FROST & SULLIVAN

SCIENCE

MEDICAL

HEALTH
CARE

Digital Healthcare Ecosystem Supporting Health And Wellness

August 20, 2019

Team
FINLAND MARKET OPPORTUNITIES

Future
Watch

1 **Recap of Digital Health Ecosystem of 2025 & Identify Key Digital Health Market Participants**

2 Select Success Stories

3 Recognize Regional Innovation Hotspots & Trends

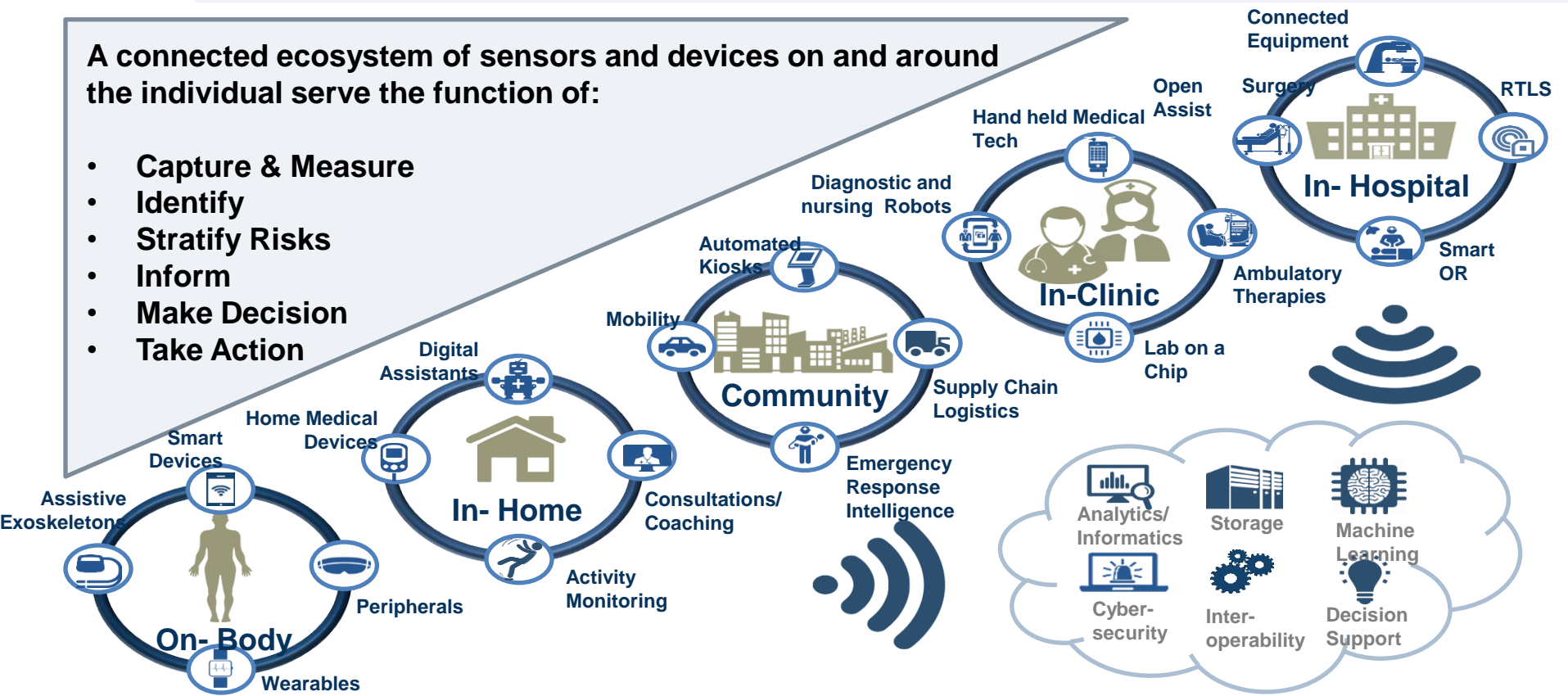**4** Learn About Global Academic Hubs for Digital Health

5 Key Takeaways

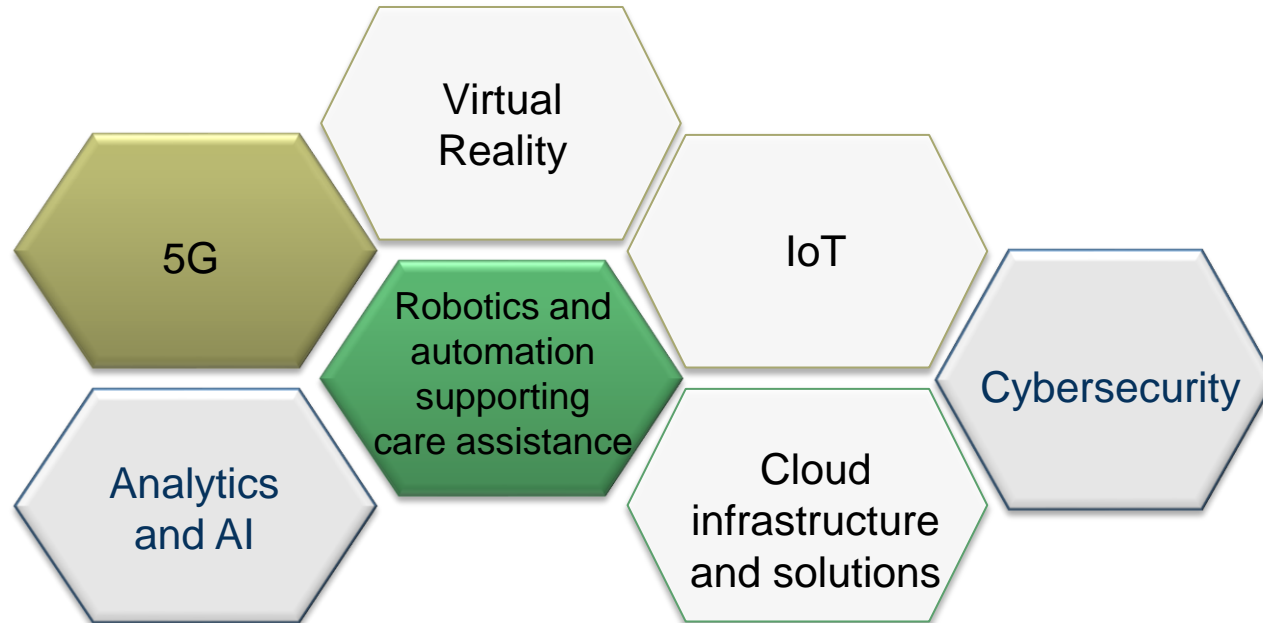# Digital health will encompass solutions across the care continuum

A connected ecosystem of sensors and devices on and around the individual serve the function of:

- **Capture & Measure**
- **Identify**
- **Stratify Risks**
- **Inform**
- **Make Decision**
- **Take Action**

On- Body
- Assistive Exoskeletons
- Smart Devices
- Peripherals
- Wearables

In- Home
- Digital Assistants
- Home Medical Devices
- Consultations/ Coaching
- Activity Monitoring

Community
- Automated Kiosks
- Mobility
- Emergency Response Intelligence
- Supply Chain Logistics

In-Clinic
- Hand held Medical Tech
- Open Assist
- Diagnostic and nursing Robots
- Ambulatory Therapies
- Lab on a Chip

In- Hospital
- Connected Equipment
- Surgery
- RTLS
- Smart OR

- Analytics/ Informatics
- Storage
- Machine Learning
- Cyber-security
- Inter-operability
- Decision Support

Source: Frost & Sullivan

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Technology enablers will support the paradigm shift to care delivery models in the future

Virtual Reality

5G

IoT

Robotics and automation supporting care assistance

Cybersecurity

Analytics and AI

Cloud infrastructure and solutions

Decentralized Care Delivery

Patient Experience and Customer Focus

Preventive and Wellness Focused

Cost Containment

Source: Frost & Sullivan Analysis

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5G

Rush Aims to Be First Hospital in U.S. to Use Standards-Based 5G

January 8, 2019

Rush teams with AT&T to explore use of ultra-fast network in technology-driven therapies

"Rush University Medical Center plans to become the first hospital to use standards-based 5G (fifth-generation) in the U.S., ultimately bringing faster broadband speeds to support the innovative information technology that Rush currently is using throughout the Rush System. Provided by **AT&T**, the 5G technology will be employed in various use cases aimed at improving outcomes, increasing staff efficiency and enhancing the patient experience."

East China to build 5G-based eye hospital

Source: Xinhua | 2019-06-02 22:08:52 | Editor: mingmei

"Xiamen, in east China's Fujian Province, will build a 5G-based eye hospital for better patient experience.

The 5G hospital will be jointly set up by Xiamen Eye Center of Xiamen University, Xiamen branch of **China Telecom** and the tech giant Huawei, according to a cooperation agreement signed by the three sides Sunday.

In the future, online livestreaming eye surgeries, remote consultation of oculists and remote guidance of eye surgeries are key areas to apply the technology, Zhang said.

Source: Frost & Sullivan

VODAFONE COMPLETES WORLD'S FIRST CONNECTION OF 5G SMARTPHONES TO ITS NETWORK
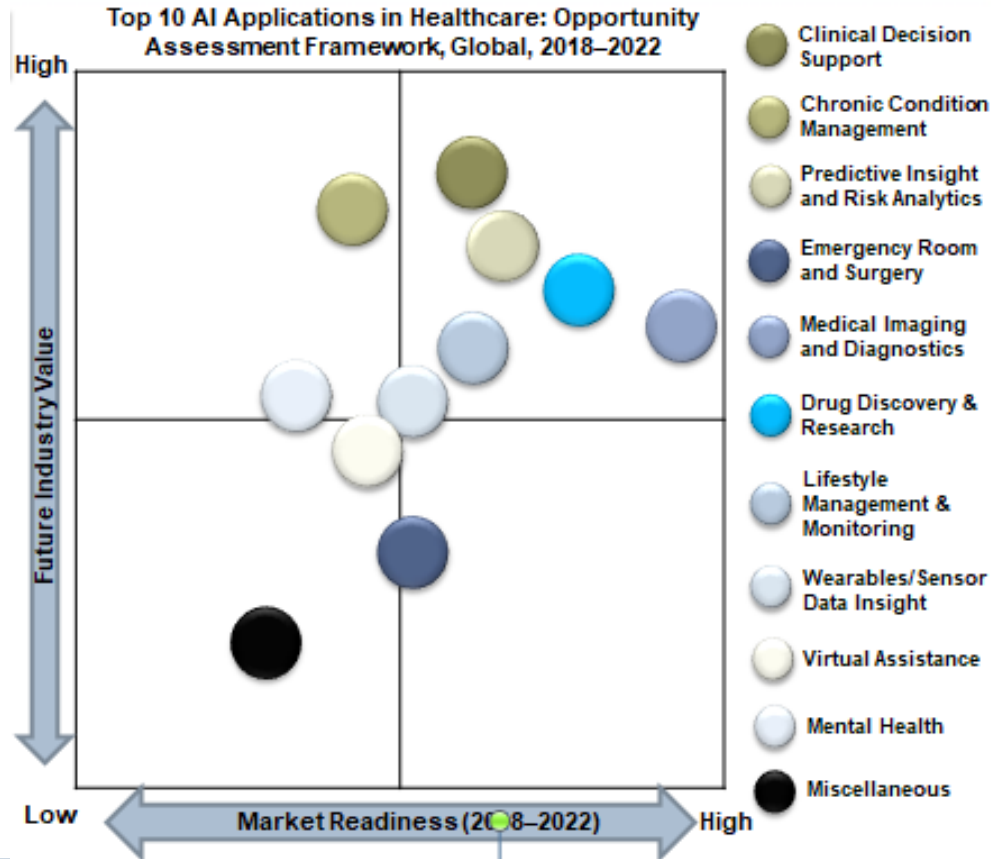
20 Feb 2019 @VodafoneGroup

Vodafone has invested €90 million in Milan to build the first 5G network in Italy, covering over 80% of the city. It has launched 31 5G use cases to date working with 38 industrial and public sector partners. The use cases cover the fields of health and wellbeing; security and surveillance; smart energy and smart cities; mobility and transport; manufacturing and industry 4.0; education; entertainment; and the digital divide. The use cases include a 5G Connected Ambulance developed with San Raffaele hospital; Europe's first live 5G news broadcast with Sky; and a self-driving robotic vehicle delivering books at the Polytechnic University of Milan campus. Vodafone has also allocated €10 million over four years for the 'Action for 5G' competition for start-ups, SMEs and social businesses.

Source: Frost & Sullivan

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Analytics and AI

Top 10 Healthcare AI Applications

Top 10 AI Applications in Healthcare: Opportunity Assessment Framework, Global, 2018–2022

Legend:
- Clinical Decision Support
- Chronic Condition Management
- Predictive Insight and Risk Analytics
- Emergency Room and Surgery
- Medical Imaging and Diagnostics
- Drug Discovery & Research
- Lifestyle Management & Monitoring
- Wearables/Sensor Data Insight
- Virtual Assistance
- Mental Health
- Miscellaneous

Axes: Future Industry Value (Low–High) vs Market Readiness (2018–2022) (Low–High)

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Top Vendors for Healthcare AI across Select Use Cases

Drug Discovery & Research
BenevolentAI · BioXcel · Exscientia · BERG · RECURSION · INSILICO MEDICINE · Zymergen

Wearable/Sensor Data Insights
EarlySense · AliveCor · current · Propeller · phys iQ · nanit · BIOSERENITY

Predictive Insights & Risk Analytics
AYASDI · Digital Reasoning · NextHealth TECHNOLOGIES · Qventus · Lumiata · APIXIO · Olive · innovaccer

Chronic Condition Management
GNS HEALTHCARE · prognos · ZEPHYR HEALTH · Wellframe · dreamed · k · LEMONAID HEALTH

Clinical Decision Support
flatiron (Acquired by Roche) · 依图 YITU · TEMPUS · maxQ Artificial Intelligence · CARIS LIFE SCIENCES · SOPHIA GENETICS · ensodata

Virtual Assistance/Virtual Nurses
babylon · SENSELY · conversa · Catalia Health · CAREVIEW COMMUNICATIONS · Your.MD · intuition robotics

Medical Imaging and Diagnostics
zebra MEDICAL VISION · ARTERYS · iCAD · IDx · Butterfly Network · HeartFlow · freenome · SIG TUPLE

Emergency Room & Surgery
Augmedics · Digital Surgery™ · MEDASENSE PAIN INTELLIGENCE · gauss · P3d · ACTIV Surgical, fka (Omniboros)

Lifestyle Management & Monitoring
Welltok · iCarbonX · PATHWAY GENOMICS · FREELETICS · AiCure · mPulse mobile · SkinVision

Mental Health
NA NEURAL ANALYTICS · ginger · cogito · Woebot · Intendu · NEURALINK

Select Vendors for Healthcare AI across Care Continuum

	Screening & Diagnosis			Treatment			Post Care Management		
Applications	Early Screening	Imaging and Non-imaging Diagnosis	Primary Care Support	Clinical Decision Support	Therapy Planning	Surgical Navigation & Execution	Condition Management	Patient Engagement	Care Coordination
Top Growth Areas	Breast/ Lung Cancer; Cardiac disorders; Afib, Mental health	Neuro; Stroke; Cardiac; Fertility; Diabetes; UTI	AI apps; Chatbots; Virtual avatars	Neuro; stroke; cardiac; patient safety	Neuro; stroke; cardiac; patient safety	Robotic surgery; surgical navigation	Diabetes, Cardiac; mental health; cancer	Interactive robots; chatbots	Treatment adherence; integrated RPM; End of life care

Key Companies: CYRCADIA HEALTH; CardioDiagnostics; Google DeepMind; Healthy.io; enlitic; maxQ Artificial Intelligence; IDx; Bruxlab; ada; babylon; sense.ly; HealthTap; iz.ai; Quest Diagnostics; HeartFlow; VITREOS HEALTH; zebra MEDICAL VISION; VERB SURGICAL; Mazor Robotics; TransEnterix; TITAN MEDICAL; doc.ai; dreamed DIABETES; AiCure; SOMPO CARE; Catalia Health; pillo; Botpartner; AfoBot; innovaccer; SENTRIAN Remote Patient Intelligence; VEEBOT; KOMPAÏ robotics; Robear

Phase of Adoption	Nascent	Emerging	Growth

Source: Frost & Sullivan Analysis

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Select Vendors for Healthcare AI Powered Clinical Management Applications

1 | Predict Disease

- IBM Watson Health
- GE Healthcare
- SIEMENS Healthineers
- PHILIPS Healthcare
- OPTUM
- enli Health Intelligence
- RxPREDiCT
- visualDx
- Medial EarlySign
- flatiron

2 | Personalize Treatment

- Cerner
- Wolters Kluwer
- American Well
- Welltok
- somatix
- ada
- apervita
- CipherHealth
- DIABNEXT
- Natural Cycles
- Epic
- Greenway Health
- tytocare
- AUGMEDIX
- medCPU
- RAIVEN Healthcare
- Oncora Medical
- prognos
- conversa Health
- Cyrcadia Health
- 2bPrecise

3 | Prevent Adverse Events

- FUJIFILM MEDICAL SYSTEMS
- intel
- NAVICAN
- SCANADU
- aira
- Ginger.io
- cogito
- DeepMind
- via oncology
- Allscripts
- QARDIO
- kiwi.ai
- kaia
- Medicity

4 | Manage Outcomes

- FUJIFILM MEDICAL SYSTEMS
- intel
- NAVICAN
- SCANADU
- aira
- Ginger.io
- cogito
- DeepMind
- via oncology
- Allscripts
- QARDIO
- kiwi.ai
- kaia
- Medicity

Robotics and automation supporting care assistance

Segmenting Healthcare Robots

Personal Service Robots

- Assistive Exoskeletons
- Intelligent Robot Companions
- Medical Service Delivery Robots
- Soft Robots
- Home Care Servant Robots
- Social Robots
- Person Carrier Robot

Medical Robots

- Rehabilitation Exoskeleton Robots
- Training Robots
- Diagnostic Robots
- Nursing Robots in Hospitals

Surgical Robots

- Minimally Invasive Procedures
- Tool Holders
- Patient Positioner
- Open Surgery Assist
- Radiosurgery

Source: Care Assistance and Pharma Automation Robots,, Frost & Sullivan

Source: Frost & Sullivan Analysis

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Daily Care and Transportation Robots

pilotfish — tangible dreams
RIKEN
ODENSE HEALTH — INNOVATION & BUSINESS
AETHON
ROBOT CARE SYSTEMS — RCS UTS:CHT — CENTRE FOR HEALTH TECHNOLOGIES
YUJIN ROBOT
swisslog

Telepresence and Rehabilitative Robots

VGo
VECNA.
iRobot
Bestic AB
InTouch Health
GIRAFF PLUS
SoftBank Robotics

Exoskeleton Robots

CYBERDYNE
ÖSSUR. — LIFE WITHOUT LIMITATIONS
RT.WORKS
ReWalk
AXOSUIT
HONDA
touch bionics
BIONIK LABORATORIES
myomo — my own motion
ottobock.
ekso BIONICS

Pharma Automation Robots

Omnicell
aesynt
ScriptPro.
Intelligent Hospital Systems

VIRTUAL REALITY

Reality technologies are on the cusp of disrupting the human-machine interface, giving rise to an entirely new computing experience.

USERS AND USE CASES

Education/ Training	Surgeons - Medical Students - Human Resources – Emergency Responders/Disaster Preparedness – Global/Remote Team Exercises – Product Sales & Marketing - Patient Education /Patient Experience
Behavioral Modification/ Mental Health/Wellness	PTSD - Autism – Schizophrenia – ADHD – Medication/Treatment Compliance - Substance Abuse - Fitness/Wellness/Weight Management - Phobias — Smoking Cessation – Sleep Disorders - Stress
Clinical Assessment	Physical Assessments - Behavioral and Psychological Assessments — Cognitive Function Assessment
Treatment for Acute and Chronic Conditions	Pain Management - Vision Disorders - Physical Therapy/Rehab - Speech Therapy — Telemedicine - Brain Injury-Alzheimer's/Dementia
Clinical Documentation	Remote Scribes - Interactive Medical Records - Data Visualization & Display

Source: Frost & Sullivan Analysis

Top Vendors in the XR Space

AR/VR Applications	Patient Experience Management	Treatment Planning & Simulation	Surgical Navigation	Telemedicine	VR based Gamification Therapy
Top Growth Areas	• MRI/ CT Scans • Distraction therapy	• Surgical and medical training • Treatment simulation	• Joint replacement Surgery	• Tele-surgery • Patient Monitoring	• Chronic Pain Management • Ortho Rehabilitation; Physical Therapy • Mental Health

Key Companies

SIEMENS Healthineers

PHILIPS Healthcare

VRHEALTH Redefine Healthcare

SURGICAL THEATER

Immersive Touch

OssoVR

VICARIOUS SURGICAL

NOVARAD

Augmedics

TrueVision SYSTEMS, INC

echopixel

1minuut zorginnovatie

VUZIX

PROXIMIE

SYNCTHINK

mindmaze

Firsthand TECHNOLOGY

psious

VRHealth

regroup THERAPY

PSICOSMART clinical apps

CleVR

Phase of Adoption	Nascent	Emerging	Growth

Cloud infrastructure and solutions

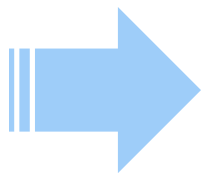# In 2025, cloud platforms will have a high demand and critical functions will depend on them for scale-ups

Current Drivers

- Cost Containment
- Data Management
- Business Process Innovation
- Industry Collaboration
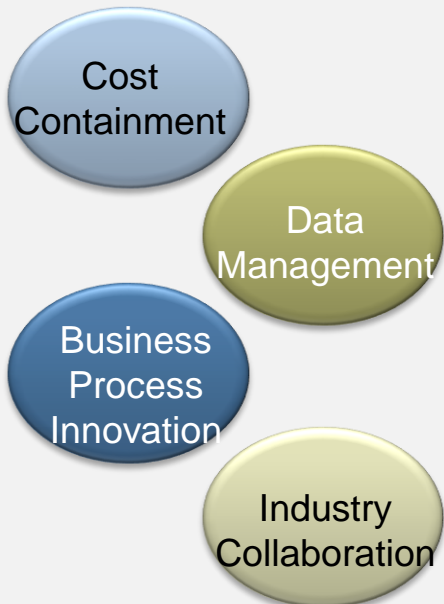
Applications in 2025

Application	Description
Imaging Informatics	Storage and archiving of very sensitive, patient data
Real World Data and Analytics	RWD is becoming very important for pharma and med-tech players
Population Health Management	Collation and analysis of de-identified patient data from disparate sources
Health Data Continuity	Collation and analysis of de-identified patient data from disparate sources
Telemedicine	Providers will be keen on investing in cloud based telemedicine solutions

Healthcare cloud computing vendor landscape by segment

Smart devices – IoT

Select Healthcare IoT Vendors

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Cybersecurity

Cybersecurity will be an essential component for digital health services characterized by integration and flexi-plans for users
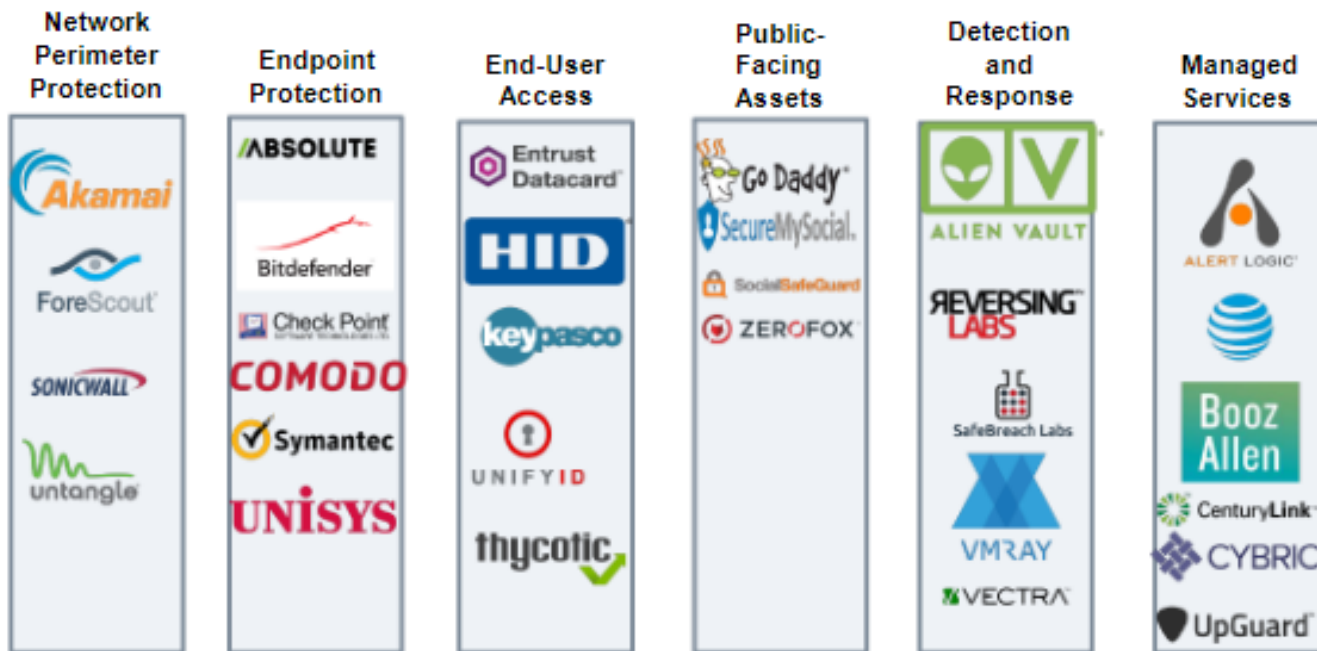
Network Perimeter Protection
- Akamai
- ForeScout
- SONICWALL
- untangle

Endpoint Protection
- ABSOLUTE
- Bitdefender
- Check Point
- COMODO
- Symantec
- UNISYS

End-User Access
- Entrust Datacard
- HID
- keypasco
- UNIFYID
- thycotic

Public-Facing Assets
- Go Daddy
- SecureMySocial
- SocialSafeGuard
- ZEROFOX

Detection and Response
- ALIEN VAULT
- REVERSING LABS
- SafeBreach Labs
- VMRAY
- VECTRA

Managed Services
- ALERT LOGIC
- AT&T
- Booz Allen
- CenturyLink
- CYBRIC
- UpGuard

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2   **Select Success Stories**

3   Recognize Regional Innovation Hotspots & Trends

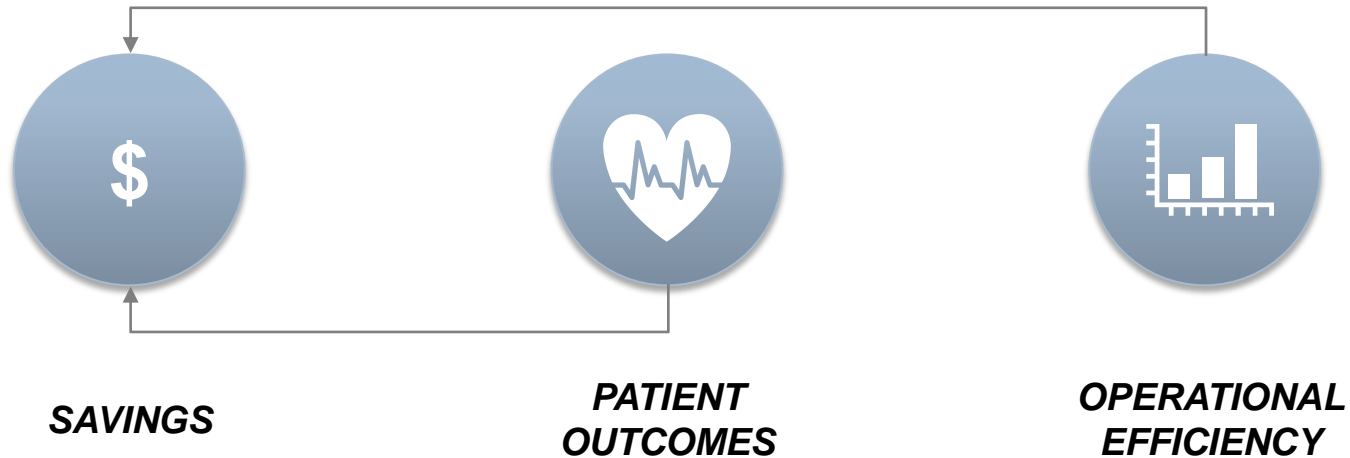**4**   Learn About Global Academic Hubs for Digital Health

5   Key Takeaways

What does Success mean for a Digital Health Solution?

SAVINGS

PATIENT OUTCOMES

OPERATIONAL EFFICIENCY

Source: Frost & Sullivan

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Hospital Care Pathway Improvement – Analytics Solution

Applicable Area:

Smart Hospitals
- Operational Efficiency
- Clinical Excellence
- Patient Experience

Opportunity

Data Analytics / AI

Hospital

FLAGLER HOSPITAL ST. AUGUSTINE — Florida, USA

Vendor

AYASDI — AI Software Solutions

Pilot Project:
9 weeks
$75,000 invested

10X ROI → Savings Generated:
$800,000 / Year

DETAILS

Analytics + AI on
- Medical Records
- Claims Data

→ **Pneumonia Care Pathway Improvement**
- $1,356 saved per patient
- 2-day reduction in hospital stay

FUTURE PLANS

Expand to
12 conditions

→ Generate
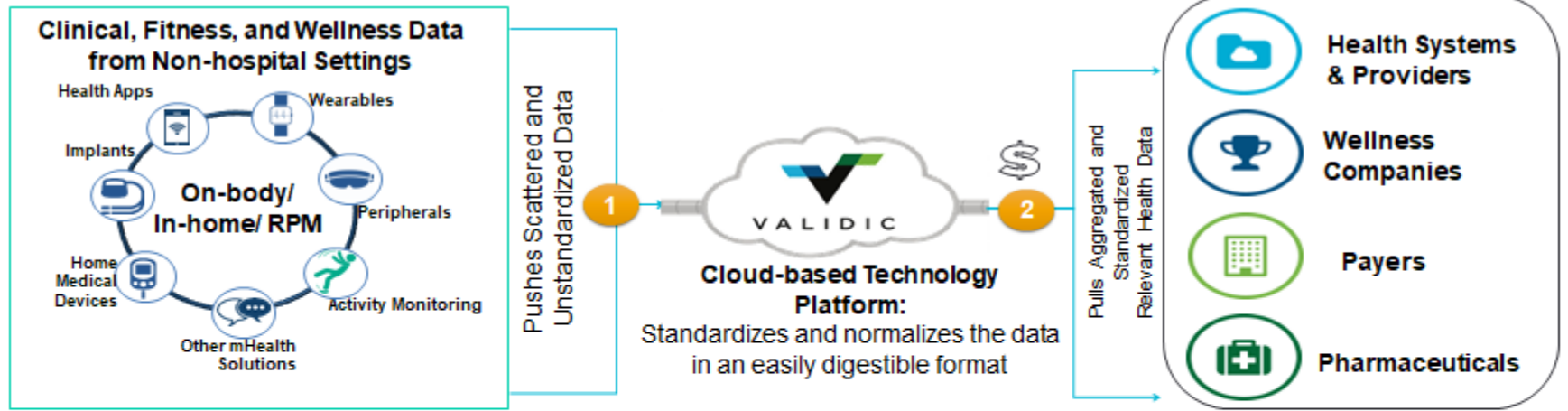**$20 million**
in savings over 3 years

Use of VR in pediatric setting leads to less reported needle pain

A new study published in the Journal of Pediatrics found that patients using a VR system reported less pain when being treated with a needle than their counterparts who received the standard of care.

Study: VR stimulates memories, improves quality of life for dementia patients

Image Source: Mobihealthnews   Source: Frost & Sullivan

Bridging Interoperability Gap – Cloud Based Solution

Clinical, Fitness, and Wellness Data from Non-hospital Settings

Health Apps
Wearables
Implants
Peripherals
Home Medical Devices
Activity Monitoring
Other mHealth Solutions

On-body/ In-home/ RPM

Pushes Scattered and Unstandardized Data

1

V A L I D I C

Cloud-based Technology Platform:
Standardizes and normalizes the data in an easily digestible format

2

Pulls Aggregated and Standardized Relevant Health Data

- Health Systems & Providers
- Wellness Companies
- Payers
- Pharmaceuticals

Quick Fact:
Ecosystem of 280+ integrations with consumer and clinical digital health technologies, Validic's platform reaches 223+ million people in 47 countries.

Monetization Model
- Service fees for pulling standardized, bulk data from Validic to organizations
- Pushing data to Validic is free for app and device makers

Benefits to End Users:
- One-to-many connectivity platform helps to aggregate and standardize most relevant health data into EHR and health systems.
- Software-as-a-service (SaaS) asset light model avoids infrastructure and installation cost.
- Drive more efficient remote patient monitoring, home care, patient discharge management, and wellness initiatives.

Source: Frost & Sullivan

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3 **Recognize Regional Innovation Hotspots & Trends**

4 Learn About Global Academic Hubs for Digital Health

5 Key Takeaways

Culture of Wellness

A growing number of people of all ages, particularly middle to upper income groups, have become more aware of the importance of healthy lifestyles and are increasingly adopting digital health tools to self track and monitor their health.

Millennials Have Kids

In 2019, Millennials (age 20 to 35 in 2016) will surpass Baby Boomers as the largest US generation and will be in prime child-bearing years. For most of these people, this time period will be their first encounter with healthcare, and many will expect to use digital health.

Growing Importance of Medicare

Each day, 10,000 Baby Boomers reach Medicare eligibility. This age wave will last through 2029. Medicare accounts for 20% of US health spending, and costs are growing. The government is focused on driving the use of digital tools to reduce costs.

Source: Frost & Sullivan

The United Kingdom
- Initiatives such as Five Year Forward View, TechUK Interoperability Charter, coordinated care efforts, and Connecting for Health
- NHS STP project
- NHS Digital, Patient Online portal by NHS, and Citizen Identity Project
- NHS One platform and NHS virtual wards
- EU-Nightingale: Smart RPM Project

Scandinavia
- A highly advanced market with new eHealth objectives and smart hospitals focused on large-scale integration projects expected to create a highly potential market for device connectivity
- Sweden, with an ageing population, investing heavily in telehealth, homecare, bring your own device (BYOD), digital health, and population health management (PHM) solutions
- Behavioral health and mHealth solutions as the most lucrative segments

Germany
- Smart eHealth citizen card rollout
- High-Tech Strategy 2020; Telematics Infrastructure rollout by June 2018
- About 44% of health investment and expenditure devoted to hospital modernisation
- Draft law on eHealth issued in January 2015 focuses on HIE and interoperability
- CCS Telehealth and Telemedicine project

Benelux
- NL top ranked for best healthcare system in Europe in 2014 by Europe Health Consumer Index
- NL priorities: to implement advanced health analytics and Big Data solutions in healthcare
- Focused on increasing number of primary care centers and digital hospital strategies across country
- Belgium investing $3.62 million in digital health solutions

Spain
- Increased funding from Spanish national health system encourages digital transformation and remuneration
- Prioritizes hospital modernization in suburban and rural locations for better care
- Spain's MoH to implement interoperable ePrescription systems (07/19)

Italy
- Focus on formation of integral national eHealth strategy
- Aims to improve exchange of ePrescriptions and eTransfer of lab data as current use is low
- Solutions currently implemented: NSIS, TSE, and CRS-SISS

France
- Reorganizing its healthcare system by combining 38 regions to form 12 regions for more joint-up care.
- The epSOS project and eGovernment plan of Italy (2012) as nationwide initiatives
- Most investments in clinical HIT, telecare, and hospital digitalization

Austria

- With more than 80% of the digitized patient records, Austria will be focusing on completely eliminating paper-based medical records and on EMR/EHR optimization in 2018.
- Austria is experiencing difficulties in rolling out enterprise-wide clinical systems because of funding issues.
- Telemedicine and telehealth are imminent trends with a high priority. In 2018, Austria will be focusing on integrating telemedicine with EMR/EHR systems.

Poland

- Poland's MoH plans will introduce eHealth systems incrementally, starting with ePrescriptions, eAppointments, and health registers, from 2018 onwards.
- Poland is developing an eHealth infrastructure co-funded by the EU, which promotes the adoption of clinical IT systems and the digitalization of medical data.
- With more than 850 hospitals and 233,000 beds, Poland will be focusing on consolidation using smart solutions to centralize healthcare services delivery in 2018.
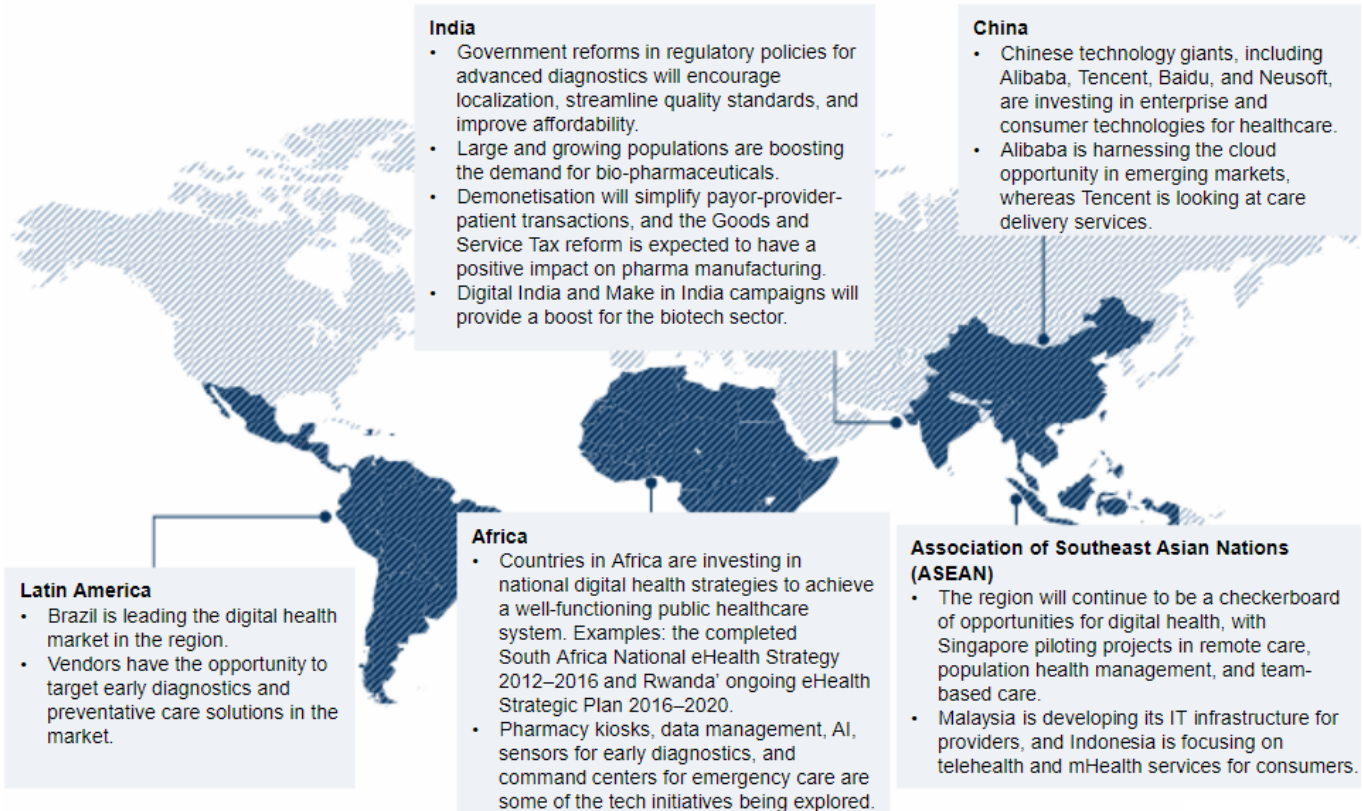
Switzerland

- In 2018, Switzerland will witness a high priority for standardizing health IT infrastructure under eHealth Suisse.
- A new federal law mandates hospitals to implement interoperable EHRs to facilitate data sharing and cooperation among healthcare providers.
- The country has set a deadline of 2020 for hospitals adopting interoperable EHRs and 2022 for nursing homes adopting interoperable EHRs.
- In 2018, the major focus will be to provide digital support for treatment processes, providing doctors, pharmacies, and hospitals electronic with access to information about patients' medication.

Rest of Europe

- EHR implementation is an especially urgent topic in Central Europe.
- The primary focus will be to introduce and actively promote healthcare digitization, increase patient safety by reducing medical errors, and provide digital access to patients' health information online.
- High investment is expected in digital health platforms and telehealth.
- Most countries will focus on forming an integral national eHealth strategy. The Rest of Europe aims to improve the exchange of ePrescriptions and eTransfer of lab data as current use is low.

India
- Government reforms in regulatory policies for advanced diagnostics will encourage localization, streamline quality standards, and improve affordability.
- Large and growing populations are boosting the demand for bio-pharmaceuticals.
- Demonetisation will simplify payor-provider-patient transactions, and the Goods and Service Tax reform is expected to have a positive impact on pharma manufacturing.
- Digital India and Make in India campaigns will provide a boost for the biotech sector.

China
- Chinese technology giants, including Alibaba, Tencent, Baidu, and Neusoft, are investing in enterprise and consumer technologies for healthcare.
- Alibaba is harnessing the cloud opportunity in emerging markets, whereas Tencent is looking at care delivery services.

Latin America
- Brazil is leading the digital health market in the region.
- Vendors have the opportunity to target early diagnostics and preventative care solutions in the market.

Africa
- Countries in Africa are investing in national digital health strategies to achieve a well-functioning public healthcare system. Examples: the completed South Africa National eHealth Strategy 2012–2016 and Rwanda' ongoing eHealth Strategic Plan 2016–2020.
- Pharmacy kiosks, data management, AI, sensors for early diagnostics, and command centers for emergency care are some of the tech initiatives being explored.

Association of Southeast Asian Nations (ASEAN)
- The region will continue to be a checkerboard of opportunities for digital health, with Singapore piloting projects in remote care, population health management, and team-based care.
- Malaysia is developing its IT infrastructure for providers, and Indonesia is focusing on telehealth and mHealth services for consumers.

Source: Frost & Sullivan

Global Digital Health Hotspots
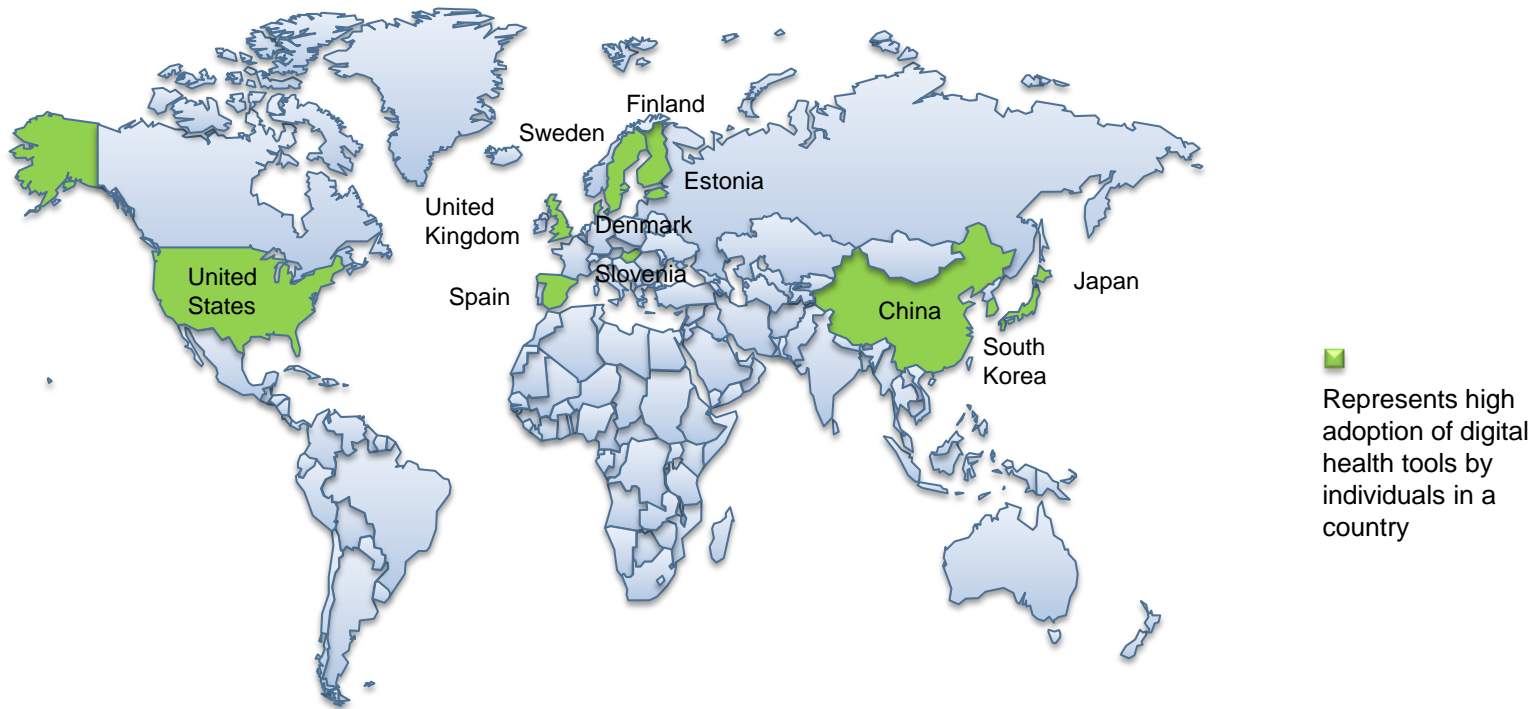
Finland
Sweden
Estonia
United
Kingdom
Denmark
Spain
Slovenia
United
States
China
Japan
South
Korea

Represents high adoption of digital health tools by individuals in a country

Source: Frost & Sullivan

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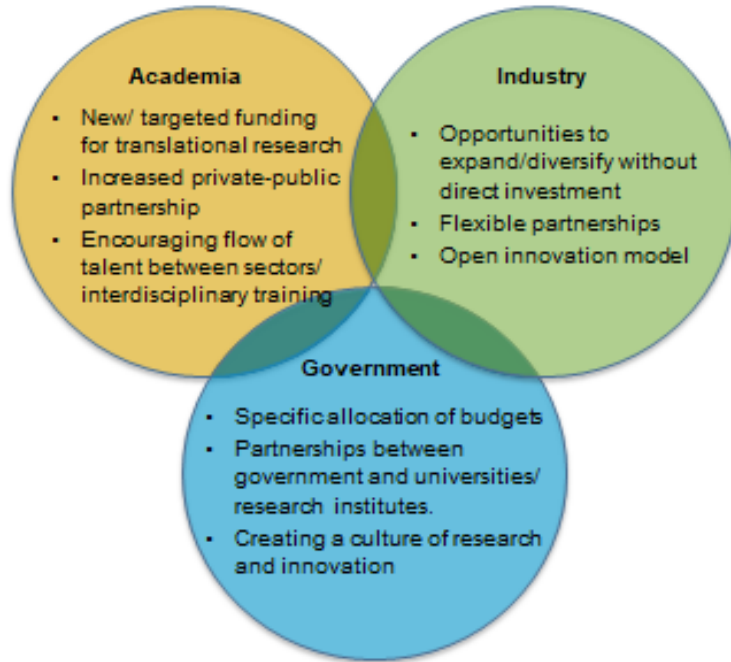
4 — **Learn About Global Academic Hubs for Digital Health**

5 — Key Takeaways

Collaboration between academia, industry and government nurtures the medical technology industry by providing the platform for clinically led innovation

Triple Helix Model of Academia-Industry-Government Collaboration

Academia
- New/ targeted funding for translational research
- Increased private-public partnership
- Encouraging flow of talent between sectors/ interdisciplinary training

Industry
- Opportunities to expand/diversify without direct investment
- Flexible partnerships
- Open innovation model

Government
- Specific allocation of budgets
- Partnerships between government and universities/ research institutes.
- Creating a culture of research and innovation

- Research and development of digital health devices faces several challenges such as **financial constraints, long lead times** to bring the product to market, and even a **lack of viable business models.**

- This has motivated several stakeholders in the industry to reconsider collaborative approaches to technology innovation.

- Best examples for medical device innovation are seen where collaborators each uses their core competence. For instance, the **clinical community provides end user input and professional opinion, academia powers innovation with its research, and industry participants with their manufacturing prowess.** This is also supported by governments and regional authorities through a favourable business environment and through research support.

- Numerous academic institutions in the US are innovating in the digital health space, making it a leading global destination for digital health R&D. **Stanford Byers Center for Biodesign** is a leading example of clinically led innovation that has benefited immensely from effective partnerships between academia and the health technology industry.
- By offering innovation **fellowships and training programs**, students and research fellows are encouraged to benefit from the facilities provided by the **Stanford Institutions for engineering, design and business** to create innovative solutions for the healthcare industry. These innovators-in-training are supported to take their solution to the next level, whether via start-up, corporate investment, or other implementation channels by using their worldwide network of innovators.
- To date, the network has attracted an overall investment **of $453 million and 32 health** technology companies have been formed from fellowship projects.

- Canada has its own 'Digital Health Hub (DGH)', which is a conglomeration of **Simon Fraser University, Fraser Health, City of Surrey and many others within the emerging Surrey Innovation Boulevard.**
- The various programs running in the DGH are focused on **mobile solutions, cloud computing and computer aided diagnosis.**

- The prominent medical innovation clusters in Europe are scattered around the Grand Est area of **France**, Medical Valley in Nurnberg and Tuttlingen in **Germany**, Emilia-Romagna of **Italy**, Galway in **Ireland**, BioRegion of Catalonia, in **Spain**, Canton Zurich in **Switzerland** and the "**golden triangle**" between London, Cambridge and Oxford in the **United Kingdom.**

- The Asia-Pacific region is not far behind in establishing Medical technology hubs.
- Examples include the Biopolis, biomedical sciences research and development (R&D) hub in **Singapore, Japan** Agency for Medical Research and Development (AMED) and **China Center for mHealth Innovation (CCmHI).**

While clinical led innovation and academic partnerships can drive research, medical technology innovation clusters provide the infrastructure, facilities and opportunity to attract investment from industry.

Sid Shah

Program Manager, Advanced Medical Tech

Frost and Sullivan

+ 91 20 6718 9766

siddharths1@frost.com

www.frost.com