The advent of consumer owned genetic profiles

Personal genetic services due for explosive growth

October, 2017

Arthur D Little

Content

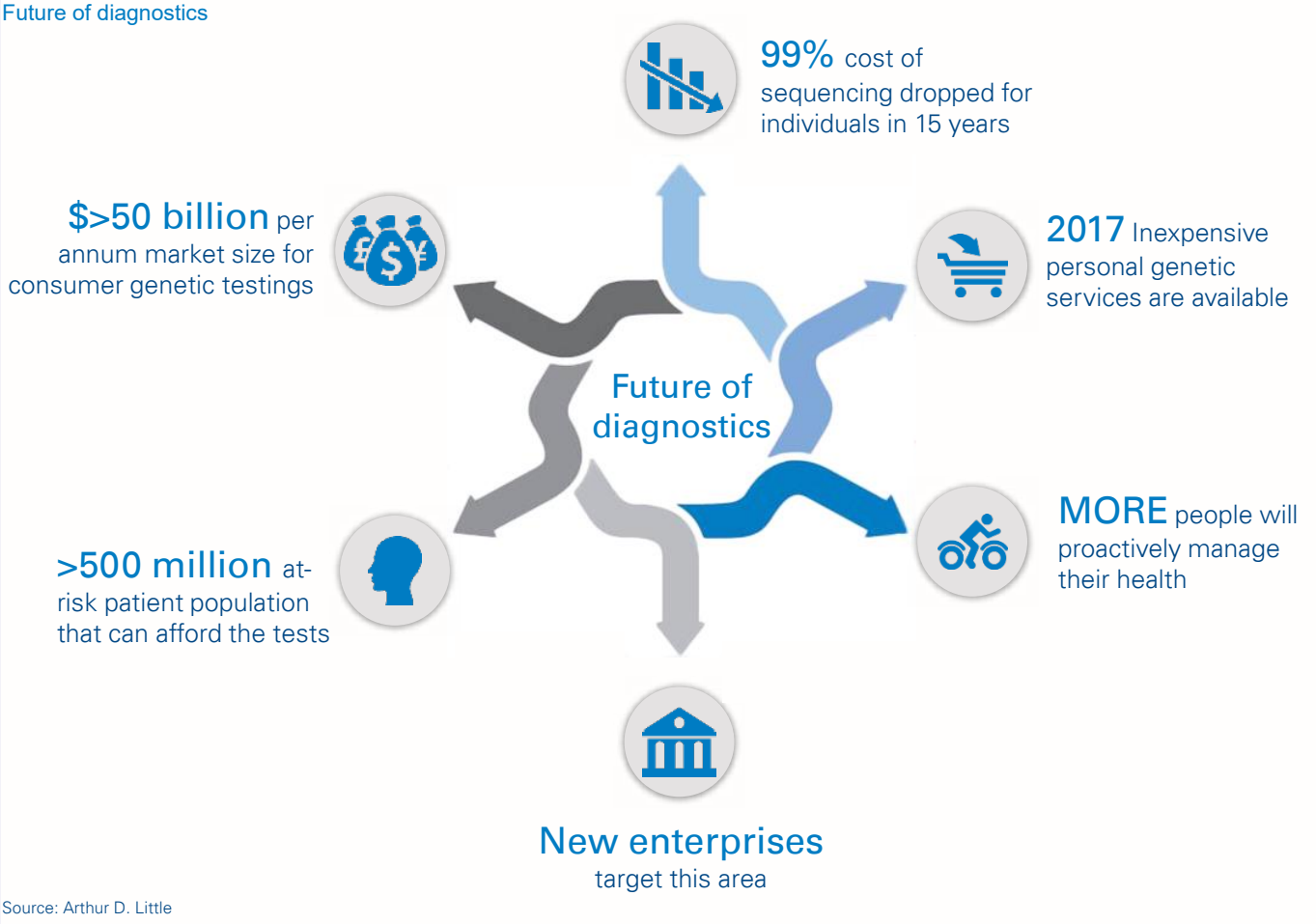
Authors:

Craig Wylie
Partner, Healthcare New York
wylie.craig@adlittle.com

Executive summary

Access to genetic information is becoming critical to the effectiveness of a new wave of medical treatments that are becoming available now. Personalized genetic services companies will act as a disruptive forces that are consumerizing genomic testing and driving rapid transformation of an industry that we expect to become a major force in personalized medicine. In this report, we consider how large this industry is likely to get in the next 10 years and start to evaluate how pharmaceutical companies, payers, providers and medtech companies will be impacted by the shift. We believe the emergence of ever cheaper testing technology means manufacturers can enhance clinical trials, payers can be selective in authorizing treatment payouts, and patients can have more confidence in outcomes.

Future of diagnostics



Source: Arthur D. Little

1. A new industry is born

The introduction of relatively inexpensive biological assays, particularly around known genetic biomarkers and mutations, is creating a new industry. Today, personal genetic services companies such as 23andMe can provide inexpensive genetic analyses directly to consumers to help them understand their risk (or that of their pets) of several major genetic-based diseases. We are at the beginning of a new era in which assays and biomarkers are increasingly important in the treatment of cancers, degenerative diseases, and infectious diseases. The first Food and Drug Administration (FDA)-approved direct-to-consumer genetic testing service is 23andMe and, just as the iPhone release in 2007 changed the entire mobile phone market, we believe the FDA approvals received by 23andMe are creating a new market.

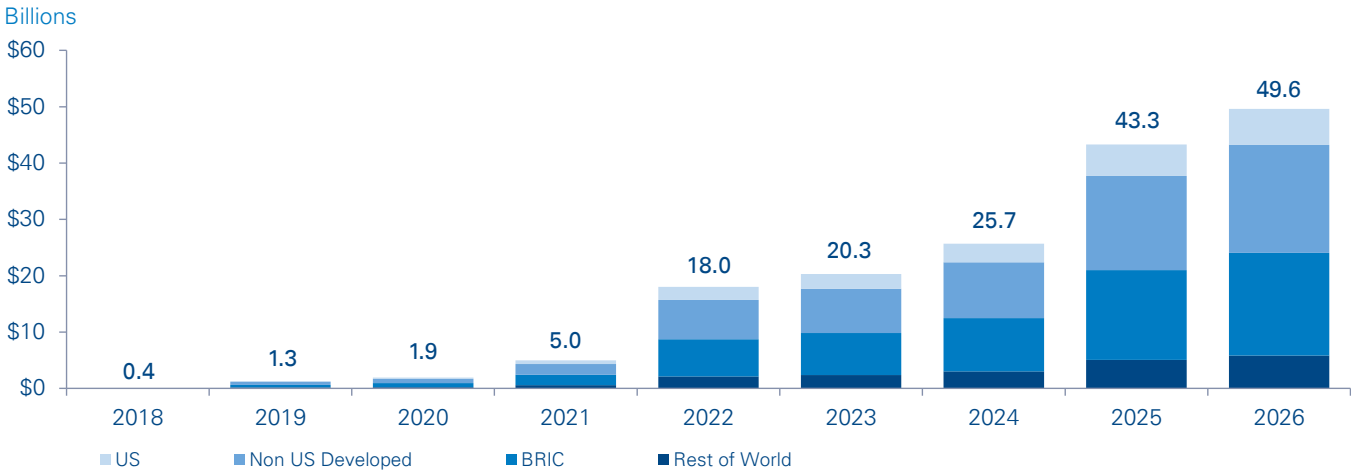
We expect the adoption curve of consumer-driven genetic testing to resemble that of other recent technology adoptions. In fact, there are many similarities between the introduction of smartphones and the breakthrough of consumer-based genetic testing. Prior to the release of the iPhone in 2007, there were feature phones which provided email and allowed users to play simple games. In 10 years, we have seen growth which has led to 77 percent of the US population owning smartphones in 2017. A similar adoption curve makes it highly likely that the current small market for consumer genetic testing – similar to feature phones – has just undergone the same shift as the phone market did in 2007 and, in 2026, will be a $50 billion per annum business.

Why the huge growth? New, innovative treatments are very expensive, and often specific to genotypes or markers. Examples include the direct-acting antiviral therapies for the treatment of Hepatitis C, OPD1 inhibitors used to treat a variety of cancers, and chimeric antigen receptor T-cell therapy (CAR-T) for the treatment of certain childhood leukemia and B-cell malignancies. People suffering from these types of diseases, as well as those who want to understand and manage their personal risk of life-threatening diseases, have a better understanding of their own genetic risk profiles and are much more engaged with the treatment profiles, than the general population. Today about 14 percent of the population has been identified as carrying a mutation or marker that puts them or their children at an increased risk of developing cancer, type-1 diabetes, cystic fibrosis, multiple sclerosis, arthritis, autism, Parkinson's, or heart disease. In the developed markets alone, that includes over 240 million individuals. If we add in the BRIC (Brazil, Russia, India and China) and Middle East markets, which are developing fast in terms of buying power and adoption of advanced therapies, the at-risk patient population that can afford the tests is well over 500 million. If we add in individuals who test but do not have markers, the numbers become even larger.

To get approval for these very expensive treatments, pharmaceutical companies need to commit to the effectiveness of the treatment – for instance, Novartis has committed to not charging for pediatric treatment with the recently approved Kymriah™ (CAR-T) therapy if there is no improvement in the first 30 days. This awareness of outcomes from treatments covers not just the manufacturer's organizations, but the payer's as well. The process needs to select the right patients, and those patients need to know if a treatment is going to work for them, as time is often is short supply. Every step of the way, from concept to new-drug investigation, to license, to reimbursement, to patient outcome, will be enhanced by the availability of diagnostic services that can reduce uncertainty and risk for the patient and align patient and supplier objectives. At the same time, developers of new therapies are delivering treatments based on greater understanding of genotypes, and patient populations are beginning to understand the risk profiles of certain genetic characteristics and mutations.

The demand for personal genetic services will grow rapidly as more people start using their genetic information to proactively manage their health. The traditional feature-phone analogy will

Market size for consumer genetic testing - forecast by region



Source: Arthur D. Little

no longer be sufficient for consumers; they will also need the iPhone of personal genetic services. Stakeholders that embrace this opportunity will find themselves in significantly enhanced competitive positions.

All stakeholders in the healthcare ecosystem stand to gain from the increasing availability and use of genetics-based diagnostics. Manufacturers can enhance their trials, payers can be selective in authorizing treatment payouts, and patients can be more confident of their outcomes.

2. So why now?

Companies such as 23andMe that conduct genetic analyses have already navigated regulatory challenges. Before now, most genetic and diagnostic interactions were clinical activities involving visits to local clinics and laboratories. Today, simple, often mail-order, tests are becoming more mainstream by providing services as diverse as identifying ethnic origins and determining the risk of hereditary diseases such as breast cancer. Genetic analysis has moved from the domain of the health-care practitioner to that of the consumer, and we see new enterprises already targeting this area (GRAIL and Elypta as examples, among others).

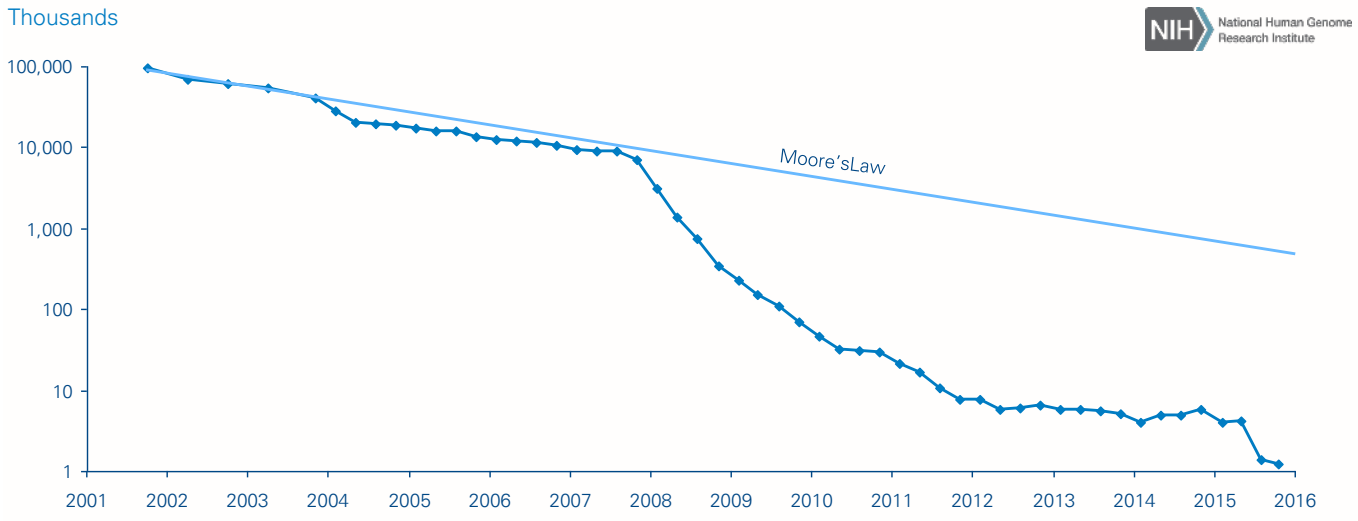
Along with the science, and as genetic testing has become more commonplace, regulatory jurisdictions are becoming clearer and authorities are getting better at defining and exercising regulatory requirements. In the United States, genetic testing has historically been regulated by the Centers for Medicare and Medicaid Services through the Clinical Laboratory Improvement Amendments of 1988 (CLIA) legislation. Several companies, such as Counsyl, Myriad Genetics, and 23andMe, are already operating under the auspices of CLIA regulations. However, the FDA is also starting to take a more active role, especially with tests sold as "kits," to ensure that the claims of the sellers are accurate and verified. Previously, the FDA sent "it has come to our attention" letters to a number of companies in this regard, and in 2014, even prohibited 23andMe from marketing its tests after the company failed to send the agency sufficient information to support its marketing claims.

Today, the pace of change is fast. Early in 2017, the FDA approved marketing directly to consumers of 23andMe's Genetic Health Risk tests for multiple diseases or conditions, thus setting the precedent and blueprint for other companies to navigate the FDA's regulatory landscape. This provides opportunities for other companies to use the "predicate device" pathway to reduce approval times for their own products and services.

The FDA's increasing involvement is expected to instill more confidence into consumers and contribute to market growth, but there are still challenges outside the direct-to-consumer space. The FDA has issued guidance (Principles for Codevelopment of an In Vitro Companion Diagnostic Device with a Therapeutic Product, July 2016) that clarifies the regulatory pathway and, although now clear, it is not simple. For example, pharmaceutical manufacturers will need to register two licenses in parallel: one for the diagnostic and another for the therapeutic product.

However, with the technological advancements led by these consumer-oriented companies, it is becoming less and less expensive for consumers to get genetic analyses done. The cost of sequencing a genome has, according to the NIH, dropped 99 percent in 15 years. This is entirely in line with Moore's law

Cost per Genome



Source: National Human Genome Research Institute

and suggests we will see further significant reductions, with an assay that costs $100 in 2017 dropping to $1 in 2026. 23andMe now charges $99 for an ancestry test and $199 for a combined health and ancestry test, while Color Genomics charges $249 for its hereditary-cancer and high-cholesterol tests.

Because of these price reductions, some payers and health-care providers have started referring patients to these consumer-oriented services, even though not all payers will currently reimburse for the services. This is a classic disruption model, and established vendors will need to navigate a market that is changing dramatically around them. For example, Quest Diagnostics has responded by launching a service, QuestDirect™, which allows consumers to initiate certain medical tests without a physician's order. There is an increasing level of activity:

- Kaiser recommends Color Genomics to its patients as a preferred vendor.
- Aetna, Humana, and United Healthcare have approved Invitae for in-network diagnostic tests for BRCA1, BRCA2 (the breast cancer-susceptibility gene) and ovarian cancer. Several years ago, payers did not cover these tests as there was little evidence behind the benefits/utility of such tests. Invitae has announced that this approval has increased the number of covered patients from 5 million to 180 million.
- The US Affordable Care Act requires payers to reimburse for genetic counselling and BRCA testing, but only for women who have personal histories of cancer and meet a few other specific requirements.
- In August 2015, Anthem became the first insurer to expand its coverage to include non-invasive prenatal testing for "average-risk" pregnancies.
- 23andMe already has more than 2 million genotyped customers and 600 million phenotypic data points.

3. How is the market going to develop?

We are at the beginning of a massive industry change bringing ownership of the genome to the individual. The current market size of genetic testing is currently between $4 and $6 billion, while the size of direct-to-consumer genetic testing is approximately $70 million and growing fast.

We expect to see continued introduction of new assays going beyond mutation-based biomarkers to actionable biomarkers for an increasing number of conditions, especially those associated with reproductive health, oncology, transplant medicine, and forensics. We also expect that a new, consumer-oriented industry that will help individuals know and manage their risks will develop. A small but wealthy portion of the patient population will look to proactively manage their risks, moving from one-off analyses to continual monitoring to receive and manage their health with existing conditions. This growth is already evident:

- The wearables market is currently at $3 billion, with 50 million devices shipped in 2015.
- Novartis, GSK, and Celgene have launched trials using Apple's ResearchKit and CareKit for real-time, ongoing monitoring.
- Companies such as Dexcom have introduced continuous glucose monitoring for diabetes.

4. How will the players adjust to this revolution?

In our opinion, every part of the market will be affected by the increase in need for, and availability of, genetic testing. Manufacturers will need to develop diagnostics strategies, and consumers will progressively take ownership of their own genomes. The increase in availability of genetic information will drive payer organizations and providers, and require a change in diagnostic and therapeutic behaviors equivalent to the change brought about by the introduction of the X-Ray machine. Instead of looking at hard- and soft-tissue damage, we are now going to be examining the risk and susceptibility inherent in our DNA.

Diagnostics companies

Diagnostics companies sit in the space between pharmaceutical and medical-device organizations; much of their work is wet chemistry, but at the same time, their products are lab equipment, chemical assays and medical devices. They have a once-only opportunity to set a strategy that embraces the consumer, not just the laboratory or health-care provider. They have the technology and in-house product development capability and, if the strategy is set right, they are best placed to benefit from the new market.

Big pharma

As the volume of innovation specific to a biomarker or phenotype increases, big pharmaceutical companies will need to increase the pace of development of diagnostic strategies that support these innovations. For some pharma organizations, this means new strategic relationships and, potentially, the acquisition of capability. Other organizations already have capability, often in separate business units, that needs to be fully integrated into the business. These strategies will need to support clinical trials, risk-benefit analyses, new-drug applications, reimbursements and the license process.

Emerging pharma

Emerging pharmaceutical organizations that are accustomed to being driven by innovation will have the opportunity to get it right early on. They will need to develop buy-or-build strategies for diagnostics into their development and licensing plans.

Medtech

Consumer-based instruments and services that focus on risk and the need for diagnostics will need to increase their support of precision medicine based on genomics, phenotypes and other biomarkers. The FDA has stated and issued guidance that diagnostics should be treated as if they were medical devices, and therefore need appropriate management through the development process. Many highly innovative companies developing new therapies do not have the expertise to do this; fortunately, device development companies do. Given the familiarity with medical devices and their regulations, medtech companies are well placed to take advantage of the new opportunities in diagnostics, and could lay claim to a significant portion of the future business.

Payers

Patients will increase pressure on payers for more expensive and innovative medications – many of which will only work in select populations. Payers will need to avoid wasting funds on treatments that will not work for any given patient, and maximize the selectivity of the treatment regimen. Payer organizations will need to support the use of diagnostics. They can also avoid expensive treatments by supporting genetic tests that identify consumers' risk profiles to cancers and other disorders, and enable them to take preventative actions or ensure early physician intervention.

Providers

Health-care providers are driven by outcomes that embody the desire to treat patients, including under-insured or other expensive patients. When this is combined with issues of laboratory space and time – both of which are scarce – providers will come under increasing pressure from their patients to conduct expensive treatments that have associated diagnostics.

Notes

Contacts

If you would like more information or to arrange an informal discussion on the issues raised here and how they affect your business, please contact:

Austria
Karim Taga
taga.karim@adlittle.com

Belgium
Marc Herlant
herlant.marc@adlittle.com

China
Russell Pell
pell.russell@adlittle.com

Czech Republic
Marcel Hominda
hominda.marcel@adlittle.com

France
Marc Herlant
Herlant.Marc@adlittle.com

Germany
Wilhelm Lerner
lerner.wilhelm@adlittle.com

India
Vikas Kharbanda
kharbanda.vikas@adlittle.com

Italy
Fabrizio Arena
arena.fabrizio@adlittle.com

Japan
Satoshi Ohara
ohara.satoshi@adlittle.com

Korea
Kevin Lee
lee.kevin@adlittle.com

Latin America
Guillem Casahuga
casahuga.guillem@adlittle.com

Middle East
Vikas Kharbanda
kharbana.vikas@adlittle.com

Nordic
Ulrica Sehlstedt
sehlstedt.ulrica@adlittle.com

The Netherlands
Martijn Eikelenboom
eikelenboom.martijn@adlittle.com

Singapore
Satoshi Ohara
ohara.satoshi@adlittle.com

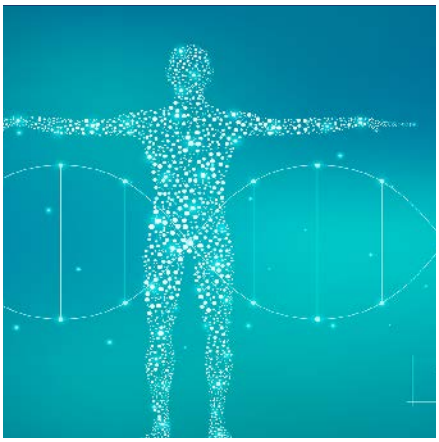
Spain
David Borras
borras.david@adlittle.com

Switzerland
Wilhelm Lerner
lerner.wilhelm@adlittle.com

Turkey
Coskun Baban
baban.coskun@adlittle.com

UK
Richard Eagar
eagar.richard@adlittle.com

USA
Craig Wylie
wylie.craig@adlittle.com



The advent of consumer owned genetic profiles – Personal genetic services due for explosive growth

Arthur D. Little

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. Arthur D. Little is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

For further information, please visit **www.adl.com**.

www.adl.com/Futureofdiagnostics