Vision 2020: 
The Need to Build Holistic, Personalized Healthcare Delivery Systems

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# Challenges for Healthcare Delivery Systems

<table>
<thead>
<tr>
<th>Cost</th>
<th>Demographics</th>
<th>Chronic Diseases</th>
<th>Life Style Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inefficient use of Information</td>
<td>Fragmented, Compartmentalized Services</td>
<td>Protracted Adoption of Best Practices</td>
<td>Subsidiarity and Policy Complexity</td>
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</table>
The Strategic Environment for Healthcare: Defining New Value Propositions

- an environment of increasing economic constraints
- managing the limit(s) of society’s willingness and ability to pay for innovation
- controlling costs while enhancing quality and outcomes
- building new alliances to optimize value-driven outcomes
  - integration of Dx, Rx, Ix
  - reliable information drives rational decisions
  - engagement of patients/consumers
  - new OTC/consumer services
The Economic, Social and Clinical Benefits of Proactive Mitigation of Disease Risk and Chronic Disease Co-Morbidities

Health Status

- Healthy/ Low Risk
- At-Risk
- High Risk

20% of the Population Generate 80% Cost

- End-of-life care
- Chronic disease progression
- Chronic disease early stage
- Acute disease
- Multiple co-morbidities

Value vs. Cost
#1  • major forces driving the evolution of healthcare
    – technology, social, economic

#2  • convergence of medicine, engineering and computing
    – molecular diagnostics for rapid profiling of health status
    – devices for remote health monitoring
    – social media, e.health, m.health

#3  • increased responsibility of consumers for personal health (wellness)

#4  • electronic connectivity and healthcare information services
    – continuity of care (cradle to grave)
    – erosion of national boundaries
    – entry of new companies not previously involved in healthcare

#5  • social media
    – from passive consumers to greater engagement in healthcare and treatment choice
Personalized Medicine Trends in the Rx World
Technology Convergence and Personalized Medicine: The Rise of Multiplex Diagnostics and Miniaturized Sensors/Devices

Molecular Medicine

Miniaturization Engineering

Computing and Information Networks
Disease Subtyping: Next-Generation Molecular Diagnostics (MDx) and A New Molecular Taxonomy of Disease

MDx Platforms

- massive parallelism
- miniaturization
- automation
- rapid
- POC

RIGHT Rx for RIGHT DISEASE SUBTYPE
Personalized Medicine: Progressive Evolution Based on Increasingly Comprehensive Profiling of Disease Risk and Health Status

- Targeted Care
  - rational Rx based on profiling of underlying molecular pathology
  - MDx and disease subtyping

- Individualized Care
  - rational Rx based on comprehensive molecular profiling of individuals
    - disease subtypes and optimum Rx
    - Rx adverse event risk
    - disease predisposition risk and mitigation

- Personalized Care
  - real time remote health status monitoring
  - transition to disease prediction and preemption
  - integration of clinical medicine and consumer health (“wellness”)
K-RAS Profiling and Anti-EGFR Monoclonal Antibody Therapy

- higher response in patients with K-RAS versus mutant-K-RAS
- estimated $604 million/year savings (ASCO)

clinical guidelines

- regulatory endorsement in product labeling
- payor adoption
The Hunt for Gene Loci Associated with Predisposition to Complex Human Diseases
• probabilistic future risk(s) versus absolute risk

• effect of environmental factors/lifestyle on risk
  – enhance
  – reduce

• ethical and legal implications
  – insurance
  – employment
  – privacy
Evolution of Molecular Profiling and Diagnostics for Improved Disease Detection, Classification and Risk Evaluation (Rx Markets)

- Early Detection of Progression Risk
- Consumer Genomics
- Genetic Predisposition to Disease
- Rx Intervention

Rx-Dx Combination for Optimum Rx Selection
Molecular Markers for Disease Subtypes
Adverse Event Risk

- 5 yr
- 10 yr
- 15 yr
Technology Convergence and the OTC and Consumer Health Worlds
Implications of Personalized Medicine for OTC Sector: Expanding the Horizon of Traditional OTC Products and Services

**Traditional Categories of Products/Services**
- Rx to OTC conversion
- Relationship with Rx industry
- M&A activity to acquire brands/market position
- Product launches increasingly affluent NICs

**New Opportunities**
- In-home diagnostics
  - Remote health status monitoring
- New life-style product classes
- E.health and m.health
- New entrants and new business models for OTC product promotion and adoption
attraction of cost-shifting to consumer for payors

regulators will continue to focus primarily on safety of eligible product categories
  – known risks and adverse event profile of Rx
  – drug interaction risks in OTC setting

availability of diagnostic tests to identify ‘at risk’ individuals for Rx classes with regulatory concerns may facilitate conversion
  – myopathy in ‘statins’

new diagnostics for use of OTC anti-infectives in developing countries
  – definitive diagnosis of organism before purchase allowed to reduce growing resistance problem
  – residual challenge of extensive use in food animal production
Wellness:

The Most Broad and Most Valuable Definition of Successful Healthcare

Consumer-Centric Health
After a Short Stay in America, Michelangelo's David Returned to Europe
Consumer Behavior and Healthcare Costs

“diabesity” $200 billion

smoking $190 billion
alcohol $20 billion
The Case for Wellness

- 30-60% of health plan claims are related to health risks that are modifiable by nutrition, exercise, stress reduction, etc.

- Well-managed employer health and productivity management programs return $6-15 for every dollar spent.

- Cost of smoking: healthcare cost of smoking over a lifetime = $220K per person = $40 in healthcare cost per pack of cigarettes smoked!

- 67% of the US population is overweight or obese, and 22% of current healthcare costs are obesity-related.

Source: Wellness Councils of America
No two employees are alike. And neither are their health decisions.

Your employees’ decisions impact not only their health, but also your company’s costs and productivity. To enable better decisions, UnitedHealthcare is leading the way with personalized health care solutions designed to help people—and businesses—stay healthy.

- Personal health assessments
- Personal wellness programs/tracking
- Personal care consultants
- Personal care plans
- Personal doctor selection
- Personal cost estimators
- Personal health records
- And more

Personalization is the heart of health care. Better decisions lead to better results.

Find out how we can personalize your employees’ health care to help your bottom line.

1.877.232.8821

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Health Status Monitoring and the Promotion of Wellness

On-Body: In-Body Sensors (OBIBs) and Remote Monitoring of Health Status
Personal Health Systems: On-Body: In-Body Sensors (OBIBs)

- wearable
- portable/mobile
- point-of-care
- implantable
- multi-parametric
- interoperability with electronic records

Mobile Health (mHealth)
On Body: In Body Sensors and Devices

Objective
- remote monitoring of health status

Applications
- multi-feature monitoring and broadband wireless networks
  - ubiquitous sensing
- enhanced autonomy for in-home aged
- proactive alerting and intervention to mitigate health incidents
- monitoring of patient compliance
- coupled linkage to remote Rx dispensing for efficient disease management

Parallel Opportunities in OTC and Consumer health markets
## Major Target Markets for Wireless Medicine

<table>
<thead>
<tr>
<th>Disease</th>
<th>Parameter</th>
</tr>
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<tbody>
<tr>
<td>Alzheimer’s</td>
<td>vital signs, location, activity, balance</td>
</tr>
<tr>
<td>Asthma</td>
<td>respiratory rate, FEV, air quality, oximetry, pollen count</td>
</tr>
<tr>
<td>Breast CA</td>
<td>ultrasound self-exam</td>
</tr>
<tr>
<td>COPD</td>
<td>respiratory rate, FEV, air quality, oximetry</td>
</tr>
<tr>
<td>Depression</td>
<td>medication compliance, communication</td>
</tr>
<tr>
<td>Diabetes</td>
<td>glucose, hemoglobin ATC</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>cardiac pressures, weight, blood pressure fluid status</td>
</tr>
<tr>
<td>Hypertension</td>
<td>continuous blood pressure monitoring, medication compliance</td>
</tr>
<tr>
<td>Obesity</td>
<td>smart scales, caloric in/out, activity</td>
</tr>
<tr>
<td>Sleep Disorders</td>
<td>sleep phases, quality, apnea, vital signs</td>
</tr>
</tbody>
</table>

Modified from: West Wireless Health Institute, Medtech Insight, August 2009
The Costs of Non-Compliance with Rx Regimens

- $177 billion projected cost
- 20 million workdays/year lost (IHPM)
- 40% of nursing home admissions
- projected 45-75% non-compliance (WHO)
- 50-60% depressed patients (IHPM)
- 50% chronic care Rx (WHO)
The Non-Compliance Problem

- non-compliance rates in both long-term and short-term treatments reach 50% of patients
- non-compliance “a worldwide problem of striking magnitude” (WHO, 2003)
- non-compliance is a major barrier for realizing the benefits evidence-based therapies
- lack of effective policies toward the problem of non-compliance at both national and European levels
In-Home POC Health Status Monitoring
The Infocosm: Emerging Networks of Global Connectivity

Life's a game
Manipulating society has traditionally been the preserve of politicians and the gods. Does the current boom in virtual worlds give social scientists and economists an opportunity to join them? Jim Giles investigates.
Digitizing Health Information
AORTA: Always On, Real-Time, Actionable

- Personal Health Record (PHR)
- Electronic Health Record (EHR)
Digitizing Health Information

AORTA: Always On, Real-Time, Actionable

Personal Health Record (PHR) and Electronic Health Record (EHR) for continuity - cradle to grave, borderless information, individual risk profiling, risk mitigation and compliance.

WELLNESS
Digitizing Health Information
AORTA: Always On, Real-Time, Actionable

- Personal Health Record (PHR)
- Electronic Health Record (EHR)

- family tree history
- life-style records
- continuity - cradle to grave
- borderless information

individual risk profiling, risk mitigation and compliance

Wellness Networks
Healthcare Delivery Networks
Telecommunications and Media Industry
Convergence:
Implications for Healthcare Delivery
and Consumer-Centric Care
e-Patient Revolution
Wireless Technologies:
Consumer and Clinical Markets Converge
iPhone Apps for Health and Fitness

- Gym Buddy
- WebMD Mobile
- Happiness
- Calorie Calculator
- Índice de masa
- Gym Technik
- Pocket Workout
- Shake Jump
- iFitness
- 8h2o
- Track’n Trail
- iPump Total Body
- Steps
- CareConnector
- GottaKickit
- Total Coach
- Anatomy Flash
- Workout Buddy
Pharma and Healthcare Social Media (Non-Brand Sponsored) Patient Communities

- **CancerCompass**: Social network about Empowering cancer patients to make informed decisions.
- **the CANARY REPORT**: Blog and social network about Multiple Chemical Sensitivity.
- **Face2FaceHealth**: Healthcare social utility designed to connect people.
- **depressiontribe**: Community network share stories, encouragement and friendship.
- **CareFlash**: Place to submit, retrieve and share information and well-wishes surrounding a loved one's health circumstances.
- **Advanced Breast Cancer Community**: Information source online community advanced (metastatic) breast cancer patients, caregivers.
- **Disaboom**: Information and resources for people with disabilities.
- **Autism151**: Campaign to pull our community together and offer a brighter, more positive view of autism.
- **cancer tv**: Discussion board featured on cancer survivors.
- **BeWellBeta**: Expert-guided communities where you have access to authoritative information about health topics.
- **Cancer Survivors Network**: Discussion board anonymous share health information.
- **DailyStrength**: Social network where like-minded people can communicate with each other and offer peer support.
- **GGuard**: Social network where like-minded people can communicate with each other and offer peer support.
- **HealingWell.com**: Social network patients, families, friends and professionals struggling with disorders and chronic illness.
- **Circle Of Sharing**: Helps cancer patients and caregivers get personalized information about the disease, and share that information.
- **eDrugSearch.com**: Search engine for Americans interested in purchasing safe, low-cost prescription drugs from pre-screened international pharmacies.
‘Take a photo and get advice’
Social Networking Sites (SNS) and their Role in Clinical Care and Personal Health

- logical extension of rapid rise of SNS in mainstream culture
- information on both treatment and wellness options
- OTC advertising

- Quality
- Trust
- Security
A New Economics for a Digital World

- information is not limited by its transportability or number of times it can be used
- networked technologies offer new, powerful ways to analyze and manage consumer behavior economic data at increasingly fine-grained scale
- new sociometrics
  - product use and advertising impact
  - product refinement
  - product relationships and new promotion channels
  - inventory and distribution logistics
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CUSTOMIZATION
In-Home Health Connection: Engaging the Elderly
Electronic Networks and Expansion of Locations for Healthcare Delivery and Support of Consumer Wellness
“Real personalized medicine should begin long before we’re faced with pharmacology”

“Our health information is too important to leave to an archaic, insular system.

If there’s no longer a need to rely solely on a doctor’s advice for treatment and care, why should we be expected to artificially limit our options.”

Thomas Goetz
Deputy Editor of Wired
Virtual Medicine Networks:
Increasingly Integrated Care and Continuity of Care

- rapid, real time access to expertise
- broader range of clinical specialties
- integrated health records
- availability of lab and Rx lab data
- drug interactions risk
- electronic Rx prescribing

**Rx**

**OTC**

**Consumer Health**

- electronic analysis of diagnostic accuracy for optimum use of ‘wellness’ products

- controlled electronic oversight of Rx to OTC conversion for products that regulators would otherwise be reluctant to grant full OTC approval
Smart Cards and Personal Electronic Health Records
Digitizing Health Information
AORTA: Always On, Real-Time, Actionable

- Personal Health Record (PHR)
- Electronic Health Record (EHR)

- family tree history
- life-style records
- OTC products
- life-style products
- new consumer services
- remote health status monitoring

- social media

- The Wellness Networks
- Healthcare Delivery Networks

- individual risk profiling, risk mitigation and compliance
- transparency and outcomes data
- targeted care
- integrated care
- in-home systems

- continuity - cradle to grave
- borderless information
- life-style records

- new consumer services

Technology Convergence and Personalized Medicine

- Molecular profiling of disease or disease risk
- Rapid, point-of-care (POC) diagnostics
- On-body:in-body sensors
- Electronic health records
- Wireless technologies and remote health status monitoring
- In-home health status monitoring
- Social media
- New healthcare information providers
- Expanded sites for healthcare delivery
- Dx-Rx combinations (right Rx for right disease and right patient)

Increased Consumer Responsibility for Personal Health (Wellness)
Regulation

- increased scrutiny of “health claims” for OTC products
  - validation, labeling
  - social media and e.promotion
- global supply chains and authenticity/safety
  - products and intermediates
  - validation of material(s) origin(s) and analytical methods
- use of electronic systems to track product use and consumer concerns
Technology Acceleration and Convergence: Healthcare Delivery and Consumer Health
The Coming Convergence in Healthcare Delivery and Consumer Health

**Technologies**
- biotechnology, medicine, engineering, computing, telecommunications and social media

**Clinical Practice**
- molecular medicine and increasingly customized care
- diagnostic, drug and device combinations
- POC testing and remote monitoring
- earlier detection of disease and improved outcomes
- reduced error and improved compliance

**Realigned Incentives**
- integrated care for complex chronic diseases
- earlier disease detection and risk reduction
- wellness versus illness
- remote health status monitoring
The Coming Convergence in Healthcare Delivery and Consumer Health

- technology and economic drivers to limit unsustainable increases in healthcare costs
- cost-shifting to consumers
- incentives/penalties for non-compliance to reduce risk/cost of illness
- major opportunities for OTC product classes for wellness/lifestyle

but

- increased regulatory scrutiny of OTC sector
  - health claims, product quality and authenticity
- increased consumer activism and networking with greater impact on product adoption/rejection
The Trajectory for Personalized Medicine Will be Different in the Clinical and Consumer Domains

Integration of Dx, Rx and Ix for Disease Management

remote health monitoring

risk identification, mitigation and compliance

consumer health (wellness)

consumer genomics

individual risk profile

10 yr
Potential Timelines for Disruptive Changes in Consumer Healthcare Arising from Technology Convergence

- social media
- lifestyle products
- m.health
- remote health status monitoring
- risk reduction and compliance
- digital health
- cost shifting to consumers
The Coming Convergence in Healthcare Delivery and Consumer Health

New Delivery Pathways

- new organizational/business models
- rapid expansion of e.health/m.health
- social media and promotion/adoption of OTC/wellness/lifestyle products/services
- integration of consumer health product categories with remote health monitoring services
- new ‘infomediaries’ will change balance of power between healthcare professionals and consumer
  - transparency, positive outcomes and performance
  - consumer choice
The Coming Convergence in Healthcare Delivery and Consumer Health

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VALUE