inventory by 13 percent, with the largest decreases occurring in some of its most expensive departments: surgery, intensive care unit (ICU), and emergency.
- **Research and development (R&D):** Pfizer leverages analytics to tailor treatments for specific patient populations. The company developed and launched the lung cancer drug Xalkori for a five-to-seven percent patient subset which has the ALK gene mutation and received US Food and Drug Administration (FDA) approval based on clinical trials on only 255 patients. The total time from discovery to approval took three years, less than half the typical timeframe.
- **Care coordination:** Washington State Medicaid enrolled its beneficiaries in a program that used a predictive modeling algorithm to determine who would benefit from a chronic care management program; this saved over $300 per member per month.
- **Digital health care payments:** Annual savings from SMAC-based digital health care payments solutions could be as high as $8 billion for the overall health care industry. As examples, one health system saved 25 percent in administrative costs by investing in digital health care payments, and a physician office reduced its time spent on claims submission and patient payment processing by 88 percent, from several hours per day to mere minutes.

Introduction

Despite experts' agreement about the value of using social, mobile, analytics, and cloud technologies (Figure 1), the health care industry lags behind others in digital technology adoption (Figure 2). In the 2015 MIT Sloan Management Review and Deloitte global study of digital business, the three industries with the most mature adoption of digital technologies — including SMAC — are IT and Technology, Telecommunications/Communications, and Entertainment, Media, and Publishing. Health care services (which includes life sciences, health systems, and health plans), while not the lowest adopter, is not ranked among the top 10 most digitally mature industries.

To demonstrate how health care and life sciences companies could deploy and leverage SMAC, we identified four operational areas, based on input from industry experts and secondary research, where SMAC may help improve business process efficiency. Although investment in SMAC in other areas may also lead to benefits, these four areas provided great evidence for cost savings:

- Next-generation supply chain
- Research and development
- Care coordination
- Digital health care payments.

Figure 1. The collective power of SMAC technologies

Using SMAC technologies to optimize business performance through IT can help organizations draw valuable business insights.[2,3]

Social

Data is created, collected, and shared at the consumer or end-user level. 2.4 billion people are estimated to be active over social media by 2018, generating immense information every minute.

Mobile

The shift to mobile devices (e.g., smartphones and tablets) plays an important role as more social media users are accessing their accounts through mobile platforms. Globally, mobile data traffic will grow 8-fold to reach 30.6 exabytes per month by 2020 with over 9 billion mobile phone users.

Analytics

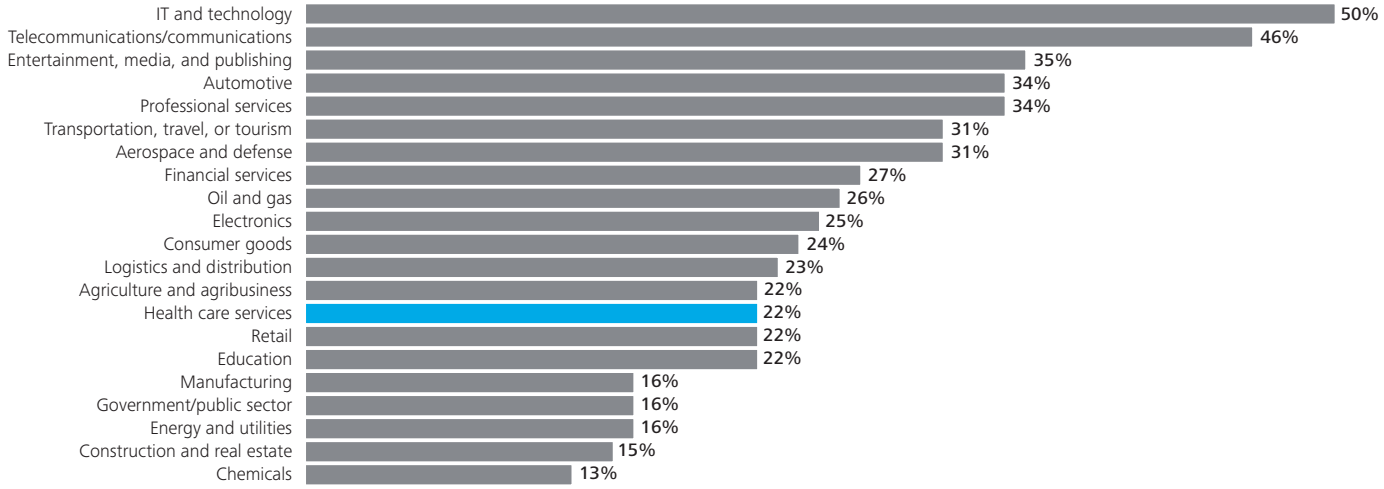
Organizations are turning to analytics to understand and mine their growing volumes of data. IDC estimated that the business analytics market will grow at a rate of 9.4% CAGR through 2018.

Cloud

An organization's data can be stored virtually through the cloud, allowing users to access and analyze the information from anywhere. Cisco says that by 2018, 78% of all workloads will be processed by cloud data centers.

Source: Statista, IDC, Cisco

Figure 2: Percentage by industry that claim their company is "digitally maturing"



Source: 2015 MIT Sloan Management Review and Deloitte Digital Global Executive Study and Research Project and Deloitte analysis.

MIT Sloan Management Review, in collaboration with Deloitte, conducted an annual survey of more than 4,800 business executives, managers, and analysts from organizations around the world. To assess companies' digital maturity, respondents were asked to rate their company against an ideal organization — one transformed by digital technologies and capabilities — on a scale of 1 to 10. Three groups emerged: "early" (1–3), "developing" (4–6) and "maturing" (7–10). The percentages of responses categorized as "maturing" are shown.

SMAC in practice: Generating health care value through capture, dissemination, application, and storage

Social: Capture
Social media is changing the way that stakeholders perceive and experience health care, as well as capture information from the marketplace. Having a presence on social media, including health care-specific sites like PatientsLikeMe could generate substantial insights on patient experiences and preferences.

Mobile: Dissemination
Mobile health (mHealth) could be used to capture data and disseminate health information to end users. According to Deloitte's 2014 survey of US Physicians, 90 percent of respondents are interested in mHealth technology and its clinical value, and 38 percent regard monitoring patients' conditions and adherence as a potential benefit of mHealth.[4]

Analytics: Application
Building a database of clinical and administrative information can help health care organizations generate targeted insights and increase the speed and efficiency of decision-making processes, both prospectively and retrospectively. Similarly, using analytics can help organizations determine which treatments have the highest success rate, which medications are most cost-effective, and which patients need additional resources and support; and provide real-time clinical decision support for individual patients and patient populations.

Cloud: Storage
As the availability of social and mobile data increases, cloud storage and computing capabilities can enable health care organizations to access highly customizable, flexible, and scalable IT-based resources and services on demand through the Internet. Many health systems are moving towards off-premise application capabilities to help reduce cost, focus on mission-critical activities, and promote continued enhancements to core clinical systems.

Next-generation supply chain

When drug shortages and counterfeit scares occur, or misplaced equipment cannot be found during a medical emergency, the health care and life sciences supply chain quickly becomes top of mind. By leveraging mobile, analytics, and cloud technologies, health care providers and drug and device manufacturers can make their supply chains more data-driven, secure, and efficient. In addition, employing SMAC technologies can help organizations meet regulatory requirements such as the Drug Supply Chain Security Act, which requires manufacturers, re-packagers, wholesale distributers, and dispensers to provide product identification, tracing, and verification of prescription drugs as they are distributed in the United States.

Mobile devices can help life sciences manufacturers track the location and storage conditions (e.g., temperature) of equipment and products, increase visibility of source ingredients and materials, and provide real-time insight into manufacturing floor activity.[5] Analytics can improve manufacturing processes through increased transparency and predictive maintenance; and distribution and logistics by, for instance, detecting problems earlier.[6] Finally, cloud computing can enable track-and-trace systems that require processing large amounts of data in real time.[7]

SMAC in practice: Johnson & Johnson

With hundreds of products in over 60 countries and more than 130 manufacturing plants, supply chain efficiency is a big concern for Johnson & Johnson (J&J).[8] J&J uses SMAC to achieve "better, faster, cheaper" results by leveraging social media to communicate with the public and proactively address complaints; running real-time analytics feeds on its manufacturing lines to measure quality and efficiency; and using cloud computing to increase storage capacity while reducing the number of servers it must maintain.[9]

Health systems spend 30 to 40 percent of their operating budget on supply chain-related expenses,[10] and could benefit by using SMAC to optimize their supply chain processes. For instance, RFID tags and similar location-based tracking technologies could help health systems better track medical supplies and medication dosages, thereby lowering costs via increased asset utilization, reduced errors, and improved patient safety.[11]

SMAC in practice: Texas Health Harris Methodist Hospital Alliance

Texas Health uses RFID tags to track high-value assets like medical equipment, lower-value items like pillows, and even patients. RFID tags help save time by allowing nurses to determine if a piece of medical equipment is being used, cleaned, or available, and to locate needed equipment quickly. Texas Health also uses RFID to determine if patients or staff come into contact with serious, contagious infections.[12,13]

By leveraging mobile, analytics, and cloud technologies, health care providers and drug and device manufacturers can make their supply chains more data-driven, secure, and efficient.

Potential returns from implementing SMAC to improve supply chain efficiencies are considerable. Literature on the topic provides evidence of substantial savings in many use cases, including manufacturing improvements and inventory management. As described below, the monetized savings alone in these use cases range from $65,000 per month to hundreds of millions of dollars. When less-quantifiable efficiency improvements, such as reducing errors, are taken into account, total SMAC-related savings may be even greater:

- **Manufacturing improvements:** After trying to increase low vaccine yields which were costing the company hundreds of millions of dollars in lost revenue from discarded vaccines, Merck turned to a cloud-based analytics solution that allowed its scientists to perform 15 billion calculations and 5.5 million batch-to-batch comparisons. Within three months, the company pinpointed and fixed an issue in the fermentation process of its vaccine production.[14]
- **Inventory management:** After deploying RFID tags to track medical and surgical supplies, Concord Hospital reduced its inventory by 13 percent, with the largest decreases occurring in some of its most expensive departments: surgery, ICU, and emergency.[15] Similarly, Sisters of Mercy Health System reduced its inventory by 38 percent after using RFID, consolidated the number of vendors it uses, and negotiated more favorable vendor prices through its increased bargaining power.[16]
- **Crash carts:** Health systems such as the University of Maryland Medical Center (UMMC) deploy RFID to ensure that crash carts (carts storing medication and equipment for patients experiencing a life-threatening event) are appropriately stocked, which reduces errors and saves time. While the error rate using manual checks is one in 20 times, the error rate using RFID at UMMC is one in 4,000.[17] In addition, the process of inventorying crash carts is up to 10 times faster with RFID. At the University of Michigan Medical Center, using RFID to track crash carts achieved positive returns on investment within three months of implementation.[18]
- **Rental costs:** By using RFID to track rental equipment that was no longer needed, Texas Health was able to reduce its equipment rental costs by $65,000 per month.[19]

R&D

Life sciences industry R&D generates large volumes of data from diverse sources including pre-clinical and clinical trials, drug approval processes, production, marketing, and post-sales. The lack of standardization across functions and datasets often hampers research collaboration and increases data collection and analysis costs. Leveraging a cloud-based analytics platform may enable improved data standardization — Roche, for instance, uses a pre-clinical software as a service solution to consolidate several key application areas and harmonize its sites worldwide.[20]

Deploying a SMAC solution also may improve collaboration among researchers, thus helping to reduce R&D time and costs. Mobile apps and social media could capture real-time data (e.g., call notes and follow-up actions from physician interactions) and allow clinical trial participants and patients to more easily document and share ongoing results of their treatments and drug side-effects.[21] Analytics could synthesize treatment outcomes, genomics, and patient behaviors from multiple sources to develop personalized medicine for specific populations. Cloud platforms for drug discovery could improve communication and collaboration among researchers, vendors, customers, the larger external research community and, possibly, regulatory bodies.

SMAC in practice: Pfizer

The FDA defines personalized medicine as "the tailoring of medical treatment to the individual characteristics, needs, and preferences of a patient during all stages of care, including prevention, diagnosis, treatment, and follow-up."[22] A recent report projects that the US market for personalized medicine will soon double, increasing from $9.2 billion in 2013 to $18.2 billion in 2019.[23] Pfizer leverages analytics to tailor treatments for specific patient populations. For instance, it developed lung cancer drug Xalkori for a five-to-seven percent patient subset which has the ALK gene mutation.[24] Pfizer received FDA approval based on clinical trials on only 255 patients rather than the thousands conventionally needed. The total time from discovery to approval took just three years, less than half the typical timeframe.[25]

Care coordination

Care coordination organizes patient care activities and shares information among all care team members, including the patient, to achieve safer and more effective care. The patient's needs and preferences are understood and care is delivered at the right time to the right person.[26]

The current difficulties of implementing care coordination — the fragmented US health system, lack of communication between health systems and patients, and a multitude of referral processes — make it a likely candidate for SMAC-based solutions.[27] Social media sites such as PatientsLikeMe can provide patients with additional information, help facilitate communication with clinicians, and improve shared decision-making.[28] In addition, patient-generated data on non-specialized social media sites such as Facebook can be mined and tracked for indicators such as fitness and mental health, and this data can be used to better target treatments and other types of support to improve care.[29] For instance, the US Department of Veterans Affairs is using predictive analytics on Facebook posts to identify potential suicide risks.[30] Crowdsourcing, another social media practice, can gather opinions about rare or difficult conditions so that a multitude of experiences are factored into a patient and provider's decision-making. Mobile devices can be used to collect, display, and deploy information at impactful times. For instance, in a pilot at Beth Israel, physicians received patient allergy alerts on Google Glass at the patient's bedside before administering medication.[31]

Analytics can provide decision support on ways to improve clinical and administrative performance, and help reduce costs and improve quality by prospectively and retrospectively identifying outlier patients. Texoma ACO, for example, used analytics to find prescription cost outliers. One patient using a $6,000/month injection that was not working well was switched to a $40/month medication that had better results and lower costs.[32] Washington State Medicaid enrolled its beneficiaries in a program that used a predictive modeling algorithm to determine who would benefit from a chronic care management program, which resulted in savings of $318 per member per month.[33]

SMAC in practice: Beth Israel Deaconess Medical Center

Beth Israel Deaconess Medical Center (BIDMC) is using SMAC technologies to improve patient care coordination:

- **Social:** The entire BIDMC care team, including the patient, can add notes and comment on others' entries in a shared, Wikipedia-like medical record.[34] BIDMC has found that allowing patients to play a more active role in their care through the shared record improves patient satisfaction and retention. As of 2015, 80,000 patients had logged into and edited their records each month.[35]
- **Mobile:** Medical records and information are available via mobile devices[36] and can be linked to devices in the patient's home that track information such as weight and exercise duration.[37]
- **Analytics:** BIDMC uses analytics to compare treatment patterns with established care guides and protocols. A team of care managers review gaps and, as needed, initiate nurse or telemedicine visits, appointments, tests, medication adjustments, or other services.[38]
- **Cloud:** BIDMC's shared medical record is hosted on the cloud. All of the health system's hospitals and ambulatory care settings are either already on, or plan to move to this cloud-based record, which will make information-sharing among stakeholders easier and faster. According to Dr. John Halamaka, Chief Information Officer at BIDMC, "The entire cost of the … cloud ends up being not particularly different from the costs that IT and the community are incurring today. In effect, we're doing innovation and doing projects in a totally cost-neutral way."[39]

SMAC technologies can help support care coordination efforts which without them are time consuming and expensive, including manual reviews by clinicians. According to our analyses, a hospital that improves care coordination using SMAC tools might save up to $3.7 million per 1,000 patients per month (Figure 3). While not all of the estimates' benefits can be directly attributed to SMAC — and the estimates may vary by specific technologies and organizational characteristics such as staffing — the potential cost savings from leveraging SMAC to improve care coordination can be considerable. Furthermore, although SMAC implementation costs (such as migrating existing IT systems to the cloud) can be substantial, SMAC investments may be offset by reducing other costs, such as replacing capital expenses (e.g. hardware, licensing, etc.) with predictable and easily scalable monthly cloud subscriptions. At BIDMC, the IT team no longer has to maintain infrastructure, and can reallocate full time equivalents (FTEs) to other tasks.[40]

Figure 3. Projected care coordination savings from implementing SMAC

Benefits	
Reduced hospital cost[a]	$442,400
Reduced 30-day readmissions cost[b]	$3,360,000
Costs	
Social[c]	$1,500
Mobile[d]	$5,800
Analytics and Cloud[e]	$68,700
Savings	**$3,726,400**

[a] In a large integrated delivery system, improved care coordination reduced average costs per patient by almost 20 percent.[41] The typical average cost per patient in a hospital is $2,200.[42]
[b] In a large integrated delivery system, improved care coordination reduced 30-day hospital readmissions by 30 percent.[43] The typical cost per 30-day readmission is $11,200.[44]
[c] Monthly cost of SalesForce Chatter Plus for 100 FTEs[45]
[d] Monthly mobile hardware and data costs for 100 devices[46]
[e] Monthly cost of open source analytics software hosted on the cloud and two data scientists on staff[47,48]

Digital health care payments

The US health care payments market is expected to double within the next decade, reaching $5 trillion by 2022 — up from $2.1 trillion in 2011 — due to the increasing number of insured individuals and the expanding share of consumer payments[49] fueled by out-of-pocket costs and enrollments in high-deductible health plans. As evidence of the market's growth, out-of-pocket payments for insured patients increased 68 percent from 2009 to 2015, from $250 billion to $420 billion.[50]

The manual, paper-based patient billing infrastructure that many health systems currently use is inadequate to efficiently process growing transaction volumes. For instance, research shows that around 30 percent of total health care payments are wasted due to disjointed, paper-based billing and administrative processes, and that nearly 20 percent of consumers have unpaid health care bills due to unfamiliar, expensive, and confusing payment processes.[51] To reduce such inefficiencies, health systems, employers, and health plans are investing in automated payment technology solutions—provided by large health care IT players (e.g., GE and McKesson), new entrants (e.g., InstaMed and Navicure), and financial institutions (e.g., JPMorgan Chase and PNC Bank)—that leverage SMAC and allow the organizations to accommodate changing consumer preferences for more convenient and simpler payment processes. Many health systems have reduced bill payment delays and delinquencies by providing portals or mobile apps that allow patients to see and pay their online balances. A single analytics platform for billing could produce customized reports and real-time analyses that also may help increase patient payments.

SMAC in practice: InstaMed

InstaMed provides a cloud-based health care billing and payment platform that connects employers, health plans, health systems, and consumers. On the consumer end, Instamed provides a mobile platform to pay, access, and manage health care expenses. For health systems and plans, Instamed automates account receivables processes (e.g., claims management, eligibility verification, and estimation) and provides analytics-based reporting and solutions to identify a consumer's payment responsibility (which reduces bad debt and accelerates payments).

The US health care payments market is expected to double within the next decade, reaching $5 trillion by 2022.

Our literature review shows that returns from investing in SMAC-based digital health care payment solutions are high. These include potential administrative cost and time savings of 25 percent and 90 percent, respectively, for a health system, as well as potential annual savings of up to $8 billion for the overall health care industry:

- **Consumer receivables:** Health systems that use the billing service PatientPay noted that more than 73 percent of patients paid their bills once opened, and that the average patient paid within 14 days.[52]
- **Electronic standards:** According to a Council for Affordable Quality and Healthcare estimate, adopting electronic remittance advice (the communication standards for exchanging electronic data) and electronic funds transfer (which ensures transfer of money from one bank account to another) may result in an annual savings to the health care industry of up to $8 billion.[53]
- **Administrative efficiency:** Using InstaMed, Good Samaritan Hospital in Indiana and Illinois has reduced patient statement costs by 25 percent and administrative time to process patient card payments by 90 percent.[54] Likewise, Eastside Pediatrics in South Carolina has decreased its time spent on claims submission and patient payment processing by 88 percent, down from several hours per day to several minutes.[55]

SMAC challenges

Despite the potential benefits, implementing SMAC is not without challenges. Life sciences and health care organizations should carefully balance risks such as:

- **Privacy and security:** Organizations must keep the Health Insurance Portability and Accountability Act and other privacy and security regulations top of mind. Employees need to understand what type of information is appropriate to share on internal and external social media sites. Mobile devices should be password-protected and have the capability to erase data if the device is lost or stolen. Using trusted networks that limit access to a single company or a group of users is one way to safeguard privacy and security.
- **Liability:** Using social media to track patient complaints could be a liability, particularly for companies in the life sciences industry because FDA regulations are still being developed. Organizations should monitor FDA guidance to understand and prepare for potential changes.
- **Organizational change:** SMAC implementation is likely to require organizational change to improve workflows and help staff understand the benefits of a more collaborative medical record or research environment. On manufacturing floors and in hospitals, personnel and patients may be resistant to being tracked, necessitating additional education and training.
- **Consolidation:** To realize the full benefits of health care industry M&A, participating organizations should consider data issues in consolidation activities, which may require reassessing their data and IT infrastructure after each merger or acquisition. Establishing an enterprise-wide data governance model can help ease these transitions.

SMAC: Better together

Health care stakeholders are more likely to realize the full value of SMAC when they use several of its component technologies to capture data, disseminate information, apply knowledge, and store collected information. Applying SMAC in next-generation supply chain, R&D, care coordination, and digital payments is a starting point for organizations. Looking ahead, SMAC technologies are likely to become increasingly common. One future application is the use of artificial intelligence (AI) in health care. AI automates tasks through the use of analytic techniques that can be performed in the cloud. Applications could include reviewing prior authorization requests, de-identifying patient care records, improving population health by identifying illness and behavior patterns, detecting fraud, and enhancing customer service.[56] Voice-activated mobile devices using Amazon's Alexa Voice Service, which currently plays music, provides news updates, and adds items to shopping lists, could also be used to remind patients to take their medications, track eating and wellness patterns, and coach patients,[57] as well as potentially refill prescriptions, schedule appointments, and connect patients directly with their physicians.

As core digital capabilities such as computing power, storage, and bandwidth continue to improve at an exponential rate,[58] the cost of implementing SMAC technologies is likely to decrease as benefits increase even further. Health care organizations that begin incorporating SMAC into their IT strategies today may be better positioned in the value-based market of tomorrow.

Endnotes

1. Business Wire, "96 Percent of Healthcare Providers Say Their Infrastructure is Not Fully Prepared to Leverage Cloud, Big Data, Mobile, Social to Optimize Their EMR," October 2014, http://www.businesswire.com/news/home/20141013005093/en/96-Percent-Healthcare-Providers-Infrastructure-Fully-Prepared, accessed February 2016.
2. Jonathan Hassell, "Talking SMAC: Revisiting social, mobile, analytics and cloud," CIO, May 2015, http://www.cio.com/article/2918194/cloud-computing/talking-smac-revisiting-social-mobile-analytics-and-cloud.html, accessed February 2016.
3. Naveen, "Time to SMAC the Healthcare Consumer," Chilmark Research, August 2014, http://www.chilmarkresearch.com/2014/08/12/time-to-smac-the-healthcare-consumer/, accessed February 2016.
4. Deloitte Center for Health Solutions, "Annual check-up on physician adoption of health IT," September 2014, http://www2.deloitte.com/us/en/pages/life-sciences-and-health-care/articles/center-for-health-solutions-us-physicians-survey-health-information-technology.html, accessed February 2016.
5. Louis Columbus, "Why Wearables' Redemption Is Waiting on the Factory Floor," Forbes, May 2015, http://www.forbes.com/sites/louiscolumbus/2015/05/21/why-wearables-redemption-is-waiting-on-the-factory-floor/#5d406e36af33, accessed February 2016.
6. InformationWeek, "Merck Optimizes Manufacturing with Big Data Analytics," April 2014, http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/merck-optimizes-manufacturing-with-big-data-analytics/d/d-id/1127901, accessed February 2016.
7. Michael Lucas, "Traceability and Safeguarding the Drug Supply Chain," Pharmaceutical Compliance Monitor, November 2013, http://www.pharmacompliancemonitor.com/traceability-and-safeguarding-the-drug-supply-chain/5846/, accessed February 2016.
8. Reuters, "Profile: Johnson & Johnson," http://www.reuters.com/finance/stocks/companyProfile?symbol=JNJ.N, accessed February 2016.
9. Amazon web services, "AWS Case study: Johnson & Johnson," http://aws.amazon.com/solutions/case-studies/johnson-and-johnson/, accessed February 2016.
10. Ron Rardin, "The future of healthcare: Supply chain," Modern Healthcare, July 2011, http://www.modernhealthcare.com/article/20110725/SUPPLEMENT/307259968, accessed February 2016.
11. Alberto Coustasse, "Impact of Radio-Frequency Identification (RFID) Technologies on the Hospital Supply Chain: A Literature Review," Perspectives in Health Information Management, http://perspectives.ahima.org/impact-of-radio-frequency-identification-rfid-technologies-on-the-hospital-supply-chain-a-literature-review/#.VpkE3vkrJD8, accessed February 2016.
12. Ephraim Schwartz, "Hospitals wringing big savings out of RFID, sensors," mHealthNews, December 2013, http://www.mhealthnews.com/news/hospitals-wringing-big-savings-out-rfid-sensors-mhealth-mobile, accessed February 2016.
13. Claire Swedberg, "Texas Health Harris Methodist Hospital Finds RTLS Provides Many Benefits," RFID Journal, June 2013, http://www.rfidjournal.com/articles/view?10789/, accessed February 2016.
14. InformationWeek, "Merck Optimizes Manufacturing with Big Data Analytics," April 2014.
15. Stephanie Baum, "5 ways the healthcare industry is implementing RFID technology," MedCityNews, December 2013, http://medcitynews.com/2013/12/5-ways-hospitals-implementing-rfid-tags-emerging-trend-healthcare/?rf=1, accessed February 2016.
16. SupplyChainBrain, "Mercy ROI Takes Optimized Supply Chain All the Way To Patients' Bedsides," http://www.supplychainbrain.com/content/research-analysis/supply-chain-innovation-awards/single-article-page/article/mercy-roi-takes-optimized-supply-chain-all-the-way-to-patients-bedsides-1/, accessed February 2016.
17. Ephraim Schwartz, "RFID yielding savings for hospitals," Healthcare Finance, January 2014, http://www.healthcarefinancenews.com/news/rfid-yielding-savings-hospitals, accessed February 2016.
18. Ibid.
19. Ibid.
20. Cindy Dubin, "Biopharma Uses Cloud Computing to Reduce Time and Money," June 2012, http://www.bioprocessonline.com/doc/biopharm-uses-cloud-computing-to-reduce-time-and-money-0001, accessed March 2016.
21. Dr. Daniel George, Dr. Liza Rovniak, and Dr. Jennifer Kraschnewski, "Dangers and opportunities for social media in medicine," Clin Obstet Gynecol 56, no.3 (2013), DOI: 10.1097/GRF.0b013e318297dc38.
22. FDA, "Paving the Way for Personalized Medicine," October 2013, http://www.fda.gov/downloads/ScienceResearch/SpecialTopics/PersonalizedMedicine/UCM372421.pdf, accessed March 2016.
23. Decision Resources, "What You Need to Know to Create or Sustain a Personalized Medicine Strategy for Your Company," November 2013, http://www.prnewswire.com/news-releases/the-us-market-for-predictive-personalized-drugs-will-double-from-2013-until-2019-234242351.html, accessed March 2016.
24. Doug Henschen, "The pharmaceutical company, No. 1 in the InformationWeek Elite 100 ranking, uses big data to tailor treatments to specific patient populations," InformationWeek, January 2016, http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/pfizer-connects-dots-to-deliver-better-treatments/d/d-id/1141527?print=yes, accessed February 2016.
25. David Bates, Suchi Saria, Lucila Machado, Anand Shah, and Gabriel Escobar, "Big Data In Health Care: Using Analytics To Identify And Manage High-Risk And High-Cost Patients," Health Affairs 33, no.7 (2014): pp. 1123-1131, DOI: 10.1377/hlthaff.2014.0041.
26. Agency for Healthcare Research and Quality (AHRQ), "Care Coordination," http://www.ahrq.gov/professionals/prevention-chronic-care/improve/coordination/index.html, accessed February 2016.
27. Ibid.
28. Wicks P, Massagli M, Frost J, Brownstein C, Okun S, Vaughan T, Bradley R, and Heywood J, "Sharing Health Data for Better Outcomes on PatientsLikeMe," JMIR 12, no.2 (2010), DOI: 10.2196/jmir.1549.
29. Suzanne Kattau, "How data analytics, mobile and social revolutionized the enterprise in 2014," filmed 2014. SiliconAngle, http://siliconangle.com/blog/2015/01/08/how-data-analytics-mobile-and-social-revolutionized-the-enterprise-in-2014-analysts-top-interviews-from-thecube/, posted January 2015.
30. Durkheim Project, http://www.durkheimproject.org/our-project/, accessed February 2016.
31. Beth Walsh, "Halamka talks new technologies," Clinical Innovation and Technology, April 2014, http://www.clinical-innovation.com/topics/clinical-practice/halamka-talks-new-technologies, accessed February 2016.
32. Melissa Huff, "Data Analytics helps Texas-based ACO find cost savings in MSSP," Becker's Health IT & CIO Review, February 2015, http://www.beckershospitalreview.com/healthcare-information-technology/data-analytics-helps-texas-based-aco-find-cost-savings-in-mssp.html, accessed February 2016.
33. Jingping Xing, Candace Goehring, and David Mancuso, "Care Coordination Program for Washington State Medicaid Enrollees Reduced Inpatient Hospital Costs," Health Affairs 34, no.4 (2015): pp. 653-661, DOI: 10.1377/hlthaff.2014.0655.
34. Walsh, "Halamaka talks new technologies," April 2014.
35. Gerald Kane, "How Digital Transformation Is Making Health Care Safer, Faster and Cheaper," MIT Sloan Management Review, July 2015, http://sloanreview.mit.edu/article/how-digital-transformation-is-making-health-care-safer-faster-and-cheaper/, accessed February 2016.
36. Kattau, "How data analytics, mobile and social revolutionized the enterprise in 2014."
37. Rebecca Weintraub, "John Halamka on social, mobile, analytics and cloud technologies for patient engagement." GHDonline, http://www.ghdonline.org/breakthrough-health-it/discussion/john-halamka-on-social-mobile-analytics-and-cloud-/, posted December 2014.
38. Ibid.
39. Kane, "How Digital Transformation Is Making Health Care Safer, Faster and Cheaper," July 2015.
40. Kattau, "How data analytics, mobile and social revolutionized the enterprise in 2014."
41. Rachel Burton, "Improving Care Transitions," Health Affairs, September 2013, http://healthaffairs.org/healthpolicybriefs/brief_pdfs/healthpolicybrief_76.pdf.
42. Kaiser Family Foundation, "Hospital Adjusted Expenses per Inpatient Day," http://kff.org/other/state-indicator/expenses-per-inpatient-day/, accessed February 2016.

43. Burton, "Improving Care Transitions," September 2013.

44. Ellie Rizzo, "6 Stats on the Cost of Readmission for CMS-Tracked Conditions," Becker's Infection Control & Clinical Quality, December 2013, http://www.beckershospitalreview.com/quality/6-stats-on-the-cost-of-readmission-for-cms-tracked-conditions.html, accessed February 2016.

45. Salesforce, "Chatter The enterprise social network that gets work done," http://www.salesforce.com/crm/chatter-editions-pricing/, accessed February 2016.

46. Verizon, "Business Plans," http://www.verizonwireless.com/biz/plans/voice-data-plans/, accessed February 2016.

47. Perceivant, "The Real Cost of Hadoop," http://perceivant.com/the-real-cost-of-hadoop/, accessed February 2016.

48. Glassdoor, "Hospital Data Scientist Salary," https://www.glassdoor.com, accessed February 2016.

49. Reuters, "Following Successful Theranos Research Report, Firm Takes Aim at Healthcare "Blind Spot" With New Website and Product Set," September 2015, http://www.reuters.com/article/2015/09/17/idUSnGNX7NYN2v+1dc+GNW20150917, accessed February 2016.

50. J.P. Morgan, "Key Trends in Healthcare Patient Payments," 2013, https://www.jpmorgan.com/jpmpdf/1320610345938.pdf, accessed March 2016.

51. Jim Malmberg, "Nearly Twenty Percent of Consumers Have Unpaid Medical Bills on Their Credit Report," Fraud Avengers, January 2015, http://fraudavengers.org/2015/01/nearly-twenty-percent-of-consumers-have-unpaid-medical-bills-on-their-credit-report/, accessed February 2016.

52. Brooke Murphy, "Why hospitals need to invest in their patient billing tech," Becker's Hospital Review, January 11, 2016, http://www.beckershospitalreview.com/finance/why-hospitals-need-to-invest-in-their-patient-billing-tech.html, accessed February 2016.

53. Council for Affordable Quality Healthcare (CAQH), "$8 Billion Savings Opportunity for Providers and Health Plans Highlighted by 2013 Index," 2014.

54. "Case study: Good Samaritan Hospital," 2015, http://www.instamed.com/wp-content/uploads/CASE-STUDY-InstaMed-Good-Samaritan-Hospital.pdf, accessed February 2016.

55. "Case study: Eastside Pediatrics," 2015, http://www.instamed.com/wp-content/uploads/CASE-STUDY-InstaMed-Eastside-Peds.pdf, accessed February 2016.

56. David Schatsky, Plamen Petrov, and Rajeev Ronanki, "Cognitive technologies for health plans: Using artificial intelligence to meet new market demands," Deloitte University Press, March 27, 2015, http://dupress.com/articles/cognitive-technologies-health-plans/, accessed February 2016.

57. Faruk Capan. "Why Amazon's Echo Device is Good for Healthcare," Medical Marketing & Media, December 2015, http://www.mmm-online.com/features/why-amazons-echo-device-is-good-for-healthcare/article/461155/, accessed February 2016.

58. John Hagel III, John Seely Brown, Tamara Samoylova, and Michael Lui, "From exponential technologies to exponential innovation," Deloitte University Press, October 4, 2013, http://dupress.com/articles/from-exponential-technologies-to-exponential-innovation/?id=us:el:dc:dup401:awa:tmt, accessed February 2016.

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