FROST & SULLIVAN

Transformations in Care Delivery

Team FINLAND MARKET OPPORTUNITIES

Future Watch

May 28, 2019

Focus Points - Agenda

1. **Healthcare Industry Global Crisis – Call for Care Delivery Transformation**
2. Decentralization of Care Delivery Models – Future Alternate Care Locations
3. Managing Chronic Disease Epidemic – Prevention & Wellness Focused Care
4. Key Takeaways

Healthcare Industry Global Crisis

Evolving societal needs are straining current healthcare systems, making it imperative to transform care delivery

CHRONIC DISEASES

$1160 Bn Cancer

$863 Bn CVD

2/3rds of all deaths

$167 Bn Respiratory (COPD)

$727 Bn Diabetes

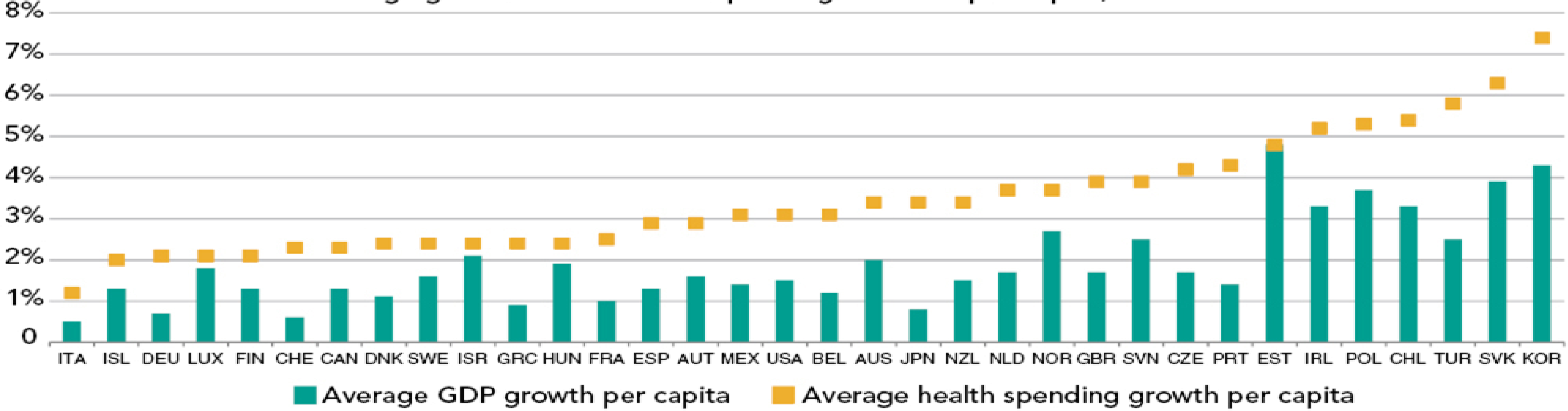
AGEING POPULATION

7 Bn people living above **80 years** of age in many parts of the world.

80% Suffer from at least **One Chronic Disease**

HEALTHCARE SPENDING HAS OUTPACED ECONOMIC GROWTH

Average growth rate of health spending and GDP per capita, 1990–2012



Source: OECD; WHO; Frost & Sullivan

Care Delivery Model Transformation

Healthcare industry needs a mind-set change to bridge current gaps in care delivery

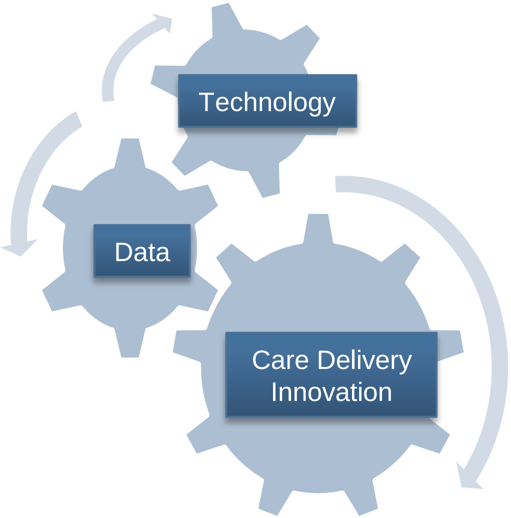
Driving Factors	*From Today As-is-State*	to	*Future To-be-State*
Focus	Process/Provider Centric		Patient Centric and Participatory
Objective	Symptomatic, Curative		Predictive and Preventive
Access/ Location	Limited in-hospital Care (Centralized)		Anytime, Anyplace Homecare (Decentralized)
Technology	Isolated Systems		Integrated Systems (Digital Medicine)
Treatment Methods	Episodic Care (Invasive)		Holistic Care (Less Invasive)
Medication	Blockbuster Medicine		Personalized/Precision Medicine

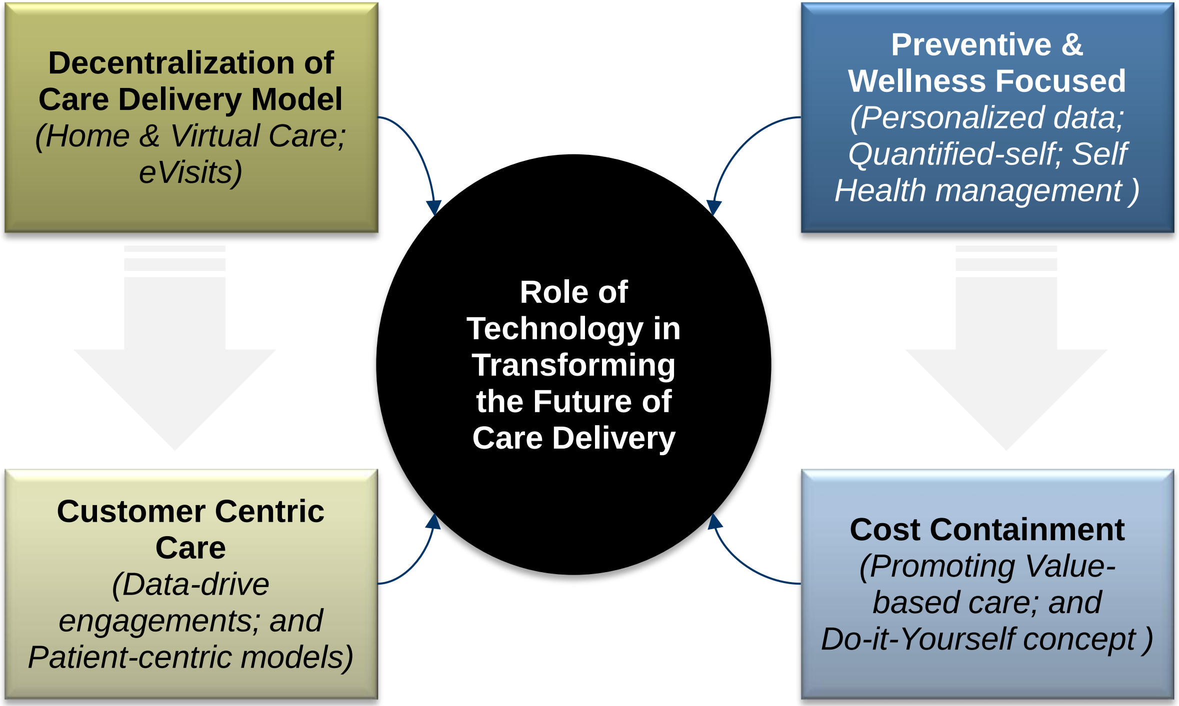
Source: Frost & Sullivan

Healthcare Digital Transformation Promises to Bridge Care Delivery Gaps

Technology & data driven paradigm shift for future care delivery innovation

Transformations in Healthcare Delivery





Source: Frost & Sullivan

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Decentralization of Care Delivery Model

Healthcare must enable a higher level of customer experience that people have come to expect based on interactions with retail and other industries

Baby Boomers & Tech-savvy Millennials

Traditional Model

Patient Searches…
Doctor / Hospital / Pharmacy

Calls payer / friends / doctor (referral)

[In-network, affordable co-pays]

Emerging Model

Patient Searches…
Doctor / Hospital / Pharmacy

Online

[In-network, affordable co-pays]

Care Delivery Moving to the Home Environment

Patient Visits…

- **Clinic**
- **Path Lab**
- **Pharmacy**
- **Health &**

Products and Services Visit Patient

- **House Call** — **Telemedicine**
- **Home Testing / Collection**
- **E-pharmacy / 3rd party delivery**
- **Online stores**

Source: Frost & Sullivan Analysis

Possible Business Model—Direct-to-consumer Healthcare

Frost & Sullivan envisions the future of Amazon's healthcare play as given on this slide.

Alexa will help check the health condition on WebMD and book an appointment with a physician

1

WebMD
Better information. Better health.™

Health and medical news and information

Check the best prices of drugs and devices on the Amazon App

2

amazon

eCommerce App (Digital Health Marketplace for Drugs and devices

Alexa (Digital Personal Assistance)

Average Healthcare Consumer

3

The new Amazon-PillPack will take care of co-payment (insurance) and provide a value-added service of shorted dosage for the desired duration (improve medication adherence)

5

Capture your feedback, replacement and health data on treatment adherence, and adverse events

Smart Delivery/ Return Service

4

Smart order fulfillment anytime, anywhere (even if no one is present to receive)

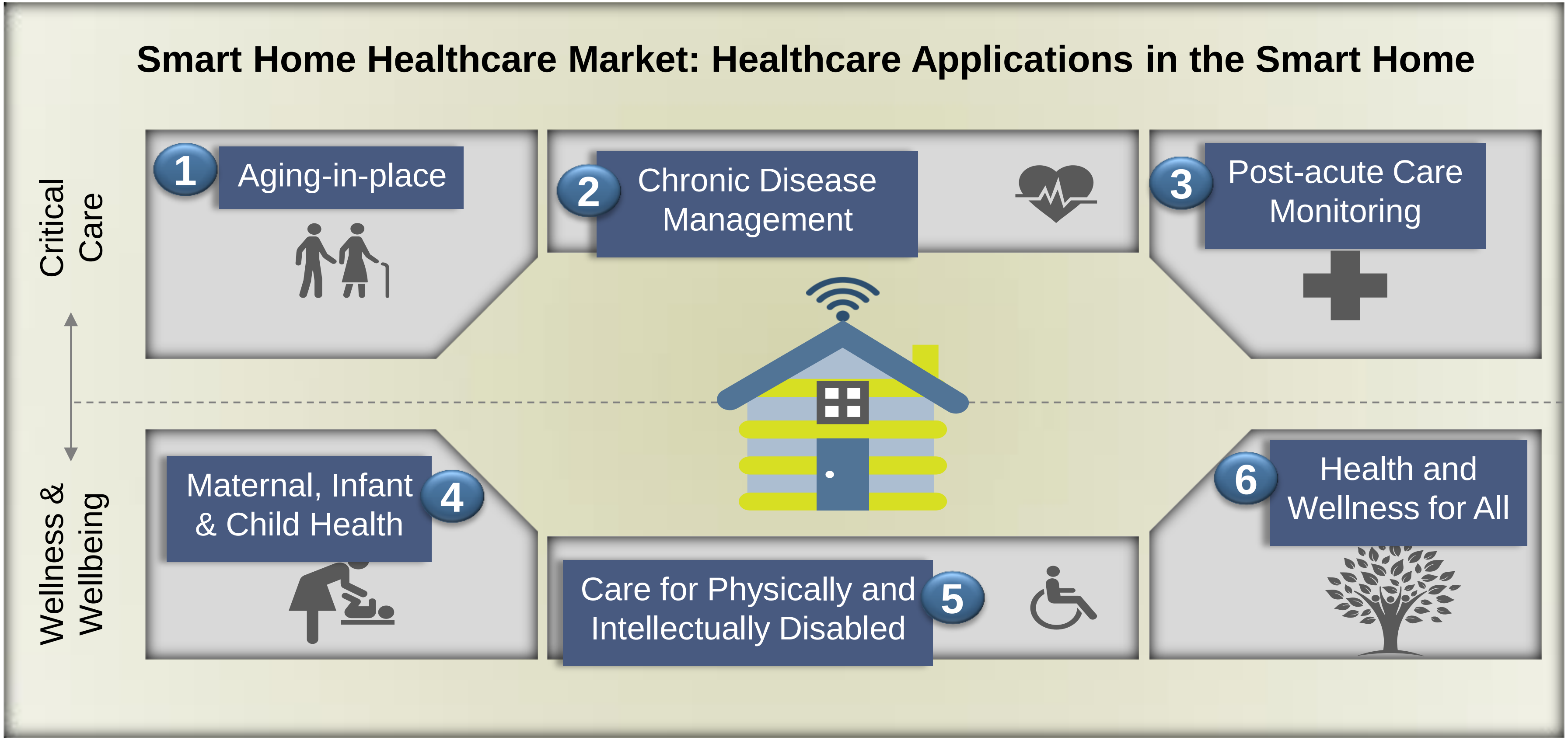
Pill Pack

Pharmacy services for managing multiple medications

Note: In 2017, Amazon and WebMD entered into a partnership for a technology and marketing program. As per this agreement, all Amazon consumer-device (Echo, Echo Dot, and Amazon Fire TV) users were given exclusive access to WebMD's healthcare information library. In 2018, PillPack was acquired by Amazon.

Source: Frost & Sullivan Analysis

Healthcare Applications in a Smart Home

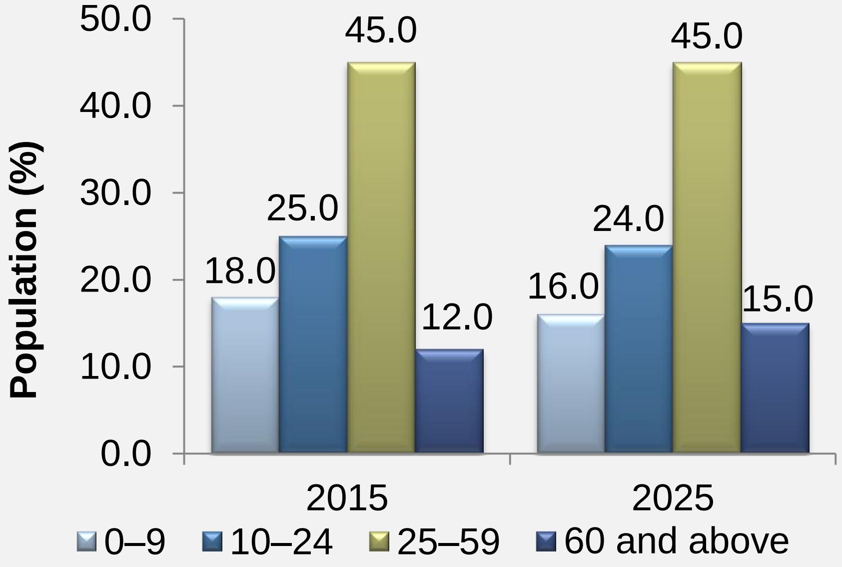


Source: Frost & Sullivan Analysis

Demand for Aging-in-Place

Senior Population (60+) Is Growing Faster than All Younger Age Groups

Population Distribution by Age Group, Global, 2015 and 2025



87% of seniors wish to age independently, and 85% of their children support this decision.

Seniors living with sensors lived 1.7 years LONGER than those living without them.

Seniors living with sensors achieve SAVINGS of $30,000 per person compared to cost spent at nursing home.

Source: AARP; Senior Helpers Survey (2017); TIgerPlace Institute (University of Missouri); Frost & Sullivan

Smart Home Features for Aging-in-Place

On-Body Wearables
- ❖ Smart implants
- ➢ Vitals/activity tracking devices and apparel
- • PERS
- • Fall detection
- • Smart hearing aids

Smartphone Apps
- ❖ Medication adherence
- ➢ Activity tracking
- • Location tracking/geofencing

Living Room
- ❖ Telehealth visits

Bathroom
- ❖ Smart pill dispensers
- ❖ Diagnostic devices
- ➢ Smart mirrors
- ➢ Smart weighing scale
- ➢ Smart toilets

Voice Interactive Diagnosis & Control Tools

Artificial Intelligence + Data Analytics

Bedroom
Sleep Quality Monitoring
- ➢ spO_2 monitoring
- ➢ Ambient environment

Entire Home
- ➢ Contactless monitoring sensors and devices for vitals monitoring
- ➢ Motion sensors for detecting activity, turning lights on/off
- ➢ Carbon monoxide, smoke and water leakage sensors for preventing mishaps
- • Smart plugs or sockets, tags and sensors for monitoring activities of daily living (ADL), keep caregivers and family members informed
- • Flashing tags to remind performing ADLs for dementia sufferers
- • Smart tags to detect location of keys, wallets, reading glasses and other items
- • Assistance robots to help with tasks and for lifting residents from bed to wheelchair

Legend
- ❖ Active Care
- ➢ Monitoring
- • Support

Kitchen
- ❖ Connect with nutritionist for diet and meal suggestions
- • Smart bin to track & reorder groceries
- • Smart cups, spoons and plates for countering tremors

Social Engagement Tools
- • Companion robots
- • Virtual companions with digital avatars that have human caregivers in the background
- • Video communication devices or screens for virtually visiting friends and family
- • Mixed/virtual reality headsets for virtual presence/reliving memories

Source: Frost & Sullivan Analysis

Analyst Perspective: HOME OF THE FUTURE

Source: Frost & Sullivan Analysis

Smart Home – Vendor Ecosystem

Living

Telemedicine
American Well
春雨医生
dr. on demand
MedWand
tytocare

PERS
Philips Lifeline
greatcall
Tunstall

Kitchen

Cooking Support
June
Gourmia
teaBOT
rotimatic
Chefling
BOSCH

Smart Appliances
SAMSUNG
smarter
LG

Eat Healthy
MARKONE
HAPI.com
DietSensor

Bedroom

Sleep
sleep number
holi
ResMed
ŌURA
beddit
ReST
Withings
somnoware
rem-fit
Smart Nora
SOMNARUS SLEEP DIAGNOSTICS

Bathroom

Toilets
TOTO
KOHLER

Weighing Scale
Withings
shapa

Mirrors
KOHLER
NAKED

Medication Adherence
HERO
livi

Entire Home

Environmental Sensing
birdi
CUBESENSORS
NETATMO
AWAIR
Live Pure

Diagnostic Devices
Koogeek
Athelas
Multisensor Diagnostics
MedWand
cue
SCANADU

Wearables / Health Devices
amiigo
OMRON
LUMO
QARDIO
mc10
dexcom
Thync
iRhythm
fitbit
jupl
Sproutling
bloom TECHNOLOGIES
SPIRE
valedo

Contactless Monitoring
vayyar
SenSaggio
OLEA SENSOR NETWORKS
COCOON CAM
MIMOCARE

Lighting
hue PERSONAL WIRELESS LIGHTING
deako
LIFX

Aroma/Sound/Light Therapy
moodo
iHome Live Life Loud
LUMIÈRE

Voice Assistants / Platforms
amazon alexa
HomeKit
Google Home

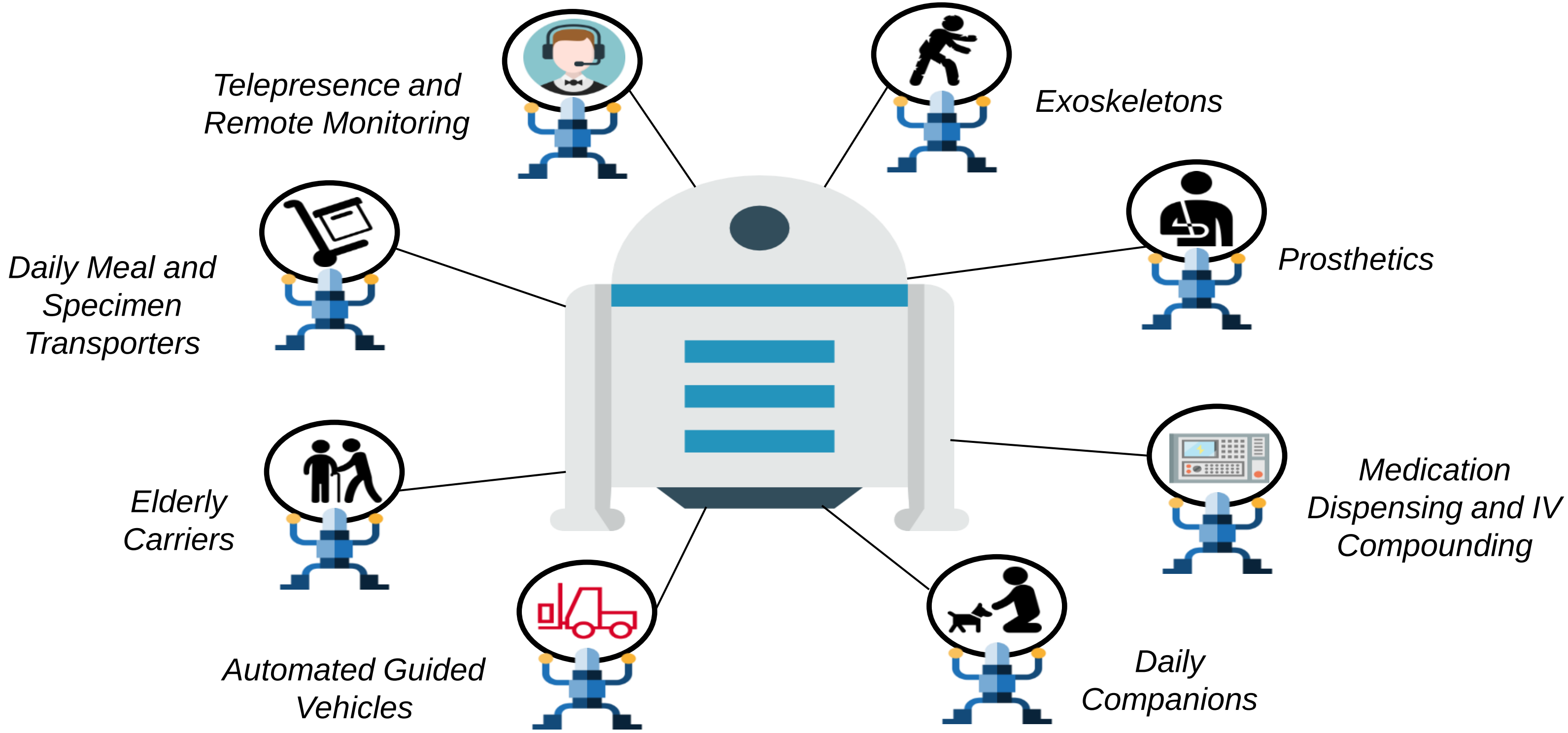
Smart Home Platforms
amazon alexa
Microsoft
C2C
orbita
SAMSUNG
LG

Robotics
ELLI•Q
sproutel
Consequential Robotics
PARO
Buddy
HANSON ROBOTICS
SoftBank Robotics
RT.WORKS
RIKEN
jibo
unibo
No Isolation
Catalia Health
sphero
ROBOKIND
neato

Source: Frost & Sullivan Analysis

Robotics and Automation Supporting Care Assistance

Areas served within hospitals



Source: Frost & Sullivan Analysis

Impact on Healthcare Stakeholders

DOCTORS

- Quality of Patient Interactions – Remote & In-Person, Improves Drastically
- Enables True Precision Health, Better Patient Outcomes
- Insights Allow Earlier Detection, Even Prevention of Disorders

HOSPITALS

- Fewer readmissions, force transformation to critical care delivery centers
- Analytics improves insights on disease progression and causes
- Improve population health, support public health initiatives

Source: Frost & Sullivan Analysis

Alternate Care Locations - Regional Readiness Assessment

Smart Home Healthcare Market: Regional Readiness Assessment, Global, 2017

Rank →

Legend: Low ● ○ High

	North America	Europe	Asia-Pacific	Latin America	Middle East and Africa
Rank	1	2	3	4	5
Infrastructure	●●●	●●◐	●●○	●◐○	◐○○
Technology	●●●	●●◐	●●○	●○○	◐○○
Government Push (Energy Efficiency)	●◐○	●●●	●◐○	◐○○	●○○
Consumer Awareness	●●●	●●◐	●◐○	●○○	●○○
Affordability & Willingness to Invest	●●◐	●●○	●○○	●○○	●●○

Source: Vision 2025 – Healthcare in the Smart Home, Frost & Sullivan

Source: Frost & Sullivan Analysis

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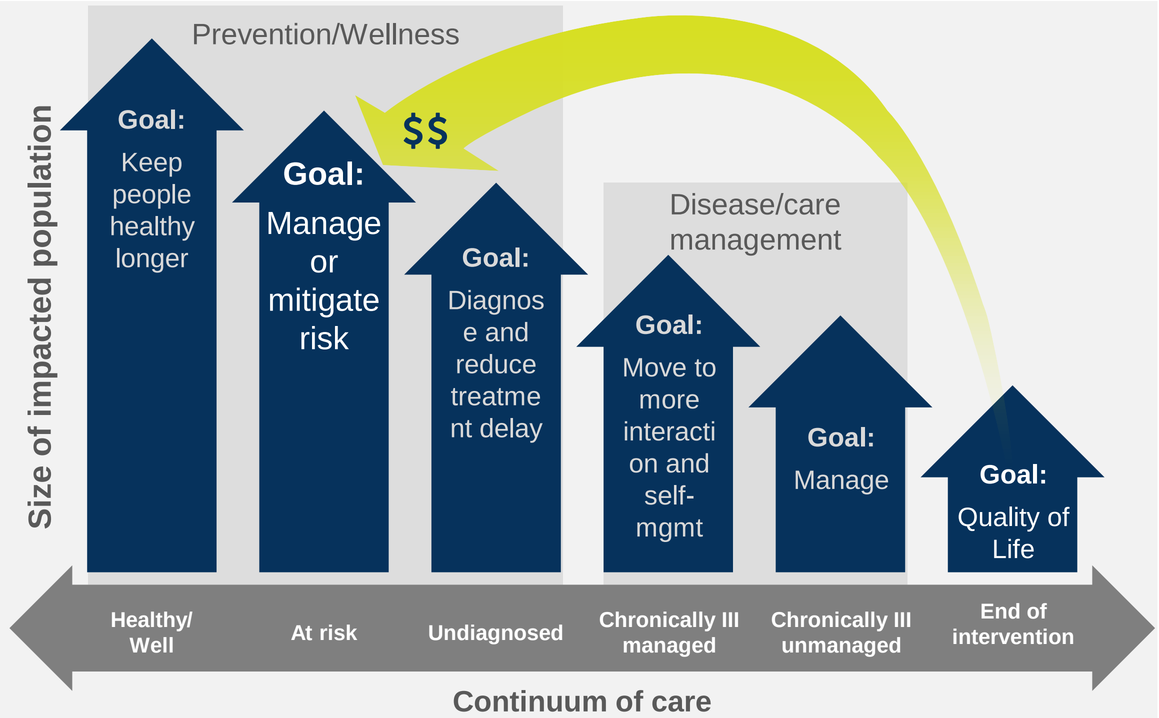
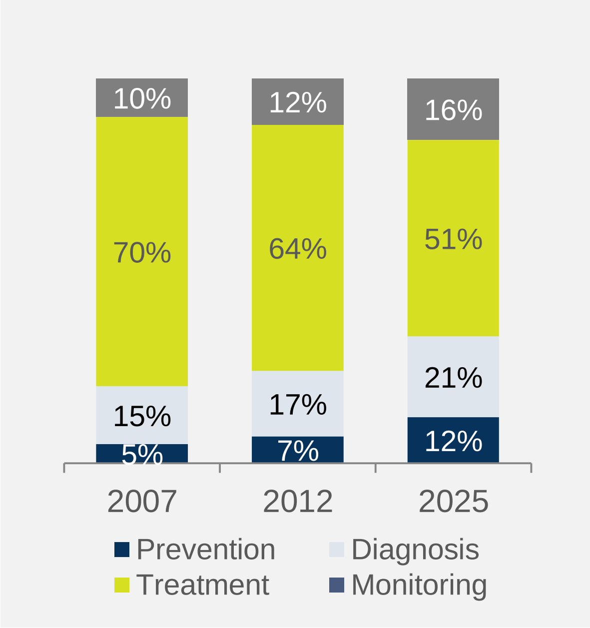
4 Key Takeaways

Prevention & Wellness – The New Focus of Care to Bend the Cost Curve

Shifting focus and investments: from acute care to prevention



Global Healthcare Spending



Source: Frost & Sullivan Analysis

Challenges with Chronic Disease Prevention and Management

Aging Population and Chronic Disease Epidemic

Proportion of Deaths Attributed to Non-communicable Diseases, Global, 2015 and 2030

68.4%	**73.9%**
2015	2030

Seniors Prone to Expensive Chronic Diseases

Proportion of Elderly Suffering from Chronic Diseases, US, 2017

80%	**77%**
One Chronic Disease	Two Chronic Diseases

Annual Cost of Chronic Diseases, US, 2017

$317 billion
Cardiovascular Disease

$245 billion
Diabetes

80% of all **heart disease, diabetes, and stroke**, and **40%** of **cancers** can be prevented by optimizing lifestyle and exogenous risk factors.


Sedentary Activities


Poor Nutrition

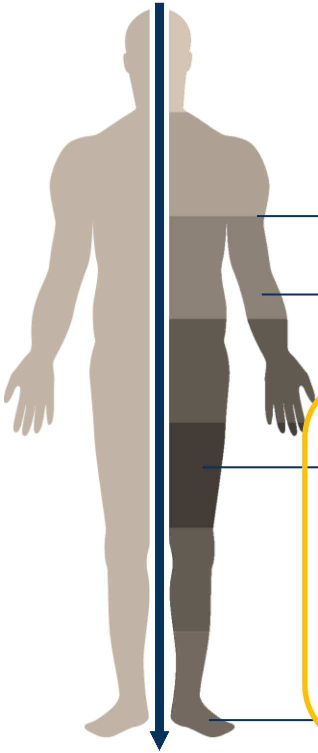

Tobacco Usage


Alcohol Consumption

Source: Frost & Sullivan Analysis

Health Data Ecosystem Beyond Omics and Clinical Factors

Include factors such as; patient medical history, remote monitoring data, lifestyle and exogenous factors.



Key Data Types/Factors		Avg. Per Patient Lifetime Data Volume (in TB)
Omics/Dx	30%	6.0
Clinical	15%	0.4
Remote Care	20%	220.0
Exogenous	35%	880.0

All the data in the American Library of Congress amounts to **15 Terabytes** (TB)

The data explosion along the care cycle globally to generate **$4x10^{10}$ TB by 2020**

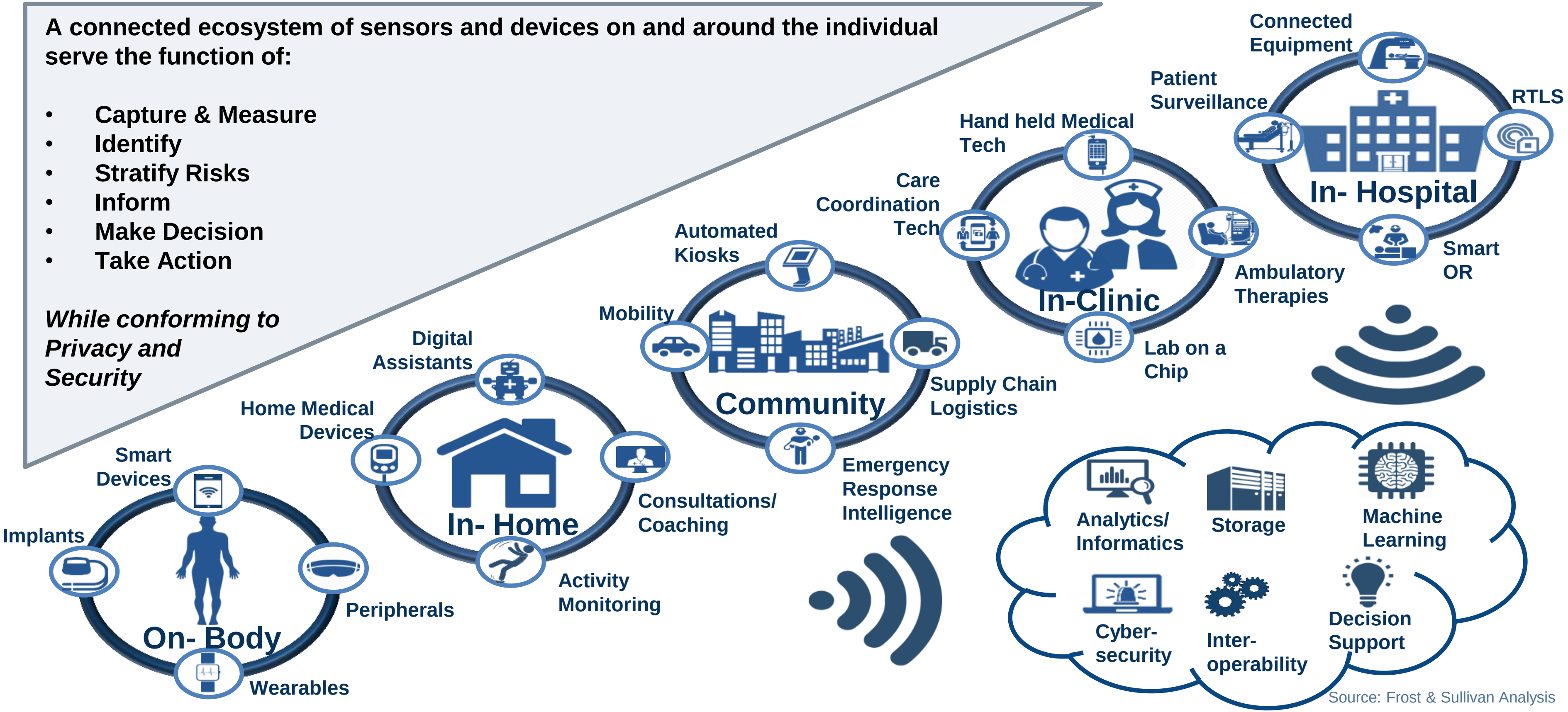
Source: IBM Watson Health; Frost & Sullivan. Analysis

The Internet of Medical Things Ecosystem

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**

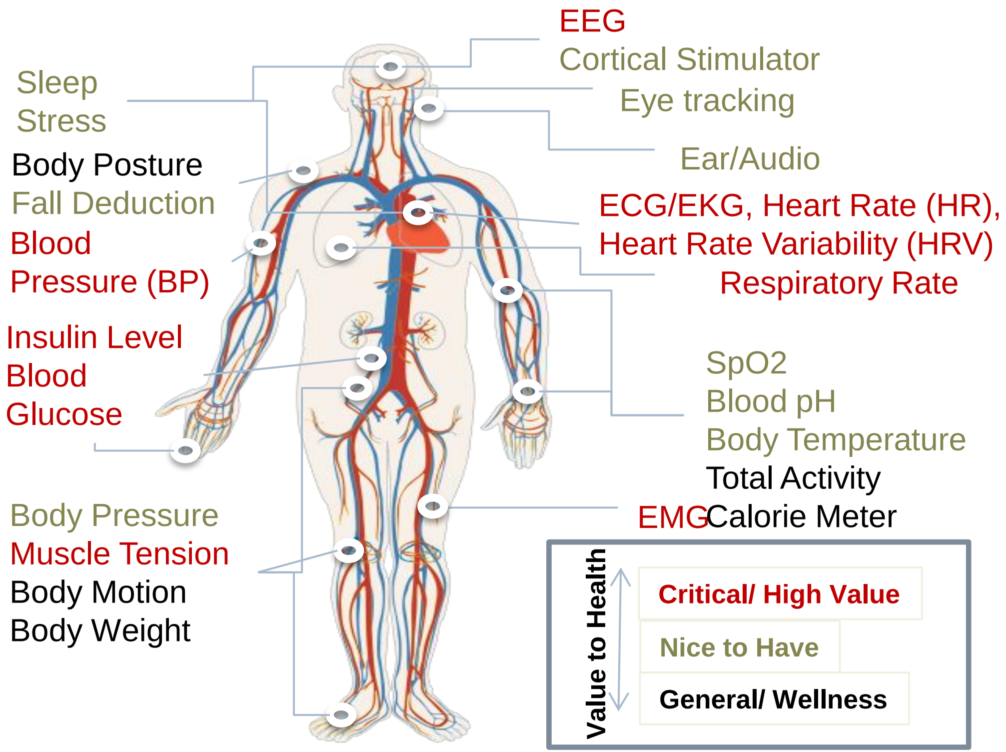
While conforming to Privacy and Security



Source: Frost & Sullivan Analysis

The Human Body - A Treasure Trove of Personalized Health Data

Wearables Harnessing Human Body Data/ Biometrics



Major Therapeutic Focus

Heart and Cardio Monitors

ECG/EKG, HR, HVR
Temperature Fall Deduction
Respiratory Rate, BP

CVD, MI, Stroke Arrhythmias Atrial Fibrillation

Diabetes and Obesity Monitors

Blood Glucose Insulin
Body Pressure
Respiratory Rate, BP
HR, Vision Body Weight

Diabetes Hypoglycemia Obesity

Respiratory and COPD Monitors

ECG, HR, SpO2, Respiratory Rate
Temperature Fall Deduction
Activity Body Posture

COPD Asthma Tuberculosis Lung Cancer Respiratory Infection

Chronic Pain Management

Body Pressure Muscle Tension
Body Posture Fall Deduction
Body Motion Body Weight
Total Activity Sleep

Headaches Joint Pain Lower backaches

Source: Frost & Sullivan Analysis

Wearables Enable Decentralization & Preventive Care

Benefits to Different Stakeholders

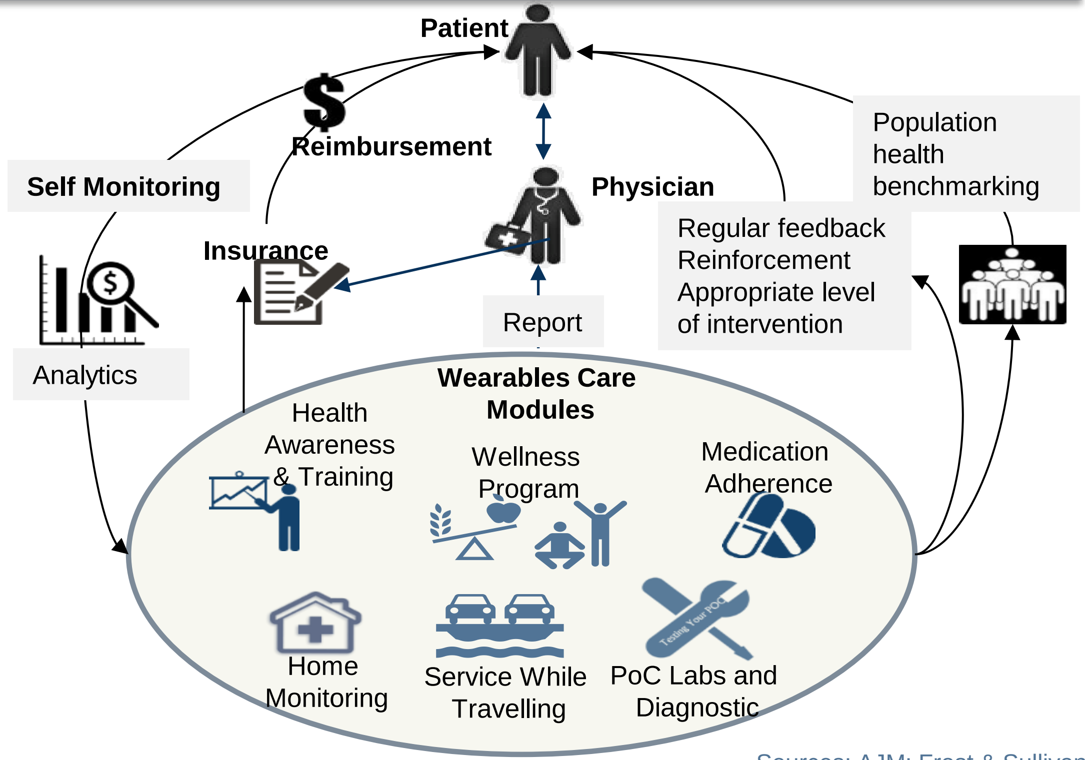
Hospital — Reduces readmission, patient process time, and test duplication

Physician — Can access comprehensive patient data and history for improved decision making and diagnosis

Patient — Can stay more informed about personal health and wellness, and benefit from reduced treatment time

Payer — Reduced treatment cost, hospital length of stay, and overall process efficiency

Wearable-Enabled Decentralized Care Model



Sources: AJM; Frost & Sullivan

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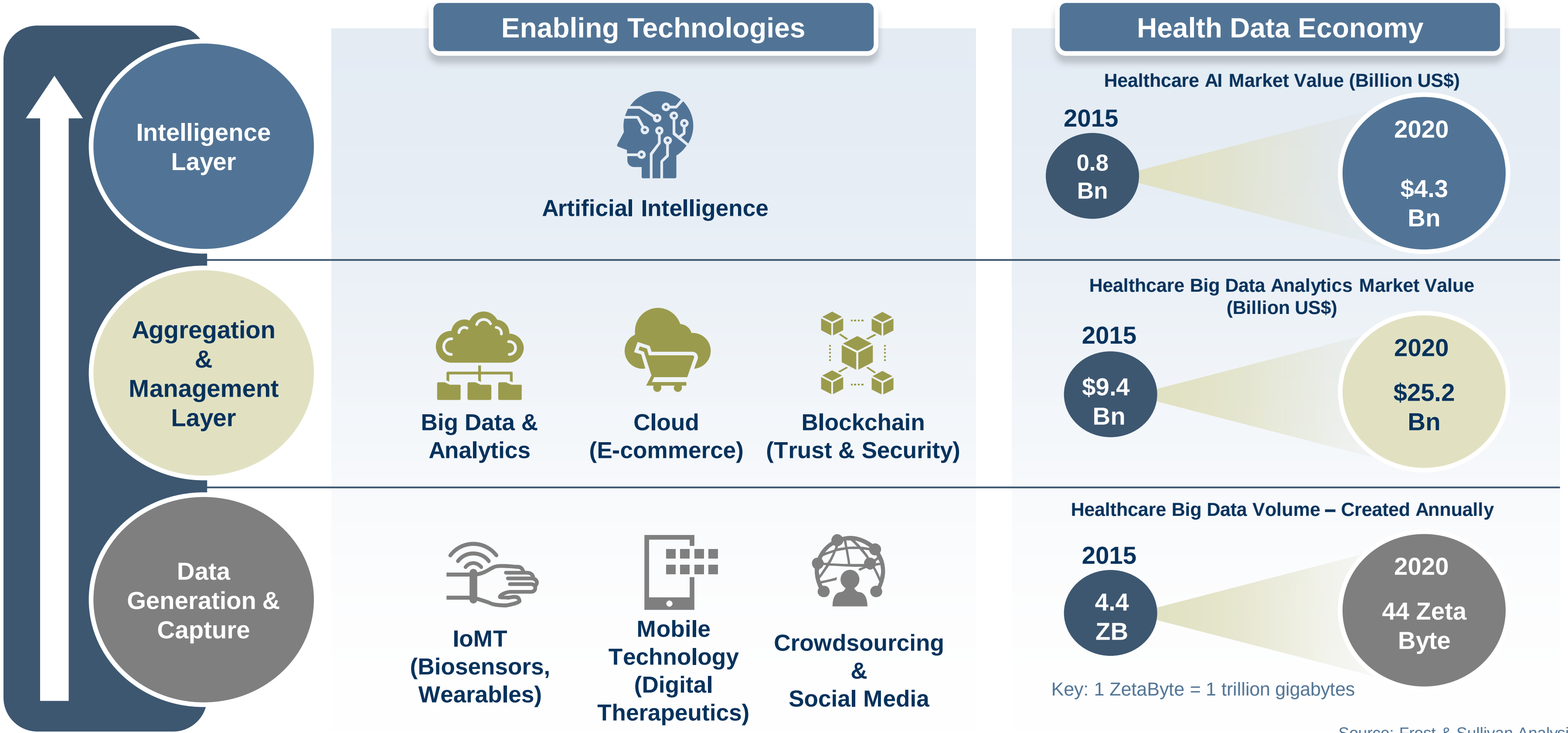
Digital Platforms Driving Transformation

Access to Data is not enough; Innovative use cases will be key differentiator



Source: Frost & Sullivan Analysis

Transforming Biopharma Business Model

Transitioning from the 'one-size-fits-all' to 'precision health' model with multi-level patient stratification

	Pharma 1.0		
	Last Decade	Current Decade	Next Decade
Driving Factors	**Blockbuster**	**Innovative**	**Medicine-as-Service**
Business Models	**Diversified Large Pharma/Biopharma**	**Lean – Specialty Pharma/Biotech**	**Virtual Pharma/Biotech Companies**
Innovation Process	Linear (In-house)	Partial Externalization and In-licensing	Open Innovation and Symbiotic Collaborations
R&D Approach	Intuition Based (Trial & Error)	Evidence Based	Precision Based
Treatment Focus	Symptom Based	Cohort Based	Algorithm Based
Drug Synthesis	Small Molecule (Chemical Based)	Large Molecule (Biologics)	Digital Medication (Rx, Dx, and Device)
Pricing Model	Mass Marketing (Volume Based)	Low Volume – High Price (Value Based)	Chronic Disease Management/PHM (Outcome Based)
Customer Focus	Clinicians and Scientists	Payers and Governments	Patients and Consumers
Marketing Channel	Sales Rep-driven B2B	Partial e-Fulfilment	100% e-Fulfilment (Rep-free D2C/D2P)
Sourcing Approach	**Transactional**	**Strategic**	**Co-innovation**

Source: Frost & Sullivan Analysis

Evolving Medical Device Service-based Business Model

Medical Device Servicization – Shifting focus from selling devices to intelligent solutions

Value for Customer

Medical Devices

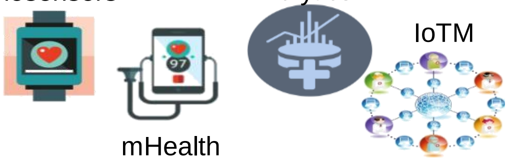
Medical Technologies

Wearables/ Biosensors

Big Data & Health Analytics

IoTM

mHealth



Digital Health Solutions

Artificial Intelligence

Augmented Reality

Robotics

Last Decade

Historic/Evidence-based Care

- Sell Parts/Hardware
- Consumables/Upgrades
- Repair/Maintenance Support
- Leasing and Buying Support

Differentiation solely through product innovation

Medical Products

Current Decade

Real-time Outcome-based Care

- Product-as-a-Service
- Data-as-a-Service
- Platform-as-a-Service
- Managed Services

Differentiation by providing services to key stakeholders such as physicians, patients, and payers

Services

\+

Medical Products

Next Decade

Predictive & Preventive Care

- Insight-as-a-Service
- AI-as-a-Service
- Robotics-as-a-Service

Differentiation via intelligent solutions for evidence/outcome-based health benefits to demonstrate value to end users

Intelligence

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Services

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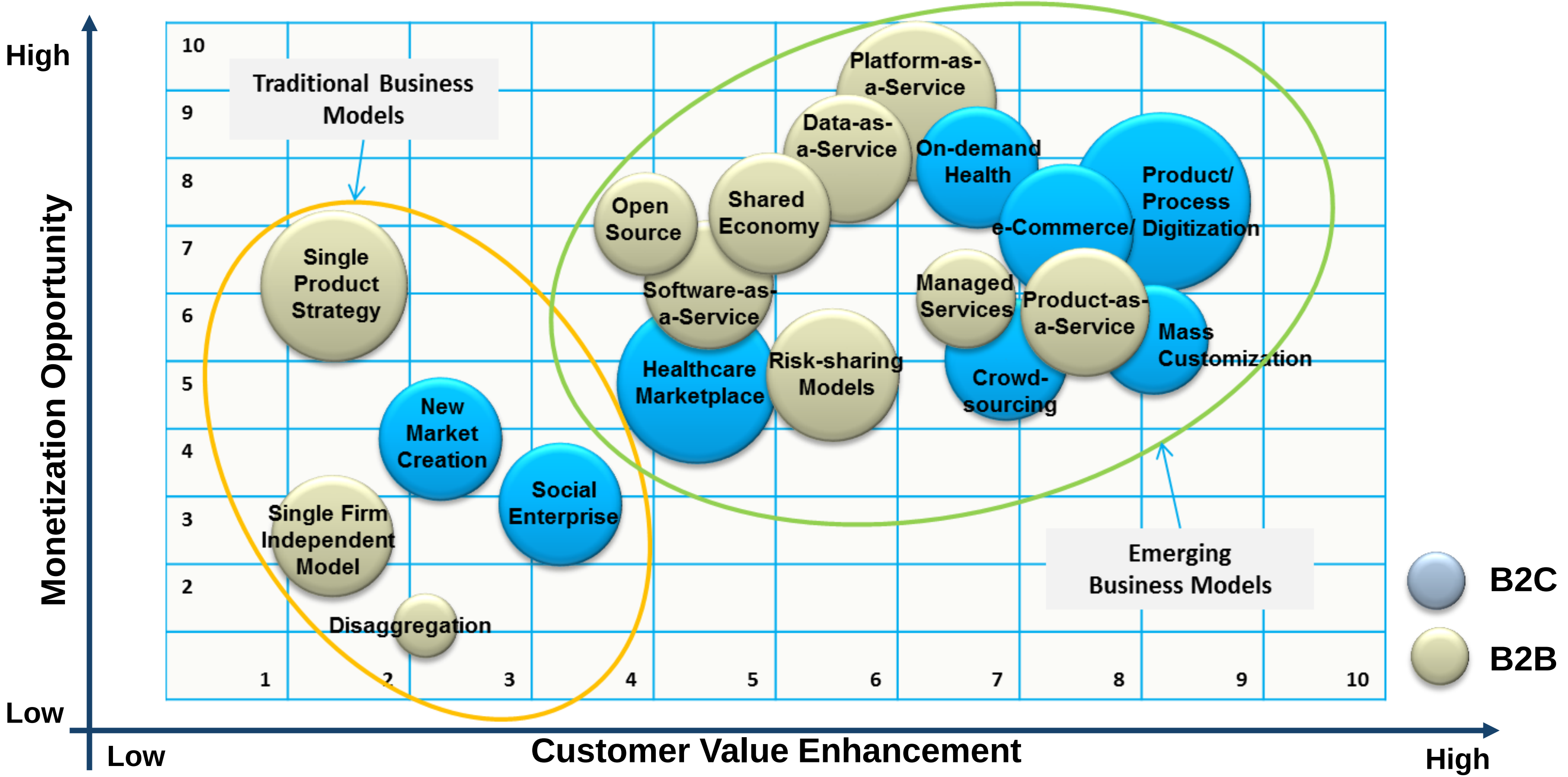
Medical Products

Image source: Thinkstock; Source: Frost & Sullivan

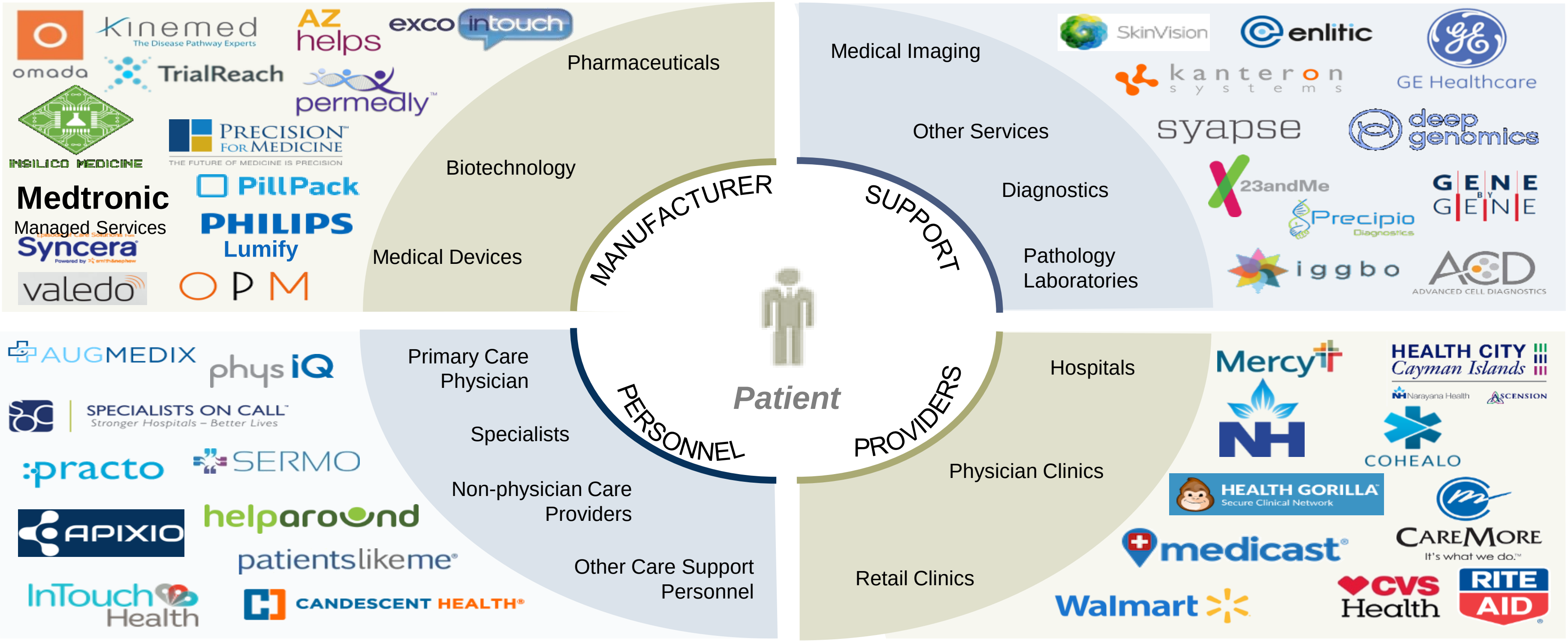
Emerging Healthcare Business/Care Delivery Models



Source: Frost & Sullivan Analysis

Vendors Transforming Healthcare Delivery Models

With transformative trends pushing the industry to innovate, similar business themes emerge from different stakeholder groups



Note: Companies list and their business models are not exhaustive, but representative in nature.

Source: Company Websites, Frost & Sullivan

Inherent Challenges For This Vision

Technical	Physical Security, Cybersecurity	Lack of Interoperability	Data Source Verification	Standardized Data Capture, Accuracy	Unique Identifiers

Real-World Application	Data Ownership	Privacy	High Costs

Source: Frost & Sullivan Analysis

A common theme for all, yet disparate means to achieve the outcomes

Digital Transformation

Past Approach	2019 and Beyond
What kind of Tech do we need?	What Outcomes are we trying to drive?
How to monetize Cool Tech approaches?	How Tech & Industry convergence will drive Business & Care Delivery Innovation?
How do you sequence and prioritize Tech adoption?	Finding the optimum Market Positioning with Intended End-users?

Source: Frost & Sullivan Analysis

Q&A

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