

# COMPANION DIAGNOSTICS IN PERSONALIZED MEDICINE AND THERAPY *(SAMPLE COPY, NOT FOR RESALE)*

Trends, Industry Participants, Product Overviews and Market Drivers

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SAMPLE

## 1. Overview

### 1.1 Statement of Report

Companion diagnostics (CDx) refers to a particular clinical diagnostic test that is under evaluation and is specifically linked to a known drug therapy. This linkage could be important in the therapeutic application and clinical outcome of a drug, such as with personalized medicine for oncology patients. The molecular diagnostics field plays a vital part in personalized medicine and has greatly expanded over the past 20 years, expanding by more than █% annually compared to most other laboratory procedures. Research will continue to produce an increased understanding of disease processes, and diagnostics manufacturers will continue to expand and refine the technology and automation needed for clinical testing. Companion diagnostics, although smaller at present, is one of the fastest growing segments in the *in vitro* diagnostics (IVD) market. And while the concept of a drug-diagnostic combination is not new, it has only recently started to generate interest with the move of healthcare towards pharmacogenomics. This report focuses on the use of companion diagnostic tests in personalized medicine with regards to cancer therapy. The global companion diagnostics market was estimated to be valued at \$█ in █ and is expected to be valued at \$█ in █ representing a compound annual growth rate (CAGR) of █%.

Companion diagnostics combined with targeted therapeutics are the tools for providing personalized treatment. The future of the companion diagnostics market is extremely promising and is predicted to grow steadily to █ with increases in the demand for high-priced specialist therapies and the demand for safer, more-efficacious drugs. It is clear that the field of personalized medicine is real, is expanding and is sustainable. In fact, it is estimated that █% of drug companies are working on personalized medicine products and that in five to ten years all oncology drugs will have a companion diagnostic. Diagnostic industry giants like Qiagen, Abbott, Roche and Illumina realize that a strong relationship between the drug industry and the diagnostics industry is crucial in the next few years. For example, FDA-approved companion diagnostic/drug combinations include Xalkori (crizotinib) and Abbott Molecular's companion test Vysis ALK Break Apart FISH Probe Kit, and (vemurafenib) with the companion test Roche Molecular's Cobas 4800 BRAF v600 Mutation Test. This review will provide an in-depth discussion and analysis of the application of biomarkers in targeted therapeutics, their predication response and efficacy, as well as their use in treating patients and selecting more efficacious medications. This summary emphasizes new and developing technology platforms aimed to aid drug treatment of patients.

### 1.2 Why You Should Read This Report

The report describes new technology platforms developed for the analyses of constituents of blood, plasma, serum or tissue that are connected to the efficacy of therapeutic agents in a clinical setting. This study tends to emphasize smaller biotech companies that have new products and procedures in this sector. Research companies in the process of developing new ideas are not reviewed in any detail here. The main objectives of this analysis are to:

- Identify viable technology drivers for companion diagnostic tests through a comprehensive examination of platform technologies for IVDs that are used to monitor the absorption, metabolism and efficacy of therapeutic drugs in individual patients.
- Provide a complete understanding of the new companion biomarker diagnostics tests—*i.e.*, predictive, screening, prognostic, monitoring, pharmacogenomic and theranostic—from their basic principles to their applications.
- Discover growing market opportunities in companion diagnostics by identifying high-growth applications in different diagnostic areas, focusing on the biggest and expanding markets in oncology (*e.g.*, biomarkers for cancer and predictive biomarkers).
- Focus on global industry development of companion diagnostic tests through an in-depth analysis of the major world markets for companion diagnostics, including growth forecasts.
- Assessment of leading companies with CDx products, pipeline developments and marketing strategies:

- Roche Diagnostics.
  - Qiagen.
  - Abbott Molecular.
  - Agilent (Dako).
  - Myriad Genetics.
  - bioMérieux.
  - Siemens Healthcare.
  - Thermo Fisher Scientific.
- Assessment of drivers and restraints for the CDx market.

### 1.3 Scope of the Report

This study differs from TriMark's *Personalized Medicine* report in that it emphasizes diagnostic tests that are directly linked in their usage to specific therapeutic agents. Other tests like the *In Vitro* Diagnostic Multivariate Index Assays (IVDMIAs) are inestimably characterized as personalized medicine tests because they determine a patient's sensitivity or susceptibility to various disease states. However, they are not strictly classified as companion diagnostic tests because they are not directly linked to a therapeutic agent, neither as a selection algorithm nor a guide to dosing regimes. TriMark's *Companion Biomarkers in Drug Development* market report examines the developing market in biomarkers that are specifically linked to a therapeutic drug either during its development or in the clinic.

This TriMark Publications report focuses on the role of companion diagnostic tests in drug development. It provides an in-depth discussion and analysis of the application of companion biomarkers to drug development and targeted therapeutics, as well as their use in clinical trials and the regulatory forum. The examination emphasizes new and developing technology platforms meant to aid in development of drugs for therapeutic use, and sometimes to be available as companion tests for these drugs in the clinic. This report also examines companies that are actively developing and marketing companion biomarkers around the world. Detailed tables and charts with sales forecasts and marketshare data are also included.

This analysis emphasizes companies that are actively developing and marketing new reagents and supplies for performing companion biomarker diagnostics tests in the clinical setting on patients undergoing administration of the U.S. Food and Drug Administration (FDA)-approved drugs. It discusses the various market trends and opportunities using new biomarkers, while providing an in-depth analysis of market share, revenue forecasts, market drivers and market restraints. The comprehensive focus of the study, backed by strategic recommendations, enables companies to position their growth strategies to benefit from the changing market conditions and obtain maximum return on investment.

The reader should consult other TriMark Publications reports at <http://www.trimarkpublications.com> for detailed discussions of important individual market segments related to the companion diagnostics market, such as clinical chemistry testing, high-growth diagnostic test markets, blood gas and electrolytes, over-the-counter (OTC) diagnostic testing markets and point of care (POC) testing. TriMark provides a separate market report titled *DNA Sequencing and PCR Markets*, which emphasizes the analytical methods and polymerase chain reaction (PCR) technology platforms used in companion diagnostics. TriMark also publishes a separate report on routine clinical tumor markers in current use and their markets: *Cancer Diagnostic Testing World Markets*.

The biotech sector developing new companion biomarkers is the focus of this examination. However, attention is paid to the hospital market segment, and separately, to the instruments, reagents and supplies marketed by major companies in this segment. Market size, growth rates and market components for instruments, reagents, controls and consumables used in this area are also analyzed. Specialty companion diagnostics testing such as pathology screening methods and special tissue stains to examine companion cells *in situ* are mentioned, since they are often part of the overall analytical focus of companies that market companion technology platforms. However, no effort is made to quantify this older and broader market. These subjects are discussed in other TriMark Publications reports.

An analysis of business trends, technology trends and developing areas of companion diagnostics testing using new biomarkers is provided, along with a brief review of the routine market for clinical companion diagnostics testing equipment and supplies in the clinical hospital market, using screening reagents and instruments for analysis of individual components in blood, serum or plasma. This study defines United States and global market dollar sales volume and analyzes factors that influence the size and growth of market segments. Activity and trends in hospital markets, including the numbers of institutions that use companion diagnostics testing and the factors that influence purchasing, are addressed in this report.

This review surveys biotech companies known for marketing, manufacturing or developing instruments and reagents for the clinical companion diagnostics market, both in the U.S. and the world. Leading companies are discussed in-depth, with sections on the companies' histories, product lines, business and marketing analyses, and subjective commentary on the companies' market positions.

Several subjects related to the major elements of companion diagnostics testing, such as clinical chemical testing instruments, are discussed only briefly in this report because they are considered separate fields or markets. Fuller explorations of these areas of interest can be found in other TriMark reports such as *Clinical Chemistry Analyzers* and *Point of Care Diagnostic Testing World Markets*.

#### 1.4 Objectives

The goal of this examination is to review the market for new companion biomarker testing equipment and supplies using reagents and instruments for analysis of individual components in blood, serum or plasma from patients, which depend on the breaking developments in the personalized medicine and cancer therapeutic spaces.

The market report includes a quantitative analysis the dollar volume of sales, both worldwide and in the U.S., and analyzes the factors that influence the size and the growth of the companion diagnostic market segments. Also examined are the subsections of each market segment where diagnostic tests are performed, showing the impact of the developing personalized medicine therapeutic approaches and targeted therapy. Additionally, a detailed discussion of companion diagnostics now on the market such as epidermal Growth Factor Receptor Companions, companions based upon Myriad's IVDMA technology, and several other promising approaches are provided.

The impact of new technology platforms on drug development and the time lines for various segments of the companion diagnostic tests are discussed. A thorough discussion of the interface between diagnostics for personalized medicine and the rise of companion testing is included with a special emphasis on cancer therapies.

- Opportunities and hurdles in the quest for new companion biomarkers using proteomics.
- Adaptive design using biomarkers.
- Revenue forecasts and growth rates for world companion diagnostics markets.
- Drivers and barriers to companion diagnostics test development.
- Tools for improving measurement, safety and validation of biomarkers.
- The gap between discovery and clinically validated biomarkers.
- New technologies for oncology biomarker discovery.
- Partnerships with pharma companies to identify therapeutic targets.
- Examination of stakeholders in companion diagnostics.
- Business and regulatory trends including breadth of product offering and pricing, FDA guidance on drug test co-development, device class.
- Acquisition, license agreements and partnerships.
- Company profiles for active participants on developing companion tests.
- Leading companies developing companion diagnostics products.
- Assessment of recent developments.

## 1.5 Key Questions Answered by This Report

Which companies are utilizing cutting-edge technologies to develop, validate and implement companion biomarkers for clinical use in a personalized medicine setting?

- Which companies are the leaders in companion diagnostic development?
- Which pharma companies are most active in using companion diagnostics with their drugs?
- What impediments still exist to incorporating promising research into clinical practice?
- How is the companion diagnostic development space evolving?
- Which companion biomarkers show the most promise for approval?
- What are the economic challenges to approval?
- How can regulatory oversight drive approval and adoption of new technologies?
- Which alliances show the greatest synergy in bringing valid biomarkers to market?
- What can and what can't be done by personalized medicine?
- What are biomarkers and how are they used in disease prediction and prognosis?
- How can biomarkers help in assessing how far a disease has already progressed (disease staging), *e.g.*, in diseases like cancer?
- What is the promise that genomic and proteomic approaches hold for personalized medicine?
- Which companion diagnostics enable clear decision-making and provide clinical utility?

## 1.6 Methodology

The author of this report holds a Ph.D. in biochemistry from the University of Minnesota and has had post-doctoral experience at the University of Connecticut School of Medicine. He has taught at Quinnipiac University and the Tufts School of Medicine, and has been a senior scientist at Pfizer Pharmaceutical Laboratories in drug development. He also has many decades of experience in science writing and as a medical industry analyst. He has over 30 years of experience in laboratory testing and instrument and reagent development technology as a licensed clinical laboratory director, as well as extensive experience in senior level management positions in pharmaceutical, biotech and medical service companies. The editor of this report is a Ph.D. in biochemistry from the University of Liverpool and an M.B.A. from Oxford Brookes University in the United Kingdom with over 35 years' experience in the medical industry, science writing and as a medical industry analyst.

Company-specific information is obtained mainly from industry trade publications, academic journals, news and research articles, press releases and corporate websites, as well as annual reports for publicly-held firms. Additional sources of information include non-governmental organizations (NGOs) such as the World Health Organization (WHO) and governmental entities such as the U.S. Department of Health and Human Services (HHS), the National Institutes of Health (NIH), the FDA and the Centers for Disease Control and Prevention (CDC). Where possible and practical, the most recent data available have been used.

Some of the statistical information was taken from Biotechnology Associates' databases and from TriMark's private data stores. The information in this study was obtained from sources that we believe to be reliable, but we do not guarantee the accuracy, adequacy or completeness of any information or omission or for the results obtained by the use of such information. Key information from the business literature was used as a basis to conduct dialogue with and obtain expert opinion from market professionals regarding commercial potential and market sizes. Senior managers from major company players were interviewed for part of the information in this report.

### *Primary Sources*

TriMark collects information from hundreds of Database Tables and many comprehensive multi-client research projects, as well as Sector Snapshots that it publishes annually. TriMark extracts relevant data and analytics from its research as part of this data collection.

## ***Secondary Sources***

TriMark uses research publications, journals, magazines, newspapers, newsletters, industry reports, investment research reports, trade and industry association reports, government-affiliated trade releases and other published information as part of its secondary research materials. The information is then analyzed and translated by the Industry Research Group into a TriMark study. The Editorial Group reviews the complete package with product and market forecasts, critical industry trends, threats and opportunities, competitive strategies and market share determinations.

## ***TriMark Publications Report Research and Data Acquisition Structure***

The general sequence of research and analysis activity prior to the publication of every report includes the following items:

- Completing an extensive secondary research effort on an important market sector, including gathering all relevant information from corporate reporting, publicly available databases, proprietary databases, direct meetings and personal interviews with key personnel.
- Formulating a study outline with the assigned writer, including important items:
  - Market and product segment grouping and evaluating their relative significance.
  - Key competitors' evaluations including their relative positions in the business and other relevant facts to prioritize diligence levels and assist in designing a primary research strategy.
  - End-user research to evaluate analytical significance in market estimation.
  - Supply chain research and analysis to identify any factors affecting the market.
  - New technology platforms and cutting-edge applications.
- Identifying the key technology and market trends that drive or affect these markets. Assessing the regional significance for each product and market segment for proper emphasis of further regional/national primary and secondary research.
- Launching a combination of primary research activities including two levels of questionnaires, executive-direct focused, company-specific and region-specific communications to qualified and experienced senior executives worldwide.
- Completing a confirmatory primary research assessment of the report's findings with the assistance of Expert Panel Partners from the industry being analyzed.

## **1.7 Executive Summary**

The global companion diagnostics market was estimated to be valued at \$ [REDACTED] in [REDACTED]. It is anticipated that the global companion diagnostics market will have increased in market value to \$ [REDACTED] by [REDACTED] representing a CAGR of [REDACTED]%. This is one of the fastest sub-industries in hyper-growth molecular diagnostic market and many industry observers believe that this growth rate can even be conservative.

Personalized medicine is the ability to determine an individual's unique molecular characteristics and to use those genetic distinctions to diagnose more finely an individual's disease, select treatments that increase the chances of a successful outcome and reduce possible adverse reactions. Personalized medicine also is the ability to predict an individual's susceptibility to diseases and thus to try to shape steps that may help avoid or reduce the extent to which an individual will experience a disease. The predictive tests referred to as companion diagnostics are used to determine a condition of use for a therapeutic drug or biological product, and assure that the effectiveness of the associated therapeutic or biologic when used with the approved companion diagnostic is in accordance with the therapeutic label.

Companion diagnostics have ushered in a new era of personalized medicine, to help personalize the treatment for an individual patient. Predictive companion diagnostics determine which patients will respond to a proposed therapeutic treatment, the appropriate dose, or those at risk for specific drug related adverse events. Use of companion diagnostics can help to evaluate a patient's response to treatment over time in order to enable changes in dosage or treatment schedule. In addition, given that the development of one single drug is now a [REDACTED] year process estimated to cost over \$ [REDACTED], with a success rate of [REDACTED] the emergence of companion diagnostics has become a major development in helping to improve the efficiency and reduce costs during the process of drug discovery and development.

The drug development costs associated with clinical trials, which represent over [REDACTED]% of the overall cost of research and development (R&D), for the pharmaceutical discovery have tripled in the last [REDACTED] years. There is no doubt that the use of CDx in adaptive trials can slow down, if not reverse, this trend. While traditional trials enrol thousands of patients at different points of the disease spectrum, scattered across multiple geographical sites, adaptive trials involve small cohorts of patients selected upon their responsiveness to the drug, and allow for the molecular characterisation of patients before the initiation of the costly Phase III trials. Smaller, shorter, and hence cheaper than traditional trials, CDx-based adaptive trials are also more likely to result in a marketed therapy, which makes them more cost-effective than their traditional counterparts. According to Price Waterhouse Coopers (PWC), in [REDACTED], [REDACTED]% to [REDACTED]% of Phase II clinical trials incorporated pharmacogenetics; this number is thought to be even higher in oncology.<sup>1</sup>

- [REDACTED]% of existing drug programs have a CDx test associated.
- [REDACTED]% to [REDACTED]% of drugs in Phase III have a CDx association.

Furthermore, PWC outlined six trends that will change the way drugs are manufactured and distributed. The first of these was focused on how health reform shifts emphasis from product features to patient outcomes. Hence, PWC believes that the government's emphasis on health outcomes as a basis for payments will require pharmaceutical companies to not only manage the manufacturing and distribution of medicines and companion diagnostics, but also to combine product offerings with data and supplemental services that add value through improved outcomes and efficiencies. This predication emphasizes the importance of companion diagnostics and how they will play a crucial role in the pharmaceutical industry as well as healthcare reform. Pharma and diagnostic companies are being forced to change their business models both internally and in partnerships. The regulatory agencies may need to create new structures/categories to deal with the combination of therapeutics and diagnostics.

### ***Market Size and Forecasts for Companion Diagnostic Tests for Cancer Therapeutics***

A near-term market opportunity for cancer companion diagnostic tests exists in drug selection for cancer therapy. This is where cancer biomarkers can impact the drug selection for therapeutic treatment. The classic example here is screening for human epidermal growth factor receptor 2 (HER2)/neu over-expression before using Herceptin® in breast cancer therapy. A specific example of a companion diagnostic test developed for a new drug and used in the setting of personalized medicine is the use of companion diagnostic tests for UGT1A1 gene activity designed to reduce possible patient toxicity for irinotecan.

The demand for new tests that are an aid to prognosis and recurrence risk in several prevalent cancers, such as breast and colon cancer, has led to the introduction of several new cancer biomarker products. TriMark sees these new cancer biomarkers adding several hundred million dollars to the market value of this testing sector within the next five years. In addition, earlier in the drug development chain, the use of biomarker companion diagnostic tests will have an immediate impact on toxicology and metabolism studies.

Dozens of biotech companies are competing with one another and seeking collaborations with big pharmaceutical companies. Although the technology in these companies is still primarily in the research phase, some groups have demonstrated proof-of-concept for companion diagnostic technologies in animal and human models. Those

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<sup>1</sup>Price Waterhouse Coopers, report, "The New Science of Personalized Medicine: Translating the Promise into Practice," (October 2009).

companies that ultimately control the rights to cancer biomarkers and their uses will become dominant players. Companies that conduct biomarker-based drug discovery and product development will achieve the greatest value.

### ***Companion Diagnostics***

Co-development of molecular diagnostics and targeted therapeutics has already been proven to be a successful strategy in the development of novel anti-cancer drugs such as Gleevec®. Adoption of biomarker development in clinical research provides great opportunities to identify patient subpopulations with differential drug responses and to uncover the underlying mechanisms. These data could help to explain if clinical trials of new drugs are adequate and offer the possibility of creating a clear prescription path based on predictive biomarkers.

Potential benefits of biomarkers as companion diagnostics include:

- Streamlining drug discovery programs.
- Providing a target for therapy.
- Identifying potential responders to a drug.
- Identifying individuals at risk for adverse events.
- Monitoring response to drug therapy.

Utility of biomarkers as companion diagnostics to drug development:

- For screening, diagnosis and prognosis:
  - Discover candidate biomarkers with enabling technologies.
  - Qualify biomarkers with acceptable sensitivity/specificity.
  - Monitor cancer chemotherapy with biomarkers.
- For therapy efficacy:
  - Verify the impact of drugs on novel targets/pathways.
  - Model pharmacokinetics/pharmacodynamics (PK/PD) for optimal biological dose determination.
  - Evaluate molecular response as an early clinical efficacy read-out.

For prediction of therapy response:

- Increase drug development predictability.
- Explore and confirm biomarkers/therapeutics in clinical trials.
- Give the right drug to the right patients at the optimal dose.

Some of the current companion diagnostic tests for cancer therapy:

- Epidermal growth factor receptor (EGFR) for colorectal cancer (CRC) and Camptosar (irinotecan).
- EGFR Express and Erbitux (cetuximab).
- HER2 and Herceptin.
- Myriad's TheraGuide 5-fluorouracil (FU).
- TheraScreen: EGFR29.
- K-RAS mutation detection kit.

The most notable advance in the past five years has been the development of molecularly targeted anti-cancer therapies, with the first approved agent in this disease category being cetuximab. Others undoubtedly will follow.

### *Companion Diagnostics and Personalized Medicine*

Genomics-based, molecular diagnostic profiling is one of the key tools for making personalized medicine a reality using well-established and reliable methods for the detection of genetic variations and single nucleotide polymorphisms (SNPs). SNPs are variations in a DNA (deoxyribonucleic acid) sequence that occur when a single nucleotide (A, T, C or G) in the sequence is altered. Personalized medicine offers the benefits of being able to:

- Select the optimal therapy—based on the presence/absence of the molecular markers that the drug is targeting or that could cause a drug-drug interaction. For example, Herceptin and the presence of HER2 marker, or Gleevec and the presence of the Bcr-Abl protein.
- Reduce adverse drug reactions—based on the polymorphic status of the patient’s cytochrome P450 genes and/or other genes that cause drug toxicity. For example, polymorphisms in UGT1A1 and adverse response to irinotecan, or warfarin and variations in CYP2C9 and a vitamin K metabolizing enzyme (VKORC1).
- Increase patient compliance—reduced or non-existent side-effects or adverse events make it easier for patients to complete the clinical trial or undergo extended drug therapy.
- Reduce time, cost and failure rate of clinical trials:
  - Use of pharmacogenomic data allows the clinical trial sponsor to “enrich” the clinical trial patient pool through better selection, enrollment and stratification of patients.
  - Pharmaceutical companies could potentially save up to \$ [REDACTED] per drug by incorporating pharmacogenomic tools into clinical trials.
  - Pharmacogenomic testing-based clinical trials can save time by being terminated early by the FDA due to success. For example, the Phase III clinical trial for GlaxoSmithKline’s Tykerb was terminated early due to remarkable efficacy in treating a defined subset of patients with breast cancer.
- Rescue drugs that are failing in clinical trials or performing poorly in the market:
  - *Herceptin*: Although clinical trials failed to show any efficacy in the general breast cancer population, Genentech re-analyzed the clinical data and correlated efficacy with the presence of the HER2 marker, thereby rescuing Herceptin, currently a blockbuster drug with \$ [REDACTED] in sales.
  - *Iressa*: Although Iressa is approved for non-small-cell lung cancer (NSCLC), it is effective in only a small subset of patients. AstraZeneca is developing a genetic test to select patients who would benefit from Iressa.
- Shift emphasis from reaction to prevention—Myriad Genetics’ BRACAnalysis identifies the hereditary propensity for breast and ovarian cancer development, allowing the patient to work with her doctor to incorporate preventative measures.

A key area of unmet market need is adverse drug reactions (ADRs)—the fifth leading cause of mortality in the U.S. Personalized medicine seeks to identify and mitigate these ADRs. The currently practiced areas in personalized medicine include:

- HER2/neu oncogene as a biomarker for breast cancer.
- AmpliChip™ cytochrome P450 (CYP450) for stratifying respondent/non-respondent populations.
- Targeting drugs for human immunodeficiency virus (HIV) based on the genotype of the virus strain.
- Management of hepatitis C virus (HCV)-infected patients undergoing antiviral therapy.

The data demonstrate the following trends:

- Current impact by theranostics (*i.e.*, personalized medicine) is on the following therapeutic areas:
  - Breast cancer.
  - Leukemias/hematological cancers.
  - HIV infection/AIDS.
  - Drug toxicity/ADRs.
- Long-term impact—more than two years away—on the following therapeutic areas:
  - Neurodegenerative diseases (such as Parkinson’s disease and Alzheimer’s disease).
  - Schizophrenia, depression and other psychological disorders.
  - Other cancers/oncology sectors.
  - Cardiovascular diseases.

These data are clear in that they segment the various therapeutic areas into two classes:

- Current or near-term market impact by theranostics/personalized medicine.
- Long-term market impact by theranostics/personalized medicine.

Areas that the respondent pool indicated as “low hurdles” for personalized therapeutics development:

- Breast cancer.
- Leukemias/hematological cancers.
- Other cancers/oncology.

Areas where “large hurdles need to be addressed”:

- Neurodegenerative diseases (such as Parkinson’s disease, Alzheimer’s disease).
- Schizophrenia, depression and other psychological disorders.
- Cardiovascular diseases.

Areas that were split approximately evenly:

- HIV infection/AIDS.
- Drug toxicity/ADRs.

Changes in pharma business models are reported on a regular basis. R&D expenditures, mass layoffs and the much feared end of the “blockbuster” era are driving both the pharma and diagnostic industries to change their paradigms. New stakeholders such as Pharmacy Benefit Managers (PBM)’s and Clinical Laboratory Improvement Amendments (CLIA) lab diagnostic models, which have evolved over the past few years, are adding to the rapid rate of change in the industry. New regulatory and reimbursement models are needed to deal with the future of a more intertwined strategy between pharma and diagnostics. The question of value and cost (of new therapeutics) will continue to be a source of debate.

Companies well positioned for the shift to personalized medicine will be the ones with companion diagnostics franchises. Specifically, IVD Kit manufacturers will see a shift in their contribution in revenue from traditional clinical laboratories such as Lab Corp, Quest Diagnostic to Pharma.

Not all companies can easily shift from a company that sells diagnostic kits and instruments to reference labs to being a major companion diagnostic player. Typically, diagnostic companies need the right technology, relevance in the space, and have management with relationships in place.

Companion Diagnostics offers a set of tools that address many of the problems that pharmaceutical companies must address, particularly with the advent of personalized medicine and profound changes in long used models of pharmaceutical development. In this report, we discuss the various stakeholders involved in companion diagnostics:

- Pharmaceutical companies.
- Diagnostic companies.
- Patients and consumers.
- Physicians and healthcare providers.
- Third party payers.
- Clinical testing laboratories.
- Regulatory agencies.

In particular, the focus is on how diagnostic companies and pharmaceutical companies are dealing with the changes in their industries to create product value in co-development of companion diagnostics for therapeutic drugs.

Key companies in the companion diagnostics market include QIAGEN N.V., Abbott Laboratories, Life Technologies (now Thermo Fisher), Illumina, Genomic Health, Inc., GE Healthcare Ltd., Roche Holdings AG, Agilent Technologies, Inc. (Dako), Ventana and Agendia N.V.