THE H IN HEALTHCARE OF 2025
THE FUTURE OF HEALTHCARE
The Times That Are Changing…

**Economically Unsustainable**
Current healthcare and human services industries

**Treatment Decisions**
Gap in accuracy

**Evidence-Based Medicine**
Less than 50% is actually evidence-based

**Aging Populations**
Requires more care

**Health Spending**
Disconnect with outcomes

*The problem is one of productivity, not of diseases, gadgets or healthcare.*

Data and machine learning capabilities can help

Source: Frost & Sullivan
The Digital Revolution

- **Expected alternative payments from the CMS by 2018**: 50%
- **Frequency at which healthcare data doubles**: 24 Months
- **Estimated global economic impact of chronic disease by 2030**: $47 trillion
- **Amount of healthcare data today**: 150+ Exabytes
- **Percentage of patients expected to use digital health services in the future**: 75%+
- **Healthcare smartphone apps in use**: 39.7 million
- **Connected/Internet of Medical Things Devices by 2020**: 20-30 billion
- **Environmental and social factors account for approximately 55% of population**: 55%

Source: Frost & Sullivan
There’s a Need for Efficient, High-Quality Healthcare

Senior Population Size Increasing

Population Distribution by Age Group, Global, 2015 & 2025

Number of Americans turning 65 everyday!
10,000

Number of centenarians in Japan!
67,824
(34.85/100,000)
[Expected to rise to 272,000 by 2050]

People aged 60 and over in 2025
1.2 billion

Current population size of India!

Source: Frost & Sullivan
Changing the Cost Curve: People want Health, not Healthcare

Shift our focus—and investments—from acute care to prevention

Source: Frost & Sullivan

Healthcare Spending By Type Of Activity, Global, 2007–2025

<table>
<thead>
<tr>
<th>Year</th>
<th>Prevention</th>
<th>Diagnosis</th>
<th>Treatment</th>
<th>Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>10%</td>
<td>70%</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>2012</td>
<td>12%</td>
<td>64%</td>
<td>17%</td>
<td>7%</td>
</tr>
<tr>
<td>2025</td>
<td>16%</td>
<td>51%</td>
<td>21%</td>
<td>12%</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Top 5 Wellness Shifts to Ensure a Healthier Population

01 Imperceptible wellness integrated in daily life

02 Wellness no longer limited to body, but extends to mind and soul

03 Diets and exercise designed around individual genomes, environment, and life goals

04 Workplace wellness programs give way to total wellness work cultures

05 Growing medical wellness tourism to health resorts, cities, and regions

Source: Frost & Sullivan
The Evolving Human Body


Body Augmentation

Hardware Augmentation

Biological Augmentation

External Wearables

Internal Implants

- Sensing enhancement
- Movement enhancement

- Brain
- Body

- Genomic
- Genetic
- Reproductive

Evolving Human Body: Capabilities of the Future, Global, 2017–2030

- Enhanced intelligence
- Increased attractiveness

- Enhanced sensing
- Extreme aging

- Disease-free bodies
- Optimized diet

- Sports optimization

- Digital hardware enhancements
- Ubiquitous and continual monitoring

- Enhanced strength

Source: Frost & Sullivan
The Big Debate: Who Owns Patient Medical Data?

- National-level Biometrics Identification Programs Leveraged
- EHR linked to Biometric ID
- Accessible to any qualified professional after patient consent by providing biometric validation, and in case of emergencies to paramedics or volunteers
- Visualization possible via the following:
  - Computers, tablets and smartphones
  - Mixed-reality devices, holographic projection devices

Source: Frost & Sullivan
Empowered Patients Can Perform At-Home Tests With Instant Diagnoses At Low Costs

Source: Frost & Sullivan
Smart Hospitals Will Feature Air Traffic Control Like Command Centers

**CAPACITY COMMAND CENTER LAYOUT AT JOHN HOPKINS HOSPITAL**

- Bed Managers
- Wall of Analytics™
- EVS Coordinators
- Operating Room Schedulers
- Transfer Leaders

**FEATURES**

- 2,550 square feet
- Technology from aviation, aerospace, and power industries—predictive analytics and systems engineering principles
- 24 staff members
- 22 information screens—Wall of Analytics
- Data from 14 sources, approximately 500 messages/minute
- GE consultation services

- 60% improvement in patient transfers from other hospitals (serious medical conditions)
- 63 minutes faster ambulance dispatch to patients.
- 30% faster in-bed assignment and 26% faster in-bed transfer processes at the ED
- 70% reduction in transfer delay from the operating room
- 21% increase in early discharge of patients

Source: Frost & Sullivan
Technology Commercialization and Maturation Timeframe

- Population Health Analytics
- Wearable Sensors
- Augmented/Virtual Reality
- Wellness Gamification
- Robotic Care
- Electroceuticals
- Advanced Materials
- 3D Printed Drugs
- Nanorobotics
- 3D Bioprinting
- Brain-Computer Interface
- Medical Tricorder
- Digital Avatars
- 3D Printed Medical Devices
- Enhancement Prosthetics
- Surveillance Tools
- Artificial Intelligence
- Precision Medicine
- Embedded Sensors
- Bio-printed Sensors
- Quantum Computing
- Regenerative Medicine

*Bars represent the horizon for technology commercialization and maturation*

Source: Frost & Sullivan
The New Connected Ecosystem

<table>
<thead>
<tr>
<th>On Body</th>
<th>In Home</th>
<th>Community</th>
<th>In Clinic</th>
<th>In Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invisible Wearables/Connected Apparel</td>
<td>Virtual Assistants Answer Health Queries</td>
<td>Drone Emergency Support</td>
<td>Smart Diagnostic Devices</td>
<td>Digitally Connected Systems</td>
</tr>
<tr>
<td>Enhanced Strength</td>
<td>Contact-less Vitals Monitoring</td>
<td>Seamless Monitoring Beyond Home</td>
<td>Instant Pathology Test Results</td>
<td>Real-time Staff, Equipment, Patient Location</td>
</tr>
<tr>
<td>Augmented Hearing</td>
<td>Food Consumption, Activity Monitoring</td>
<td>Telehealth Kiosks in Public Places</td>
<td>Telemedicine/Telepresence Technology</td>
<td>Virtual Departments (ICU)/Hospitals</td>
</tr>
<tr>
<td>Smart Pills for Imaging, Drug Delivery</td>
<td>Telemedicine enabled TVs &amp; Screens</td>
<td>Smart Supply Chain Logistics</td>
<td>AI-based Scribe Support</td>
<td>Analytics for Operations and Patient Outcomes</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan

Analytics/Informatics  | Storage  | Machine Learning  | Cybersecurity  | Interoperability  | Decision Support |
-----------------------|----------|-------------------|----------------|-------------------|------------------|

AI Will Transform Healthcare As We Know It

AI Needed to Process and Manage Big Data

4.4 ZB

44 ZB

1 ZetaByte = 1 Trillion Gigabytes !!!

Data Created Annually

The Medicine of the Future

- EHR Analysis
- Population Health Management
- Clinical Decision Support
- Treatment Regime Designing
- Predictive Care Guidance
- Medical Image Processing
- Virtual Personal Assistants
- Cost Comparison
- Precision Medicine
- Hospital Error Reduction
- Predictive Modelling

Source: Frost & Sullivan
5G Technology to Enable IoT and Continuous Monitoring In Healthcare

5G trials are underway using various spectrum bands

<table>
<thead>
<tr>
<th>Potential 5G bands</th>
<th>Potential 5G bands</th>
<th>Potential 5G bands</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US</strong></td>
<td><strong>EU</strong></td>
<td><strong>CJK</strong></td>
</tr>
<tr>
<td>600 MHZ</td>
<td>700 MHZ</td>
<td>3.3-4.2 GHZ</td>
</tr>
<tr>
<td>2.6 GHZ (sprint)</td>
<td>2.6 GHZ (sprint)</td>
<td>4.4-4.9 GHZ</td>
</tr>
<tr>
<td>3.55-3.7 GHZ</td>
<td>3.4-3.8 GHZ</td>
<td>28-39 GHZ</td>
</tr>
<tr>
<td>20, 37, 39 GHZ</td>
<td>26 GHZ</td>
<td></td>
</tr>
<tr>
<td>57-71 GHZ (&lt;______)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Global Mobile Suppliers Association; Qualcomm; Frost & Sullivan

$1.1 TRILLION

5G Enabled Output in Healthcare

TODAY

2035
<table>
<thead>
<tr>
<th>PHARMACEUTICALS &amp; BIOTECHNOLOGY</th>
<th>MEDICAL TECHNOLOGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$30+ B</strong> Targeted Therapeutics</td>
<td><strong>$500 M–$1 B</strong> External Neurostimulation Devices</td>
</tr>
<tr>
<td><strong>$30+ B</strong> Immuno-Oncology Checkpoint Therapeutics</td>
<td><strong>$250–$500 M</strong> Assistive Robotics</td>
</tr>
<tr>
<td><strong>$1+ B</strong> MRI Adaptive Radiation Therapy</td>
<td><strong>$250–$500 M</strong> AI Enabled Clinical Decision Support</td>
</tr>
<tr>
<td><strong>$1 B</strong> AI Medical Image Analysis</td>
<td><strong>$1 B</strong> Clinical Predictive Analytics</td>
</tr>
</tbody>
</table>

_Source: Frost & Sullivan_
Where are the Jobs in the Future?

<table>
<thead>
<tr>
<th>TECHNICIANS &amp; INFORMATION TECHNOLOGY EXPERTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companion Robot Technician</td>
</tr>
<tr>
<td>Internet of Things Business Analyst</td>
</tr>
<tr>
<td>Brain Computer Interface Designer</td>
</tr>
<tr>
<td>Health Data Scientist</td>
</tr>
<tr>
<td>Deep Learning Expert</td>
</tr>
<tr>
<td>AI Chatbot Communications Designer</td>
</tr>
<tr>
<td>Gamification Designer</td>
</tr>
<tr>
<td>Virtual Reality Therapy Designer</td>
</tr>
<tr>
<td>Medical Drone Route Designer</td>
</tr>
<tr>
<td>Plastic/Reconstructive Surgery 3D Printing Specialist</td>
</tr>
<tr>
<td>Voice Assistant Healthcare Content Specialists</td>
</tr>
<tr>
<td>Robotic Clinical Documentation Specialists/ Scribes</td>
</tr>
<tr>
<td>Virtual Hospital Manager</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Where are the Jobs in the Future? (continued)

Source: Frost & Sullivan

<table>
<thead>
<tr>
<th>MEDICAL SPECIALTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telesurgery Specialist</td>
</tr>
<tr>
<td>Augmented/Virtual Reality Surgery Planner</td>
</tr>
<tr>
<td>Nanomedical Engineer</td>
</tr>
<tr>
<td>(Synthetic) Organ Designer</td>
</tr>
<tr>
<td>Cryopreservation Specialist</td>
</tr>
</tbody>
</table>
## Where are the Jobs in the Future? (continued)

### HEALTH ADVISORS

<table>
<thead>
<tr>
<th>Lifestyle Strategist</th>
<th>Healthcare Navigator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epigenetic Counselors</td>
<td>Health Finances Planner</td>
</tr>
<tr>
<td>Patient Assistant</td>
<td></td>
</tr>
</tbody>
</table>

### WATCH OUT FOR

<table>
<thead>
<tr>
<th>Health Data Hacker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brain Neurostimulation Specialist</td>
</tr>
<tr>
<td>Biological/Genetic Terrorist</td>
</tr>
</tbody>
</table>

*Source: Frost & Sullivan*
What will the “H” in Healthcare Stand for?

Human interests and value predominate, and supersede everything else

<table>
<thead>
<tr>
<th></th>
<th>PAST</th>
<th>PRESENT</th>
<th>FUTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs</strong></td>
<td>LOW</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>LOW</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

Source: Frost & Sullivan
Contact Details

Reenita Das
Partner, Senior Vice President
Transformational Health
Frost and Sullivan
408-857-9386
rdas@frost.com