Growth and Innovation in the Healthcare Industry

Trends, Opportunities, and Challenges

January 17, 2014
# Healthcare—What Survey Participants Identified as Hot Topics

<table>
<thead>
<tr>
<th>Rank</th>
<th>Market Topic</th>
<th>% of Respondents Nominating as Hottest Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mobility in Healthcare/mHealth</td>
<td>51%</td>
</tr>
<tr>
<td>2</td>
<td>Cloud in Healthcare: Current Issues</td>
<td>45%</td>
</tr>
<tr>
<td>3</td>
<td>Regulatory Environments</td>
<td>44%</td>
</tr>
<tr>
<td>4</td>
<td>Cancer Market Outlook</td>
<td>39%</td>
</tr>
<tr>
<td>5</td>
<td>Remote Monitoring</td>
<td>38%</td>
</tr>
<tr>
<td>6</td>
<td>Drug Delivery Market</td>
<td>35%</td>
</tr>
<tr>
<td>7</td>
<td>Patient and Consumer Engagement</td>
<td>32%</td>
</tr>
<tr>
<td>8</td>
<td>Healthcare Dashboards</td>
<td>31%</td>
</tr>
<tr>
<td>9</td>
<td>Electronic Health Records/Electronic Medical Records</td>
<td>31%</td>
</tr>
<tr>
<td>10</td>
<td>Growth Drivers Impacting the Medical Devices Segments</td>
<td>30%</td>
</tr>
<tr>
<td>11</td>
<td>Drug Discovery Research Outsourcing Market</td>
<td>28%</td>
</tr>
<tr>
<td>12</td>
<td>Homecare Market Trends - Demand, Addressable Segments, Infrastructure, and Policy</td>
<td>25%</td>
</tr>
<tr>
<td>13</td>
<td>Video Telemedicine</td>
<td>24%</td>
</tr>
<tr>
<td>14</td>
<td>Cardiovascular Therapeutics - Dyslipidemia/CHD Prevention</td>
<td>24%</td>
</tr>
<tr>
<td>15</td>
<td>Changing Profiles of Influencers and Decision-makers Impacting Medical Device Choice</td>
<td>22%</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Healthcare Policy Issues Addressing Quality, Access, Cost

- Incentive payments
- Accountable Care Organization
- Medical Home
- Population health management
- Patient Empowerment

Moving the needle gets harder

FDA Regulation of Mobile Health (Second Edition)

Genetic Testing Improves Lives

Telehealth

China's Rural Healthcare Reform

70% Live in rural China

$124 Billion To improve healthcare by 2020

1,700,000 Training required for rural network healthcare professionals

Improving Quality

F R O S T & S U L L I V A N
Telehealth and mHealth
Telehealth Industry—Percent Revenue Forecast by Vertical Market

Key Takeaway: Remote monitoring is the oldest and largest of the three subsegments, with sizable contributions from both the professional and consumer sectors.

Telehealth Industry: Percent Revenue Forecast by Vertical Market, North America, 2012

- **Remote Monitoring**: 71.1%
- **Video Telemedicine**: 11.4%
- **mHealth**: 17.5%

Market Revenue, 2012: $2.39 Billion

- $430M 2012
- $280M 2012
- $1.74B 2012

Note: Does not include general infrastructure or managed services. All figures are rounded. The base year is 2012. Source: Frost & Sullivan analysis.
Consumers Believe mHealth Will Improve Convenience, Quality, and Cost

Surveys of consumers show an increasing interest and enthusiasm for using mobile devices to engage with healthcare providers.

In the next three years, patients agree that...

<table>
<thead>
<tr>
<th>Percentage</th>
<th>mHealth Application/Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>52%</td>
<td>mHealth applications/services will make healthcare substantially more convenient for me</td>
</tr>
<tr>
<td>48%</td>
<td>mHealth applications/services will improve the quality of healthcare I receive</td>
</tr>
<tr>
<td>46%</td>
<td>mHealth applications/services will substantially reduce my overall healthcare costs</td>
</tr>
</tbody>
</table>

Top drivers for patients to begin using or increase using mHealth -

- Ability to access by my healthcare providers more conveniently/effectively: 46%
- Ability to reduce my own healthcare costs: 43%
- Ability to take greater control of my health: 32%
- Ability to obtain information that is difficult or impossible for me to obtain from other sources: 28%
- Ability to access better quality healthcare: 25%

Source: The Economist Intelligence Unit (2012) and PWC: Emerging mHealth: Paths for Growth (2013) and Frost & Sullivan
Which Telehealth Markets Will Have the Highest Impact on Healthcare Industry?

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>% Rating High + Very High Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Healthcare and Disease Management</td>
<td>93%</td>
</tr>
<tr>
<td>Remote Physician / Specialist Services</td>
<td>91%</td>
</tr>
<tr>
<td>Telemental Health</td>
<td>73%</td>
</tr>
<tr>
<td>Video Diagnostic Teleconsultation</td>
<td>66%</td>
</tr>
</tbody>
</table>

Base: Telehealth Respondents (ATA 2013; N=63)
Q. Please rate the following telehealth markets on their level of overall impact for healthcare industry over the next five years.
mHealth The Most Likely Additions To Telehealth Services

Users’ Responses Regarding the Most Likely Additions To Their Telehealth Services, North America, 2012–2015

- **mHealth**: 23%
- **Remote Consultation (Non-specialist…)**: 10%
- **Telerehabilitation**: 10%
- **Teleimaging**: 4%
- **Telenursing**: 7%
- **Telestroke/Neurology**: 10%
- **Teleimaging**: 12%
- **Telecardiology**: 8%
- **Post-discharge Remote…**: 12%
- **Other Selection***: 5%

*Other Selection was a write in answer.

Base: Telehealth User responses (ATA 2012; N=83); Note: Multiple Mention Response
Q. What telehealth service are you looking to add in the next 3 years? (check all that apply)

Source: Frost & Sullivan.
Next Steps for mHealth

Adoption
- Personal devices
- Professional solutions

Regulation
- FDA guidance finally released
- Impact to date on funding

Business model success
- Waiting for reimbursement?
- Will ACOs be the tipping point?
- Sustainable consumer models?

Value
- Clinical efficacy still unproven?
- Long term value to individuals?
Adoption and Impact of Cloud Technology
Confluence of Change in HC Driving Shift Toward the Cloud

- Targeted Care
  - Data creation and storage
  - Information sharing
  - Information access
  - Impact of genomic data

- Prevention
  - Costs

- Cost Control

- HC Innovation
Confluence of Change in HC Driving Shift Toward the Cloud

- Data creation and storage
- Deployment speed
- Information sharing
- Scalability
- Information access
- HCIT personnel shortages
- Impact of genomic data

- Targeted Care
- Prevention
- Cost Control
- HC Innovation

- Data silos
- Costs
Cloud Solutions Are Aligned With Healthcare Shifts

Collaboration in research means moving partners to the data

Cloud allows scale in storing big data

Care collaboration and transitions in care require flexible access and merged data sets

Cloud is a key enabler of mobilizing data for use by consumers and enterprise users

Source: Frost & Sullivan analysis
Healthcare Transformation Will Require Shared Access

With 5,400 petabytes of raw data from next generation sequencing to be stored by 2018, cost effectively storing and making this data accessible to clinicians and researchers will require cloud solutions

Not if, but when…

“Within ___ years, it will be considered malpractice to treat a patient without consideration of their individual –omics data”

Source: Frost & Sullivan analysis
### Cloud Solutions Can Help Address HCIT Challenges

<table>
<thead>
<tr>
<th>DATA</th>
<th>INTEGRATION</th>
<th>ANALYTICS</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>We are creating millions of useful data points, from a wide variety of sources…</td>
<td>…But the data is provided in separate solutions which prevent getting a holistic view of the patient</td>
<td>Predictive analytics has arrived…Natural language processing will become a commodity…</td>
<td>Analytics alone cannot drive process change. Analytics ideally need to create actions, with prompts and information embedded in workflows (not in stand-alone platforms)</td>
</tr>
</tbody>
</table>

**DATA** → **INTEGRATION** → **ANALYTICS** → **ACTION**
Trust Among Consumers

According to a recent survey of 6,000 people in 10 countries (sponsored by Cisco)

74% of patients are comfortable having their health records available in the cloud, assuming adequate security (excluding Germany and Japan)

Consumers view benefits as outweighing costs or risks of storing health information in the cloud – at least to the degree they understand the risks
Big Data...Briefly
Leveraging Big Data To Reduce Healthcare Costs

Natural Language Processing

Promote Predictive Analytics
Cues to intervene Patient engagement

Insurer
- Biometric sensors
- Claims data
- Registration forms

Hospital
- Published research
- EHR
- Emails, text messages

Physician’s office
- mHealth apps
- Remote Monitoring
- Photos, video

Home
- mHealth apps
- Remote Monitoring
- Photos, video

Pharmacy
- Imaging files
- Social media

Imaging Center
- Clinician notes
- Discharge summaries
- Genetic information
Types of Analytics Applied in Healthcare Big Data Solutions

What Happened?

More Traditional Healthcare Analytics

New Analytics Tools Needed By ACOs

COMPARATIVE ANALYTICS

PREDICTIVE ANALYTICS

DESCRIPTIVE ANALYTICS

PRESCRIPTIVE ANALYTICS

What Will Happen?

Source: Frost & Sullivan
Vendor Consolidation, Startups and Large IT Market Entrants

Software, Platform, Integration, Customization, Consulting, Services
Opportunities to Leverage Big Data

New Data Sets, New Tools, New Business Models

- Clinical Decision Support (*Accelerate dissemination of research findings*)
- Individualization of Treatment and Interaction
- Comparative Effectiveness and Outcomes Research
- Clinical Trial Design
- Direct-to-Consumer Analytics
- Microsegmentation of Cohorts and Consumers

Source: Frost & Sullivan
Consumer Engagement
Consumerization

Increased individual financial responsibility

Quantified self

Behavioral economics

Social networks and online health resources

Source: Frost & Sullivan
Patients Bring A Consumer Mindset To Healthcare Interactions

“We have not been able to accelerate to that next level of providing that customer experience that people come to expect when interfacing with a hotel or other industry”

Retail & Finance
- Customer service focus
- Comparison shopping
- Self-service, online shopping
- Special offers

- Real time info at point of use
- Info comes to consumer
- High levels of interaction and Q&A online and in person

Transportation & Distribution
- Proactive outreach to stimulate consumer response
- One stop shop
- Anytime, anywhere service

- 24 / 7 / 365 support via phone, chat, etc.
- Direct outreach to consumers based on consumer preferences
- One stop resolution or call back

Source: Frost & Sullivan.
What Are Consumers Looking For From Healthcare Engagement?

- Breaking down “bricks and mortar” approach to healthcare
- 24/7 access to personal health information via web portal
- Ability to communicate with providers via email
- Test results and other data delivered via mobile devices
- Online scheduling and bill pay
- E-visits

- Clear explanations of condition
- Content to help patients understand health status
- Shared-decision making
- “In the loop” – treat patient like a member of the healthcare team
- “I want all my information in one place so my community has access”

- Preference-based care vs. evidence-based care
- Customized approach to communication
- “Respect my wishes for privacy and security”

Source: Frost & Sullivan
Social Networks: Where Patients Are Empowered

Patients flock to sites to share experiences and learn from others with similar conditions.

What do people discuss online regarding health conditions?
- Symptoms
- Treatment options
- Medications, side effects, etc.
- Doctor-patient interaction
- Emotional support

What health conditions are discussed?
- Breast cancer
- Depression
- Bipolar disorder
- Arthritis
- Cardiovascular disease
- Fibromyalgia
- Alzheimer’s disease

Source: NM Incite, Frost & Sullivan analysis.
Consumer Attitudes Towards Care Delivery Are Changing

According to a recent survey of 6,000 people in 10 countries (sponsored by Cisco)

76% of patients say access to care is more important than physical human contact with their care provider

70% of patients would trust an automated device to provide a diagnosis and determine whether or not they needed to see a doctor

87% of patients would trade off time, money and/or convenience to be treated at a perceived leading healthcare provider, and gain access to trusted care and expertise
### Two Views of the Provider–Patient Relationship

<table>
<thead>
<tr>
<th>Practitioner centered</th>
<th>Patient centered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information giving</td>
<td>Information exchange</td>
</tr>
<tr>
<td>Authoritarian (parent-child)</td>
<td>Shared decision making, Cooperation</td>
</tr>
<tr>
<td>Dictated behavior</td>
<td>Negotiated behavior</td>
</tr>
<tr>
<td>Compliance</td>
<td>Adherence</td>
</tr>
<tr>
<td>Resistance is bad</td>
<td>Resistance is information</td>
</tr>
<tr>
<td>Persuade, Manipulate</td>
<td>Understand, Adjust, Accept</td>
</tr>
<tr>
<td>We save the patient</td>
<td>Patient saves themselves</td>
</tr>
</tbody>
</table>

Source: Steve Basiago, Walgreens Health Services
Multi-Channel Approaches Add Value In Patient Engagement

- More interactions
- More often
- Engagement more critical

- Personalization in interaction
- Approach depends on engagement goal
- Automate, escalate, engage

Patient experience changes over time: optimism, acceptance, knowledge, social support, etc.

Source: Frost & Sullivan
Opportunities to Address Empowered Patients

- Consumer is addicted to repairative care → Value of preventative care not sold
- Health literacy is low, anxiety regarding diagnosis
- Not just data, what’s the meaning
- Information provided like a financial statement
  - Here’s where you started the month...this month’s activities...here’s where you are now

Content that is individualized + personalized
Patient ownership of data
Packaged episode of care bundle, customized and purchased online
Network, Collaborate

Combine patients to create consumer power
Direct-to-consumer analytics
Research and market products designed for specific types of patients
Gaming, Rewards, Motivation

Source: Frost & Sullivan analysis.
Medical Device Connectivity
Interoperability Platform

Point-to-point Connectivity enables Standardized Electronic Records, Remote Healthcare and Diagnostics, Remote Clinical Care, Electronic Medical Records, and Mobile Healthcare.
## Key Configuration Considerations

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Categorizing Devices</strong></td>
<td>Categorization of devices based on use and data transmission. Episodic devices obtain a single set of measurements at a fixed time. Continuous tracking devices, are continuously capturing data and device performance information, some are stand alone while others can transmit across an enterprise network.</td>
</tr>
<tr>
<td><strong>System Deployment</strong></td>
<td>Deployment is tied to how the device fits in the clinical workflow. Does it require a point of care component, or is central station monitoring sufficient.</td>
</tr>
<tr>
<td><strong>Patient Association</strong></td>
<td>Patient association is critical to effective implementation of connectivity solutions. Initiation can either be patient centric or location centric. Ensuring tracking across the workflow and proper patient disassociation is of equal importance.</td>
</tr>
<tr>
<td><strong>Data Validation and Security</strong></td>
<td>Synchronized time stamping, security from malware, downtime protocols, and integration of data with an EMR are among the most challenging issues to adoption of interoperability systems.</td>
</tr>
<tr>
<td><strong>Change Management</strong></td>
<td>Protocols for change management as devices get replaced or upgraded are important to factor into the network, and consider contingencies of how changes to one might affect another. It requires coordination from both institutions and OEM’s.</td>
</tr>
</tbody>
</table>
Spheres of Influence Lack Alignment

Key Supporting Organizations

- Clinicians
- Patients
- Professionals in leading HC Organizations
- System Safety Experts
- Manufacturing Representatives
- Standards Setting Organizations
- Regulatory Bodies
- Research & Academic Institutions
- Patient Safety Advocates
- Payers

Supporting Organizations for Interoperable HC Systems
Available Third Party Solutions – Qualcomm Life

- With the acquisition of Healthy Circles and investment in PracticeFusion, Qualcomm Life is expanding capabilities for data integration and potentially analytics.
Available Third Party Solutions – iSirona and Capsule Technologies

www.isirona.com
<table>
<thead>
<tr>
<th></th>
<th>Capsule Technology</th>
<th>Cardiopulmonary Corp.</th>
<th>CareTrends</th>
<th>iSirona</th>
<th>Nuvon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishing connectivity</td>
<td>Proprietary component (Neuron with Status)</td>
<td>Proprietary component (multiport bridge)</td>
<td>PC (with CareTrends Client)</td>
<td>PC (with iCS)—typically fanless PC</td>
<td>Proprietary component (IDM-MG 3000)</td>
</tr>
<tr>
<td>Patient association location</td>
<td>POC proprietary component or EMR (</td>
<td>POC proprietary component</td>
<td>POC PC*</td>
<td>Within the EMR, vendor application, or ventilator (depending on how system is configured at time of installation)</td>
<td>EMR/ADT (location-centric, so association occurs when patient is assigned a location)</td>
</tr>
<tr>
<td>and application</td>
<td>depending on how system is configured at</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>time of installation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation of data</td>
<td>Within EMR</td>
<td>Within POC proprietary component or within EMR (depending on how system is configured at time of installation)</td>
<td>Within CareTrends Client software on POC PC or within EMR (depending on how system is configured at time of installation)</td>
<td>Within EMR or vendor application (depending on how system is configured at time of installation)</td>
<td>Within EMR**</td>
</tr>
<tr>
<td>Patient disassociation</td>
<td>Automatic or manual</td>
<td>Automatic or manual</td>
<td>Manual (when user stops data collection via the software)</td>
<td>Automatic or manual</td>
<td>Automatic or manual (depending on EMR capabilities)</td>
</tr>
<tr>
<td>Summary</td>
<td>Good for applications in which bedside PC</td>
<td>Good for applications in which bedside PC workstation is not available or planned; allows flexibility in terms of patient association and data validation</td>
<td>Requires PC at POC; allows flexibility in terms of data validation</td>
<td>Requires PC at POC and may require an additional workstation for patient association (to access EMR or vendor application); allows flexibility in terms of patient association and disassociation and data validation</td>
<td>Good for applications in which bedside PC workstation is not available or planned; typically supports location-centric association, and patient disassociation and data validation occur via the EMR</td>
</tr>
</tbody>
</table>

* The POC PC can be any existing mobile workstation and can be used to access vendor-specific applications as well as the EMR and other clinical information systems.

** The vendor plans to release the CFS later this year; this product will allow users to view and validate the data within the VEGA system before transfer to the EMR.
Healthcare Market Outlook
### Personalization, Communication, Decentralization, Collaboration

<table>
<thead>
<tr>
<th>From...</th>
<th>...To</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Size Fits All</td>
<td>Personalized/Precision Medicine</td>
</tr>
<tr>
<td>Fragmented, One-way</td>
<td>Integrated, Two Way</td>
</tr>
<tr>
<td>Provider Centric</td>
<td>Patient Centric</td>
</tr>
<tr>
<td>Procedure-based</td>
<td>Bundled, Capitated</td>
</tr>
<tr>
<td>Centralized, Hospital-based</td>
<td>Decentralized, Community-based</td>
</tr>
<tr>
<td>Fragmented, Specialized</td>
<td>Collaborative, Shared Information</td>
</tr>
<tr>
<td>Based on Individual Expert</td>
<td>Based on Protocols and Analytics</td>
</tr>
<tr>
<td>Treating Sickness</td>
<td>Preventing Sickness (Wellness)</td>
</tr>
</tbody>
</table>

**Source:** Frost & Sullivan
Care Delivery Transformation: From Acute Care to Prevention
Track, Predict, Intervene, Manage

- Early identification and prevention
- New models of care delivery to improve:
  - collaboration among providers
  - patient knowledge, self-help and health
- Increase intervention
  - Higher touch at lower cost

Size of Impacted Population
- Healthy/“Worried Well”
- “At Risk”
- Undiagnosed
- Chronically Ill Managed
- Chronically Ill Unmanaged
- End of Life

Prevention/Wellness

Goal:
- Keep People Healthy Longer

Goal:
- Manage or Mitigate Risk

Goal:
- Diagnose and Reduce Treatment Delay

Goal:
- Move to More Interaction and Self-Mgmt

Goal:
- Manage

Goal:
- Quality of Life

Source: Frost & Sullivan
### Pharmaceuticals—Business Outlook

<table>
<thead>
<tr>
<th>Types of Companies</th>
<th>Last Decade</th>
<th>Current Decade</th>
<th>Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>Approximately $328 billion (pharma) (total drugs market - $353 billion)</td>
<td>Approximately $766 billion (pharma) (total drugs market - $830 billion)</td>
<td>Approximately $1,350 billion (pharma) (total drugs market - $1,487 billion)</td>
</tr>
<tr>
<td><strong>Main Focus</strong></td>
<td>Focus was on better screening of drug candidates and faster market launch because the clinical development process is risky and lengthy.</td>
<td>Commercialization of drug candidates is the main focus. Non-core competencies, including activities such as drug discovery, drug development (early stage clinical development), and manufacturing, are being outsourced.</td>
<td>Convergence with drug discovery, drug development, and drug delivery</td>
</tr>
<tr>
<td><strong>Market Dynamics</strong></td>
<td>M&amp;As and alliances with pharmaceutical firms</td>
<td>M&amp;As and alliances with biotech firms</td>
<td>M&amp;As and alliances with drug discovery, drug development, and drug delivery companies</td>
</tr>
<tr>
<td></td>
<td>Very high ROI for successful drug candidates (those with successful market launch and positive clinical trial data on efficacy and safety), for example, Pfizer’s Lipitor (Atorvastatin)</td>
<td>Acquisition, and alliances with drug discovery, drug development companies, and academic institutions reduces the growing R&amp;D productivity gap for the pharmaceutical companies. De-risking of R&amp;D and drug development with cost-effective model is the main driver for the growth of pharmaceutical firms.</td>
<td>Focus is on less competitive, niche disease segments, and; thereby, shifting away from the blockbuster model.</td>
</tr>
<tr>
<td><strong>Types of Companies</strong></td>
<td>Big pharma, small and medium pharmaceutical companies, CMOs, CROs, generics</td>
<td>Big pharma, biopharmaceutical companies, small and medium pharmaceutical firms, CROs, CMOs, generics</td>
<td>Integrated companies</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Biotechnology—Business Outlook

<table>
<thead>
<tr>
<th>Last Decade</th>
<th>Current Decade</th>
<th>Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approximately $25 billion</td>
<td>Approximately $63 billion</td>
<td>Approximately $136 billion</td>
</tr>
<tr>
<td><strong>Main Focus</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main focus was on drug discovery, leveraged by a healthy funding scenario.</td>
<td>Focus is on niche disease segments such as cancer and autoimmune diseases.</td>
<td>Personalized medicine - more efficient drug development process, based on the research on disease pathophysiology and genetic risk factors</td>
</tr>
<tr>
<td><strong>Market Dynamics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The high growth rate and increasing number of licensing and collaboration deals in the biotech industry attracted investments, not only from pharmaceutical companies but also from investment banks and VCs due to the high future prospects of the industry. Moreover, increased funding and support from the government were the other key drivers for growth of the biotechnology industry.</td>
<td>Lucrative disease segments with premium pricing opportunities such as oncology are the main growth driver. Success of various monoclonal antibodies (mAb) such as Rituxan/MabThera (rituximab) and Avastin (bevacizumab) is a key impetus for growth.</td>
<td>Potential high ROI on personalized medicine will be the main growth driver.</td>
</tr>
<tr>
<td><strong>Types of Companies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug discovery, drug development companies, CROs, CMOs, and biotech firms</td>
<td>Drug discovery, biopharmaceutical companies, biotech firms, CROs, CMOs, and biosimilar companies</td>
<td>Integrated companies</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
## Clinical Diagnostics—Business Outlook

<table>
<thead>
<tr>
<th>Last Decade</th>
<th>Current Decade</th>
<th>Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>$24,504.2 Million</td>
<td>$40,208.3 Million</td>
</tr>
<tr>
<td><strong>Main Focus</strong></td>
<td>Immunochemistry and clinical microbiology were the largest segments mainly because the human genome had just been sequenced and; therefore, molecular techniques were under development or on their way to the market. Immunochemistry and culture-based techniques were the only available technologies.</td>
<td>As opposed to tests that needed to be scaled up to be performed at the central lab, tests now need to be scaled down to be performed at the point of care, but at the cost of a lab test. Molecular diagnostics are now recognised as a very effective alternative to culture-based and ELISA-based techniques.</td>
</tr>
<tr>
<td><strong>Market Dynamics</strong></td>
<td>There was need for a validated technique that could be scaled up to the volumes of central laboratories, which offered actionable results at economic costs. EIA and culture-based were best-suited at that time and; thus‘ were the most widely used techniques.</td>
<td>Need for speed and need at the point-of-care are the key drivers of today. Biomarkers-based diagnostics are driving growth in many segments, such as molecular diagnostics, point of care, and tissue diagnostics.</td>
</tr>
<tr>
<td><strong>Types of Companies</strong></td>
<td>EIA reagents and equipment suppliers and reagent suppliers for both EIA and culture techniques such as Abbott, Bio-Rad, Bayer, Roche, Beckman Coulter, bioMerieux, Sigma Aldrich</td>
<td>Diagnostic companies with multiple areas of focus include Roche, Siemens, J&amp;J, Abbott, Beckman Coulter, Bayer, bioMerieux, Sysmex, Alere, Becton Dickinson, Instrumentation Laboratory, Qiagen, Radiometer, and Gen-Probe.</td>
</tr>
</tbody>
</table>
## Medical Devices—Business Outlook

<table>
<thead>
<tr>
<th>Last Decade</th>
<th>Current Decade</th>
<th>Next Decade</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td>$153.40 Billion</td>
<td>$271.55 Billion</td>
</tr>
<tr>
<td><strong>Main Focus</strong></td>
<td>More emphasis on quality of treatment and cure because treatment time was never a constraint. Invasive procedures were the golden standard.</td>
<td>Faster diagnosis and prompt therapy along with patient safety using minimal invasive technologies</td>
</tr>
<tr>
<td><strong>Market Dynamics</strong></td>
<td>Consistently increasing number of chronic cardiovascular diseases led to most pertinent surgical intervention when absolutely required.</td>
<td>Improved diagnostic imaging capabilities coupled with advanced minimally invasive technologies has led to increased procedural volume and product uptake.</td>
</tr>
<tr>
<td><strong>Types of Companies</strong></td>
<td>Presence of individual imaging, devices, and pharmaceutical companies, for example, Johnson and Johnson, GE Healthcare, and Merck and Co.</td>
<td>Individual companies have started moving towards intersection, for example, BD and Novartis.</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Top 10 Global Healthcare Trends

2010 – 2020

Projected Impact on the Healthcare Industry

High Impact

Low Impact

Low

High

Certainty

Innovation vs. Knowledge

Drugs get Smarter

Power Patient Generation

Shift to Personalised Healthcare

Prevention Before Cure

Web: Power Patients Unite

Patients become Customers

Cyber Docs

Hospitals go Virtual

Devices become monitors, monitors become devices

Source: Frost & Sullivan
Three Big Predictions

1. As healthcare is geared towards a personalized medicine model, companion diagnostics will alter drug development and the commercialization process of drug candidates. Combining biomarkers and drugs will result in enhanced therapeutic efficacy and safety.

2. The healthcare and life sciences industry will consolidate further in this decade with many big pharma companies seeking alternatives to the blockbuster model.

3. The rise of new technologies capable of integrating medical devices into a connected platform enhances the functionality of devices, reduces the manpower burden, and minimizes errors.

Source: Frost & Sullivan
Healthcare Convergence
# Healthcare—Convergence with Other Industries

## Key Industries Tracked in Addition to Company’s Core Markets, 2013

<table>
<thead>
<tr>
<th>Industry</th>
<th>Cross-interest 1</th>
<th>Cross-interest 2</th>
<th>Cross-interest 3</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>A&amp;D</td>
<td>ICT 39%</td>
<td>A&amp;T 26%</td>
<td>EPS 20%</td>
<td>111</td>
</tr>
<tr>
<td>A&amp;T</td>
<td>EPS 25%</td>
<td>ICT 24%</td>
<td>EBT 9%</td>
<td>282</td>
</tr>
<tr>
<td>CMF</td>
<td>EPS 37%</td>
<td>A&amp;T 36%</td>
<td>EBT 27%</td>
<td>167</td>
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<tr>
<td>EPS</td>
<td>EBT 24%</td>
<td>A&amp;T 20%</td>
<td>IPC 18%</td>
<td>180</td>
</tr>
<tr>
<td>EBT</td>
<td>EPS 44%</td>
<td>ICT 26%</td>
<td>CMF 21%</td>
<td>57</td>
</tr>
<tr>
<td>HC</td>
<td>ICT 18%</td>
<td>CMF 15%</td>
<td>M&amp;I 8%</td>
<td>238</td>
</tr>
<tr>
<td>IPC</td>
<td>EPS 42%</td>
<td>A&amp;T 26%</td>
<td>CMF 26%</td>
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<tr>
<td>ICT</td>
<td>HC 23%</td>
<td>A&amp;T 19%</td>
<td>EPS 19%</td>
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</tr>
<tr>
<td>M&amp;I</td>
<td>A&amp;T 42%</td>
<td>EPS 38%</td>
<td>IPC 38%</td>
<td>26</td>
</tr>
</tbody>
</table>

A&D = Aerospace & Defence  
A&T = Automotive & Transportation  
CMF = Chemicals, Materials & Food  
EPS = Energy & Power Supplies  
EBT = Environment & Building Technologies  
HC = Healthcare  
IPC = Industry & Process Control  
ICT = Information & Communication Technology  
M&I = Measurement & Instrumentation

Source: Frost & Sullivan
Healthcare—Convergence with Other Industries

Key Areas of Technology and Business Model Convergence

Connected Health
- mHealth, Health Information Exchange Systems, Chronic Disease Management

Life Sciences
- Active Pharmaceutical Ingredients, Excipients and Intermediates, Drug Delivery, Device Coatings
- Robotic Diagnostics, Automation - Lab-on-Chip, LIMS, Robotic Surgery
- Valves, Heat Exchangers, Centrifuges, Dryers, Bioreactor

Advanced Medical Technology
- Supply Chain, Warehousing, Freight Forwarding Bulk Drugs, Chemicals, Biologics, and Finished Dosage, Cryostorage of Devices

Source: Frost & Sullivan
## Ranking of Mega Trends

*Health, wellness, and well-being is the highest ranked Mega Trend*

<table>
<thead>
<tr>
<th>Mega Trend</th>
<th>Overall</th>
<th>A&amp;D</th>
<th>A&amp;T</th>
<th>CMF</th>
<th>EPS</th>
<th>EBT</th>
<th>HC</th>
<th>IPC</th>
<th>ICT</th>
<th>M&amp;I</th>
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<tbody>
<tr>
<td>New Business Models: Value for Many</td>
<td>53%</td>
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<td>45%</td>
<td>47%</td>
<td>50%</td>
<td>46%</td>
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<td>48%</td>
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<td>Future of Mobility</td>
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<td>73%</td>
<td>37%</td>
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<td>Social Trends</td>
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<td>45%</td>
<td>37%</td>
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<td>Beyond BRIC: The Next Game Changers</td>
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<td>Connectivity and Convergence</td>
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<td>45%</td>
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<td>44%</td>
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<td>70%</td>
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<tr>
<td>Future Infrastructure Development</td>
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<td>Smart is the New Green</td>
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<td>35%</td>
<td>53%</td>
<td>55%</td>
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<td>18%</td>
<td>38%</td>
<td>25%</td>
<td>29%</td>
</tr>
<tr>
<td>Health, Wellness, and Well-being</td>
<td>31%</td>
<td>15%</td>
<td>18%</td>
<td>38%</td>
<td>12%</td>
<td>27%</td>
<td>81%</td>
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<tr>
<td>Urbanization: City as a Customer</td>
<td>29%</td>
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<td>Innovating to Zero</td>
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<td>25%</td>
<td>42%</td>
<td>26%</td>
<td>32%</td>
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<td>19%</td>
<td>21%</td>
</tr>
<tr>
<td>Bricks and Clicks</td>
<td>11%</td>
<td>10%</td>
<td>10%</td>
<td>10%</td>
<td>14%</td>
<td>12%</td>
<td>8%</td>
<td>9%</td>
<td>10%</td>
<td>7%</td>
</tr>
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