Health Care Technology Trends in 21th Century

เป็นสุข
PENSOOK

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ASHOKA INNOVATORS FOR THE PUBLIC

FIGURE 4: Projected Health Spending as Percent of GDP

Source: PricewaterhouseCoopers' estimates

US — Other OECD Countries
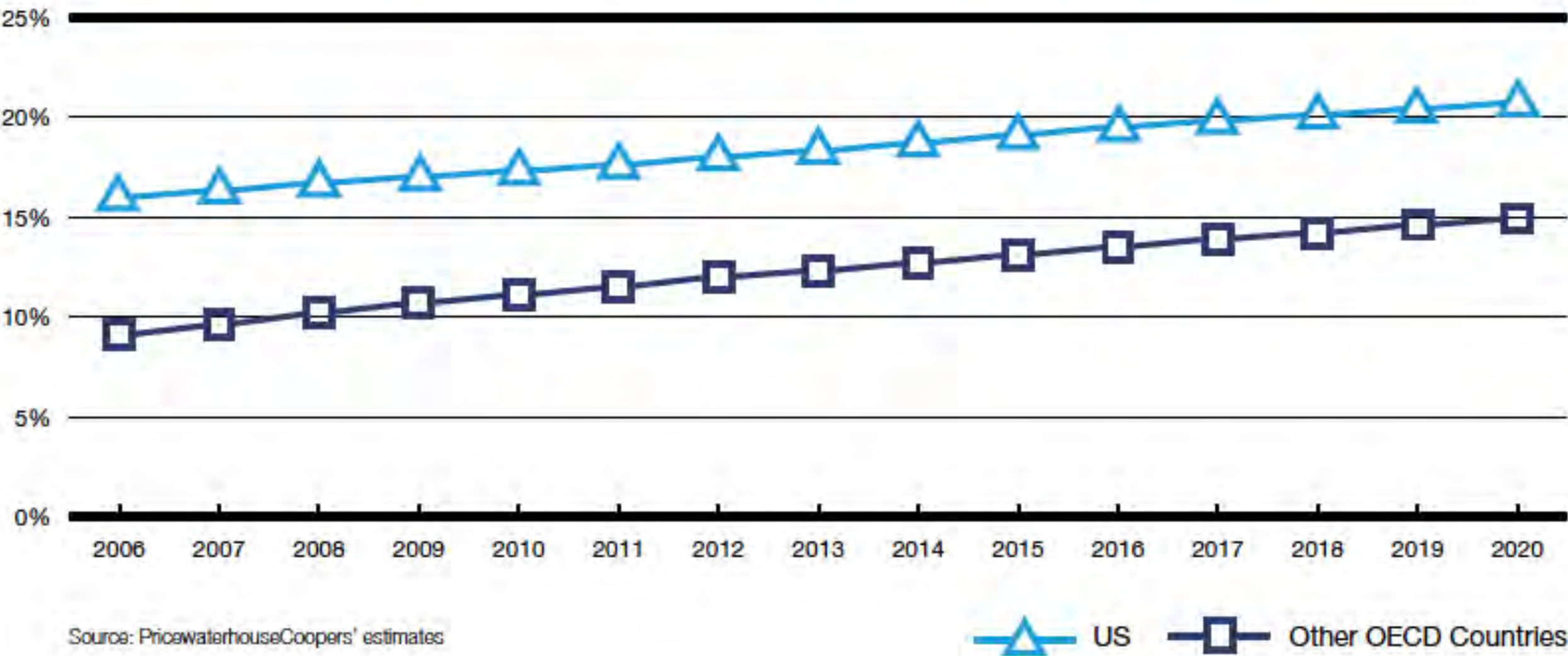
Our Health Care System in the Future !

รวมงบเหมาจ่ายรายหัว (บาทประชากร) ปีงบประมาณ 2546 - 2553

1,202.40
1,308.50
1,396.30
1,659.20
1,899.69
2,100.00
2,202.00
2,401.33

OBESITY
WORLD WIDE

1.5 BILLION
ADULTS ARE OVERWEIGHT

65%
OF THE WORLD'S POPULATION LIVE IN COUNTRIES WHERE THEY ARE *MORE LIKELY TO DIE FROM OBESITY* THAN MALNUTRITION

25%
HIGHER HEALTH CARE COSTS COMPARED TO A PERSON OF AVERAGE WEIGHT

43 MILLION CHILDREN UNDER 5 ARE OVERWEIGHT
That's almost 7%!

WORLD'S FATTEST COUNTRIES

NAURU
94.5% overweight

FSM
Federated States of Micronesia
91.1% overweight

COOK ISLANDS
90.9% overweight

TONGA
90.8% overweight

NIUE
81.7% overweight

SAMOA
80.4% overweight

PALAU
78.4% overweight

KUWAIT
74.2% overweight

USA
74.1% overweight

KIRIBATI
73.6% overweight

BY THE NUMBERS:
200 MILLION MEN & **300 MILLION WOMEN**
ARE OBESE.

THAT'S MORE THAN
10%
OF THE ADULT POPULATION

AND THE PROBLEM IS
GROWING

OBESITY IN 1980	OBESITY IN 2008
7.9% OF WOMEN	**13.8%** OF WOMEN
4.8% OF MEN	**9.8%** OF MEN

Overweight and obese are defined as abnormal or excessive fat accumulation that may impair health.

YOU NEED TO BURN
3500 CALORIES
TO DROP *A SINGLE POUND* OF BODY FAT

That's about 9 hours on the elliptical

$300 BILLION
ANNUAL HEALTH CARE COSTS FOR OBESITY IN THE U.S. AND CANADA

SEVERELY OBESE PEOPLE DIE UP TO
10 YEARS SOONER
THAN THOSE OF NORMAL WEIGHT

INFOGRAPHIC BROUGHT TO YOU BY
ACTOSINJURYLAWYERS.COM
CREATED BY ONOMEDIA.COM

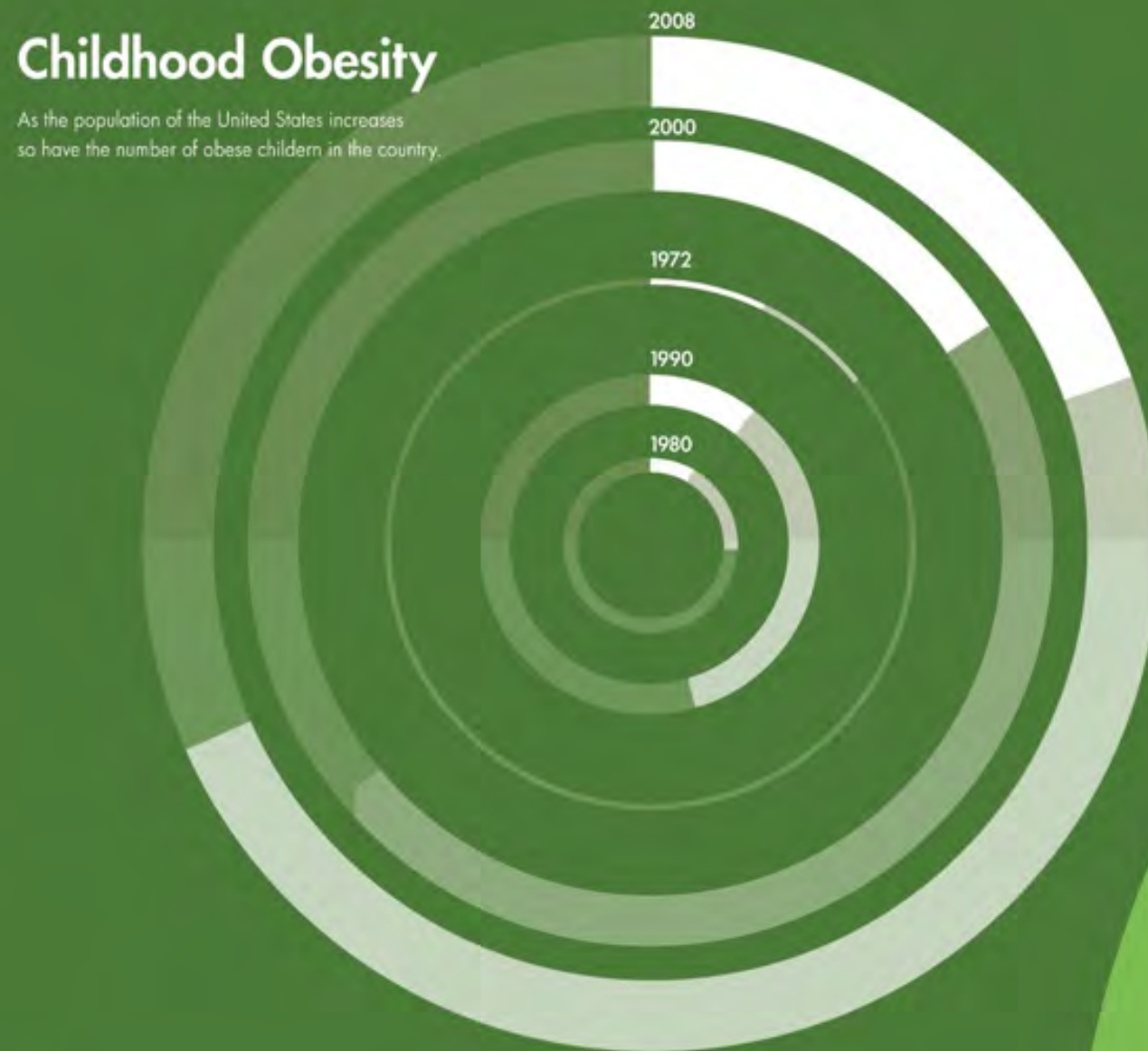# BMI=KG/M²

Body mass index (BMI) is a simple index of weight-for-height

Childhood Obesity

As the population of the United States increases so have the number of obese childern in the country.

2008

2000

1972

1990

1980

Color can be used to distinguish nutrient dense foods from less healthy choices. Aside from knowing that natural, and whole foods are healthier than processed foods, color, and color density can indicate how nutritious they are. Darker colors pack more nutrients per calorie than lighter ones and each color is generated naturally by a different set of nutrients. Consuming a colorful array of natural foods helps insure a variety of nutrients are ingested, and makes for a beautiful plate.

Eat more of the foods toward the outter edges of the value scale and limit the amounts of food toward the center.

Dark leafy green vegetables

Solid green vegetables

Non-green vegetables & fruit

Beans/Legums

Startchy vegetables & whole grains

Fish, non-fat dairy, wild meat, & fowl

Red meat, refined grains, refined oils, & sweets

● Obese child population

◉ Overweight child population

◉ Total U.S. child population

Obesity is defined by having a body mass index (BMI) of 30 or higher. An overwieght BMI is 25 to 29.9. To calculate a BMI divide weight in pounds by height in inches squared, then multiply by a conversion factor of 703. Many BMI calculators can be found on the internet.

Sugar & Spice
CHILDHOOD OBESITY IN AMERICA

Practice Fusion's Research Division released data on pediatric BMI, highlighting the scope of the childhood obesity epidemic as the nation's children head back to school.

More information: www.practicefusion.com/research

Feeling the burn
How many calories do kids burn in everyday activities?

99 calories
mowing for 45 mins

36 calories
walking the dog for 30 mins

18 calories
cleaning their room for 15 mins

The top 3
States with the highest sample childhood BMI rates.

California   Tennessee   Texas

Average Obesity by Age
- Girls' BMI
- Boys' BMI

25%
20%
15%
10%
5%

20 calories

| 3 – 5 years old | 6 – 8 years old | 9 – 11 years old | 12 – 14 years old | 15 – 18 years old |

Boys BMI
- Underweight
- Normal
- Obese
- Overweight

4%
21%
15%
60%

pediatric obesity

Girls BMI
- Underweight
- Normal
- Obese
- Overweight

3%
10%
16%
63%

60 calories
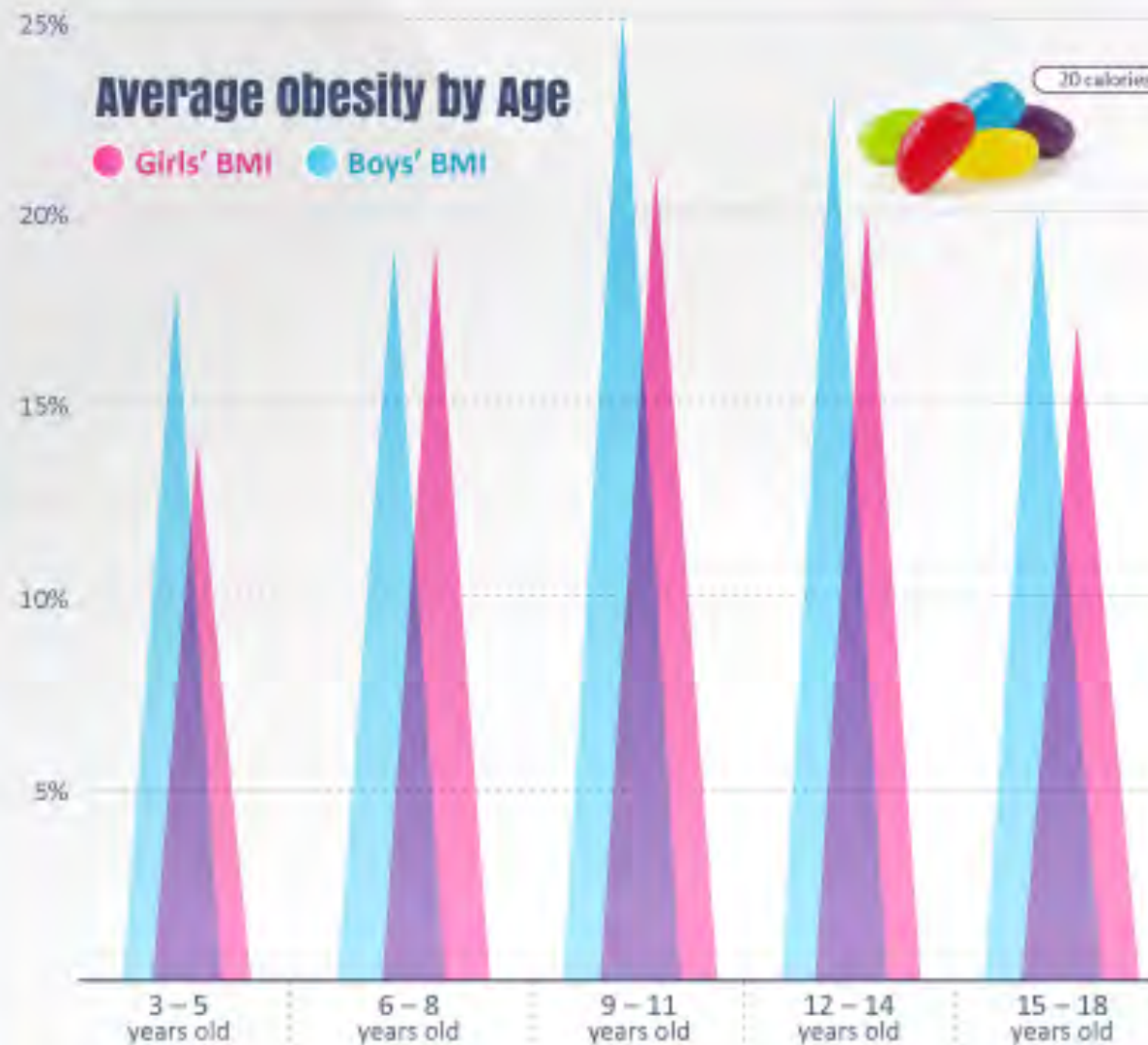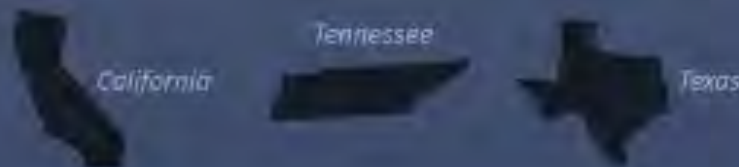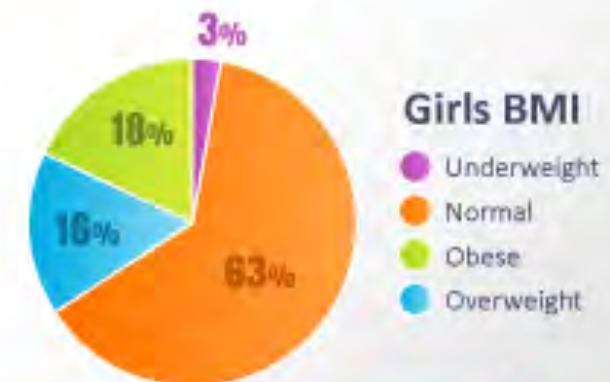
Obesity by gender
The percentage of overweight children nationwide is at an alarming rate.

25%
20%
15%
10%
5%

21% Boys
18% Girls

overweight or obese
1 out of 3 children are now overweight or obese based on findings from Practice Fusion's dataset.

total obesity tripled
Since 1980, obesity prevalence among children and adolescents has almost tripled.

- Underweight
- Normal
- Obese
- Overweight

4%
19%
16%
61%

131 calories

practice fusion

IN ONE GENERATION...

SODA consumption DOUBLES in girls & TRIPLES in boys[4]...
#of TVs in homes QUADRUPLES...#of foodservice establishments DOUBLES[1]
...the #of calories children consume outside the home nearly DOUBLES[1]

CHILDHOOD OBESITY TRIPLES

>>> % OF CHILDREN AGED 2–19 WHO ARE OBESE >>>

2010
1 in 3 children are overweight or obese [4]

obesity in teens
TRIPLES[2]
1980: 5%
2008: 18.1%

obesity in children ages 6-11
almost TRIPLES[2]
1980: 6.5%
2008: 19.6%

20% · 18% · 16% · 14% · 12% · 10% · 8% · 6% · 4% · 2% · 0%

2010
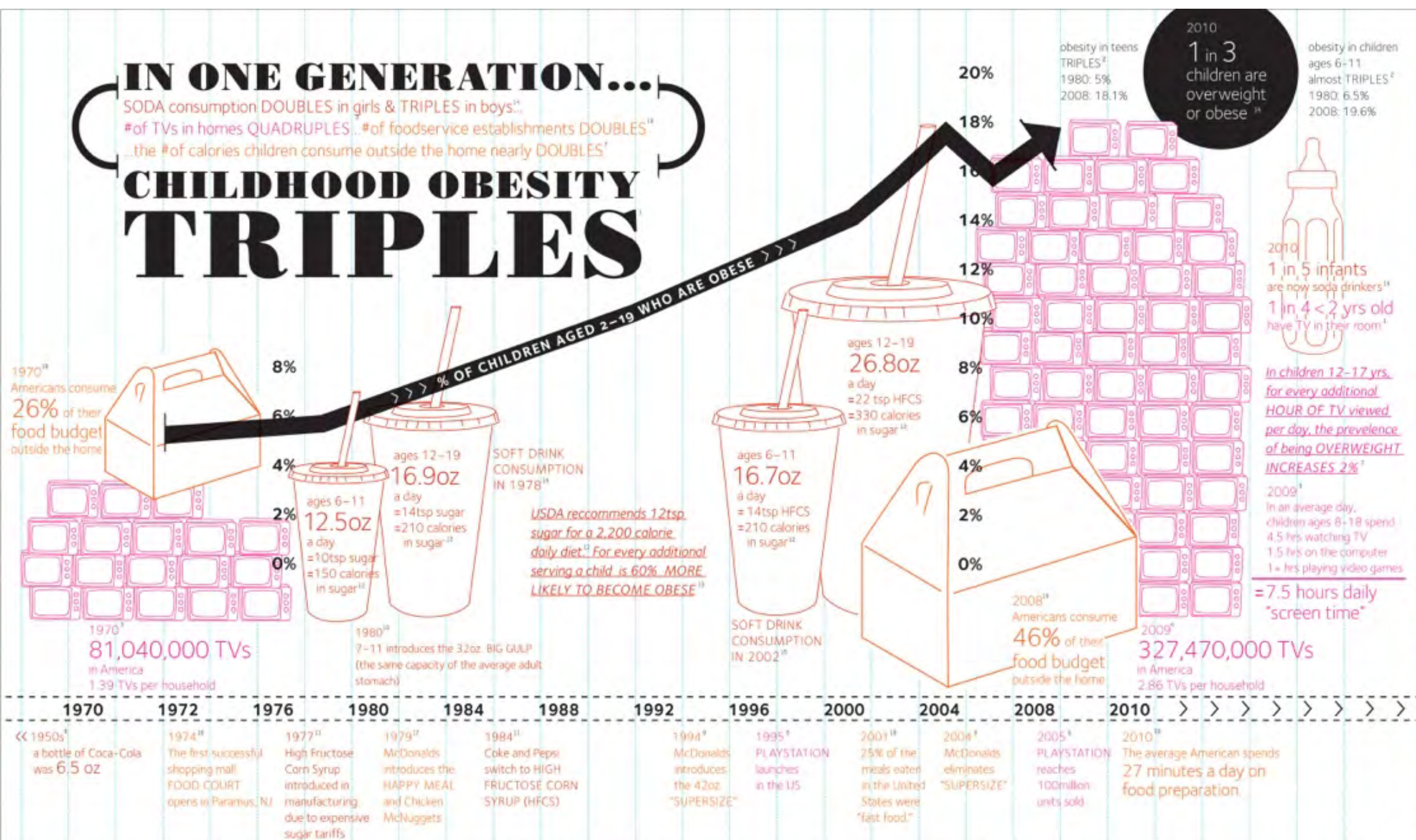1 in 5 infants are now soda drinkers[19]
1 in 4 <2 yrs old have TV in their room[1]

In children 12-17 yrs, for every additional HOUR OF TV viewed per day, the prevelence of being OVERWEIGHT INCREASES 2%[3]

2009[3]
In an average day, children ages 8-18 spend
4.5 hrs watching TV
1.5 hrs on the computer
1+ hrs playing video games
= 7.5 hours daily "screen time"

ages 12-19
26.8oz
a day
=22 tsp HFCS
=330 calories
in sugar[12]

ages 6-11
16.7oz
a day
= 14tsp HFCS
=210 calories
in sugar[12]

SOFT DRINK CONSUMPTION IN 2002[15]

ages 12-19
16.9oz
a day
=14tsp sugar
=210 calories
in sugar[12]

ages 6-11
12.5oz
a day
=10tsp sugar
=150 calories
in sugar[12]

SOFT DRINK CONSUMPTION IN 1978[14]

USDA reccommends 12tsp sugar for a 2,200 calorie daily diet[13] For every additional serving a child is 60% MORE LIKELY TO BECOME OBESE[13]

1970[16]
Americans consume
26% of their food budget outside the home

1970[5]
81,040,000 TVs in America
1.39 TVs per household

1980[10]
7-11 introduces the 32oz. BIG GULP (the same capacity of the average adult stomach)

2008[16]
Americans consume
46% of their food budget outside the home

2009[5]
327,470,000 TVs in America
2.86 TVs per household

1970	1972	1976	1980	1984	1988	1992	1996	2000	2004	2008	2010 > > > > > > > >

<< 1950s[6]
a bottle of Coca-Cola was 6.5 oz

1974[16]
The first successful shopping mall FOOD COURT opens in Paramus, NJ

1977[11]
High Fructose Corn Syrup introduced in manufacturing due to expensive sugar tariffs

1979[17]
McDonalds introduces the HAPPY MEAL and Chicken McNuggets

1984[11]
Coke and Pepsi switch to HIGH FRUCTOSE CORN SYRUP (HFCS)

1994[9]
McDonalds introduces the 42oz "SUPERSIZE"

1995[6]
PLAYSTATION launches in the US

2001[18]
25% of the meals eaten in the United States were "fast food."

2004[9]
McDonalds eliminates "SUPERSIZE"

2005[6]
PLAYSTATION reaches 100 million units sold

2010[16]
The average American spends 27 minutes a day on food preparation.

TAKE ACTION

SPEND A WEEK WITHOUT YOUR "SCREENS"
The next TURNOFF WEEK is September 18-24. Millions have participated. There are now Turnoff Events in all 50 states.
www.screentime.org

PLEDGE TO STOP DRINKING SODA FOR THE SUMMER
Children in the Bay Area are pledging a Soda-Free Summer. Now in its 3rd year, the campaign will reach 100,000 residents.
www.co.contra-costa.ca.us

BRING HEALTHIER FOOD OPTIONS TO YOUR LOCAL BODEGA
Since January 2005 the Healthy Bodegas Initiative has worked with over 1,000 bodegas in East and Central Harlem, the South Bronx and Central Brooklyn, NY
www.nyc.gov

REPLACE SCREENTIME WITH FAMILY MEAL TIME
Let's Move provides tools to help log your TV and active time, commit to TV free meals and bedrooms and plan family shopping
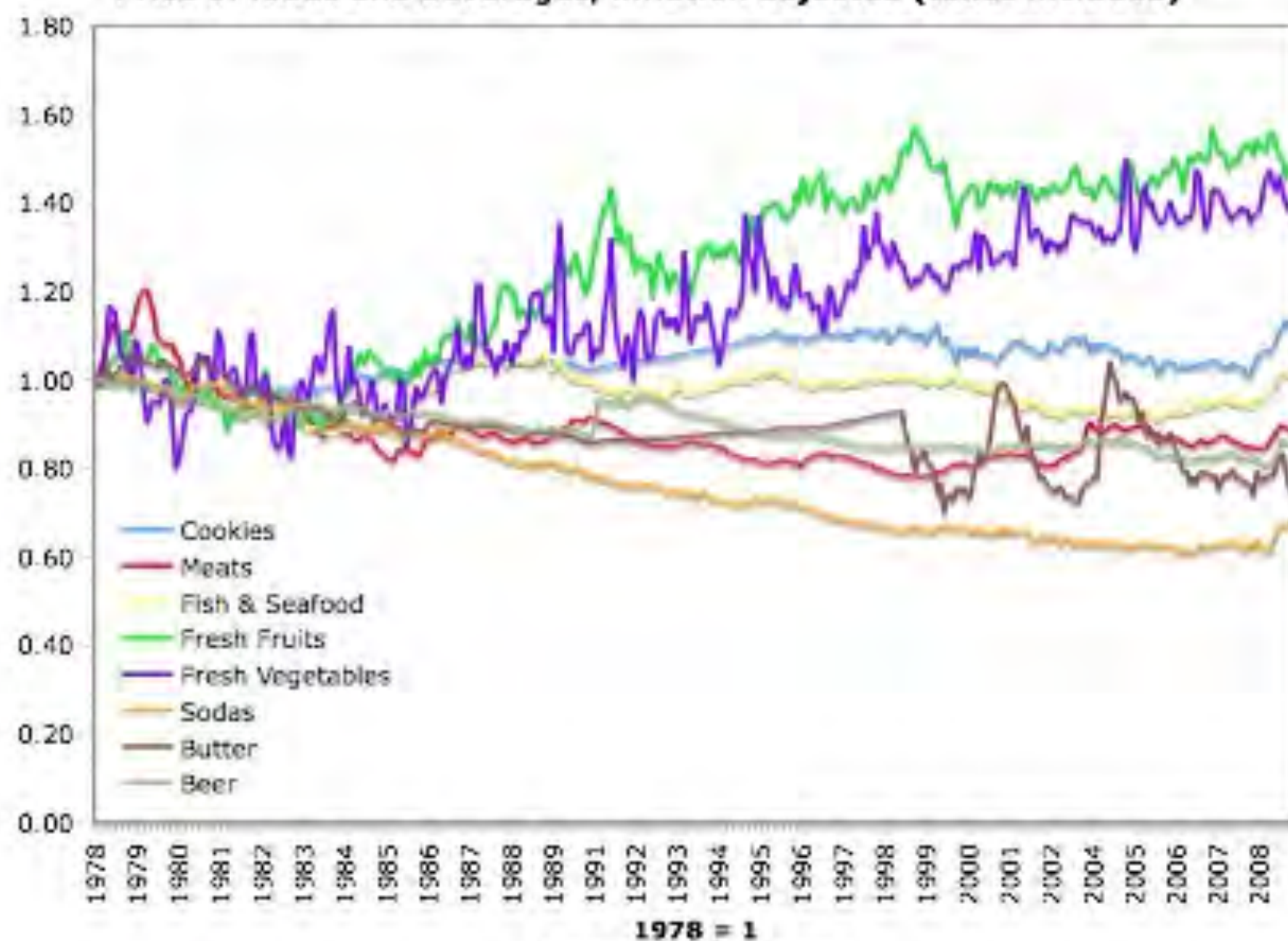www.letsmove.gov

REVERSE THE CURVE

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SOURCES CITED: **1. White House Task Force on Childhood Obesity (2010). SOLVING THE PROBLEM OF CHILDHOOD OBESITY WITHIN A GENERATION (PDF). Retrieved from: http://www.letsmove.gov/tfco_fullreport_may2010.pdf. **2. Childhood Obesity Statistics (2010). Childhood Obesity Epidemic in America. Retrieved from: http://www.childhoodobesitystatistics.net/epidemic.php. **3. Media Trends Track (2009). TV Basics: TV Sets Per Household. Retrieved from: http://www.tvb.org/central/media/trends/track/tvbasics/07_3_TV_Per_HH.asp **4. Nielson Wire (2009). More than Half the Homes in U.S. Have Three or More TVs. Retrieved from: http://blog.nielsen.com/nielsenwire/media_entertainment/more-than-half-the-homes-in-us-have-three-or-more-tvs/ **5. National Heart Lung and Blood Institute (2010). We Can: Reduce Screen Time. Retrieved from: http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/reduce-screen-time/index.htm **6. Sony Computer Entertainment (2005). "PlayStation 2 Breaks Record as the Fastest Computer Entertainment Platform to Reach Cumulative Shipment of 100 Million Units" (PDF). Press release. Retrieved from: http://en.wikipedia.org/wiki/PlayStation. **7. Pediatric Overweight: A Review of the Literature. The Center for Weight and Health, University of California, Berkeley. June 2001. Retrieved from University of California Agriculture and Natural Resources Nutrition Online Media Kit http://news.ucanr.org/mediakits/Nutrition/nut/factsheet.shtml. **8. Robbins, Becky (2010). Helium. Reasons for huge increase in soft drink consumption in US Retrieved from: http://www.helium.com/items/1800640-soda-consumption-in-the-united-states **9. Wikipedia (2010). Supersize. Retrieved from: http://en.wikipedia.org/wiki/Supersize **10. Today I Found Out (2010). The 7-11 Double Big Gulp Holds 200% More Than the Average Adult Human's Stomach. Retrieved from: http://www.todayifoundout.com/index.php/2010/01/the-7-11-double-big-gulp-holds-200-more-than-the-average-adult-humans-stomach/. **11. Pada, James Jr. eHow: The History of High Fructose Corn Syrup. Retrieved from: http://www.ehow.com/about_5106547_history-high-fructose-corn-syrup.html. **12. Rysavy, Tracy Fernandez (2007). Real Money. Coop America's The Sinister Side of Coke. Retrieved from: http://www.kickcoke.org/realmoneyfeb.htm. **13. Harvard Science (2001). Increased consumption of soda promotes childhood obesity. Retrieved from: http://harvardscience.harvard.edu/medicine-health/articles/increased-consumption-soda-promotes-childhood-obesity **14. The Feed Foundation: 30 Project (2010). The Challenge in the Past 30 Years. Retrieved from: http://30project.org/the-challenge **15. Sebastian, R., Cleveland, L., Goldman, J., Moshfegh, A. 2008. USDA Agricultural Research Service Consumer Interests Annual Volume 52: Trends in the food intakes of children 1977-2002. Consumer Interests Annual. Vol. 52. Retrieved from: http://docs.google.com/fileview?id=1dvAq2qqWVsDvrfdczyCW0Sd8wzcy7DvY8VqSGYXRLn450K1As18JJvm2?N&hl=en **16. "Home Left More On Mom's And 'Just His Own" Shopping Centers Today (International Council of Shopping Centers) May 2004. Retrieved from: http://en.wikipedia.org/wiki/Food_court **17. McDonalds (2010) Our Company: Travel Through Time with Us. Retrieved from: http://www.aboutmcdonalds.com/mcd/our_company/mcd_history.html **18. Schlosser, Eric. Fast Food Nation (2001). **19. Ayala, Guadalupe X. et al (2008). Obesity: A Research Journal. Away from Home Food Intake and Risk for Obesity: Examining the Influence of Context. Graduate School of Public Health, Center for Behavioral and Community Health Studies, San Diego State Research Foundation and San Diego State University, San Diego, California, USA. Retrieved from: http://www.nature.com/oby/journal/v16/n4/full/oby2008344.html **20. Pollan, Michael (2009). NY Times. Magazine Out of the Kitchen, Onto the Couch. Retrieved from: http://www.nytimes.com/2009/08/02/magazine/02cooking-t.html?pagewanted=all. Note: Obesity is defined as BMI ≥ gender- and weight-specific 95th percentile from the 2000 CDC Growth Charts.

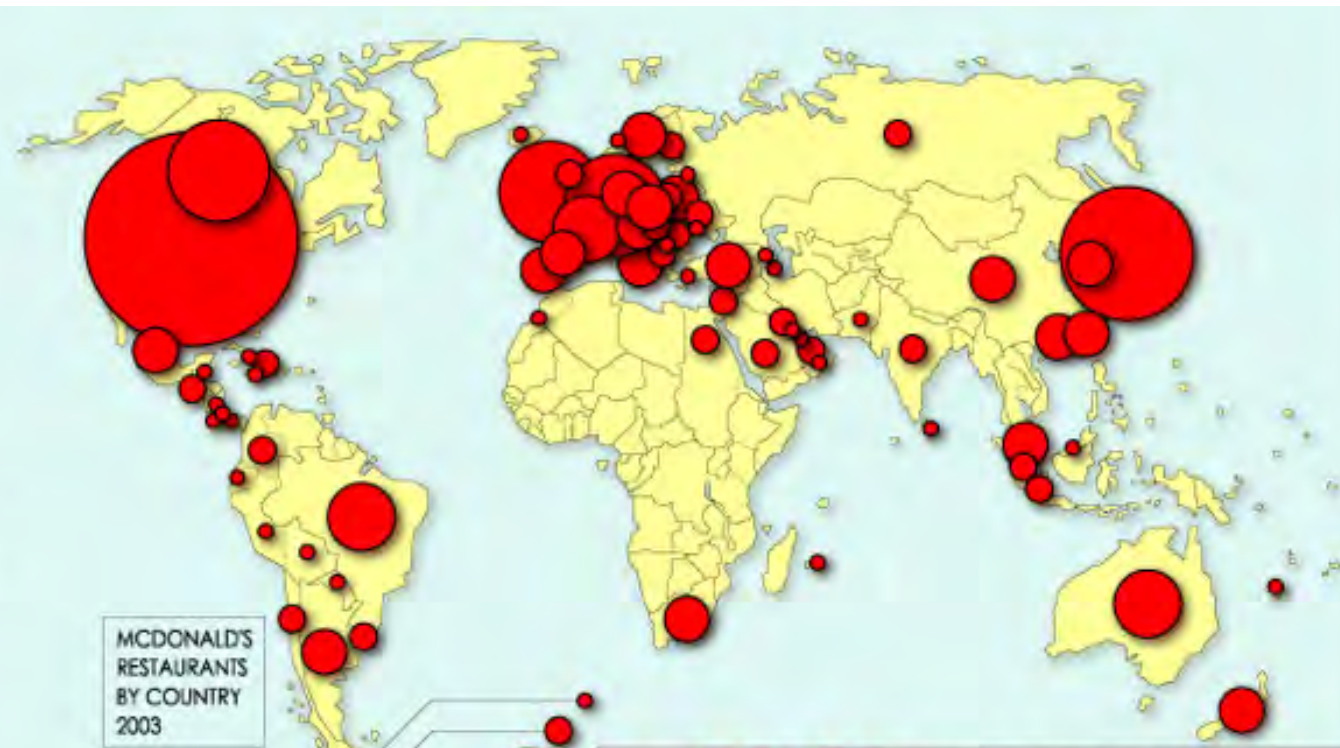**Price of foods and beverages, inflation adjusted (taxes included)**

Legend:
- Cookies
- Meats
- Fish & Seafood
- Fresh Fruits
- Fresh Vegetables
- Sodas
- Butter
- Beer

1978 = 1
Source: BLS, via Haver

THE MAGIC BEAN SHOP

A single cup of Starbucks coffee can depend upon as many as 19 different countries. Between the coffee beans, the milk, the sugar, and the paper cup, Starbucks coffee is a global hub that connects some of the poorest countries in the world with some of the wealthiest.

= COFFEE BEAN SOURCE

= PAPER SOURCE FOR CUPS

= SUGAR SOURCE

STARBUCKS STORES BY COUNTRY 2003

- 1 - 24
- 25 - 99
- 100 - 249
- 250 - 999
- 1,000 +

6,200 STORES WORLDWIDE, WITH THREE NEW STORES OPENING DAILY
Sources: Starbucks.com, US Department of Agriculture, Fortune Magazine

NUMBER OF STARBUCKS SHOPS WORLDWIDE

6000
5000
4000
3000
2000
1000

1987   1991   1995   1999   2003

MCDONALD'S RESTAURANTS BY COUNTRY 2003

- 1 - 19
- 20 - 99
- 100 - 499
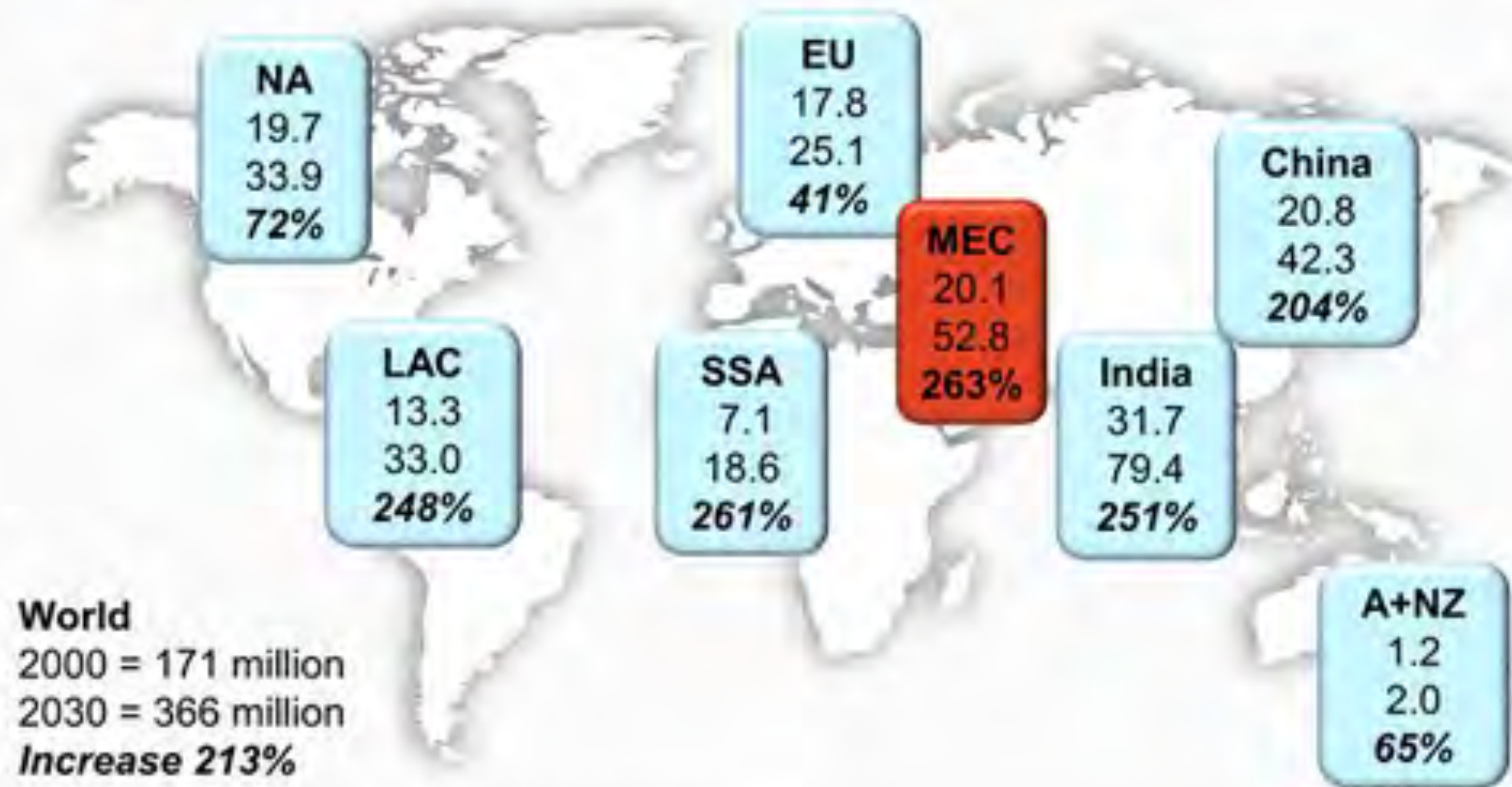- 500 - 999
- 1,000 - 1,999
- 2,000 - 9,999
- 10,000 +

THE FRIES THAT BIND US

Probably the single most visible symbol of American influence worldwide, McDonald's has over 31,000 restaurants in 118 countries, employing more than 1.5 million people. Despite its 13,000 restaurants in the USA, McDonald's is slipping at home. Its customer satisfaction is worse than any other fast food chain, and ranks lower than all major airlines and the IRS.
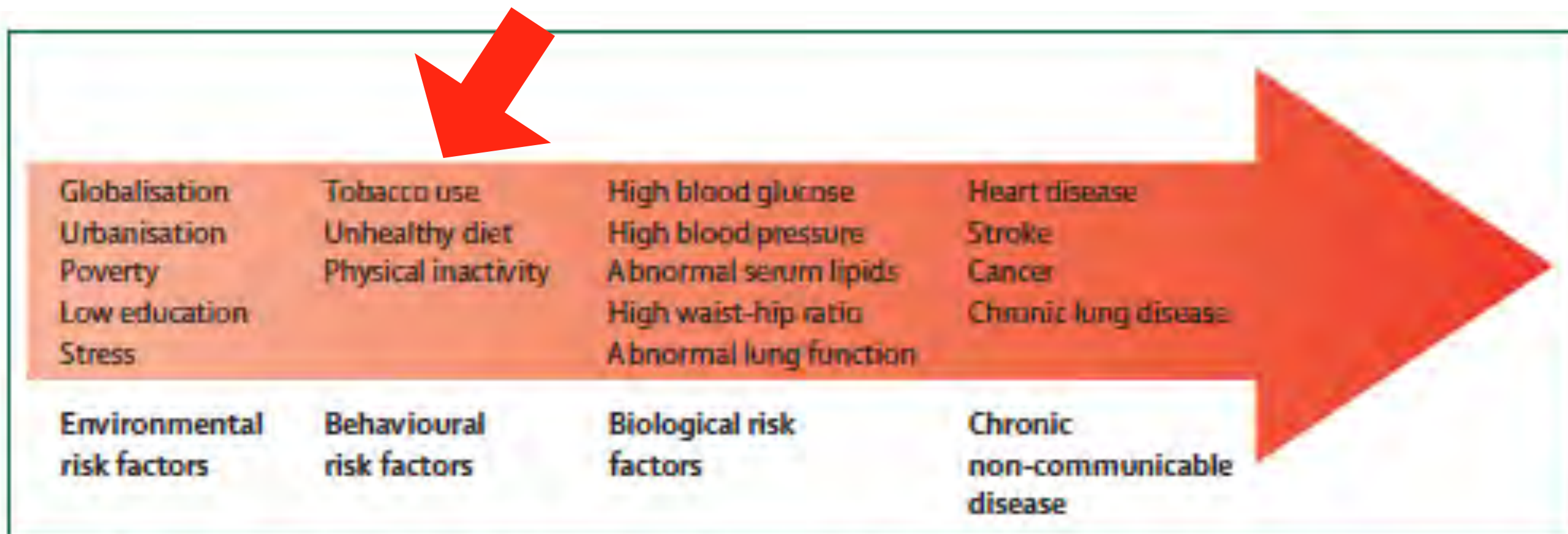
Sources: McDonalds.com, CIA World FactBook, Fortune Magazine

$41 BILLION IN SALES

BILLIONS OF DOLLARS

GDP OF AFGHANISTAN $21 BILLION

40
35
30
25
20
15
10
5

$4.1 BILLION IN SALES

$4.3 BILLION IN SALES

$8 BILLION IN SALES

$8.2 BILLION IN SALES

$9.4 BILLION IN SALES

$11.3 BILLION IN SALES

Global Projections for the Diabetes Epidemic: 2000–2030 (in millions)

NA
19.7
33.9
72%

EU
17.8
25.1
41%

China
20.8
42.3
204%

MEC
20.1
52.8
263%

LAC
13.3
33.0
248%

SSA
7.1
18.6
261%

India
31.7
79.4
251%

A+NZ
1.2
2.0
65%

World
2000 = 171 million
2030 = 366 million
Increase 213%

Wild S et al. *Diabetes Care*. 2004;27(5):1047–1053.

15

Figure 1: The causation pathway for chronic non-communicable disease
Modified from reference 12.

Globalisation Urbanisation Poverty Low education Stress	Tobacco use Unhealthy diet Physical inactivity	High blood glucose High blood pressure Abnormal serum lipids High waist-hip ratio Abnormal lung function	Heart disease Stroke Cancer Chronic lung disease
Environmental risk factors	Behavioural risk factors	Biological risk factors	Chronic non-communicable disease

FIGURE 2: Four Stages of Global Health

1950-1970	1970-1990	1990-2010	2010-
Fundamental	**Discovery**	**Reactive**	**Sustaining**
Access Public health initiatives	Pharmaceuticals	Physicians Financing Accreditation Outsourcing	Transparency Disease migration Convergence Patient migration

The Third Phase of the Internet

?

Phase 3
Collaboration

Capability

Phase 2 - Content

Phase 1 - Communicating

1969   1980   1990   2000   2010

Health 2.0

Health outcomes
Self-expression
Enhancement
Prevention
Normalization
Improvement
Cure

Self

Actions

Research
Treat
Intervene
Experiment
Track
Measure

Peers

Professionals

Measure	Conditions Symptoms	Genome	Biomarkers	Behavior	Environment
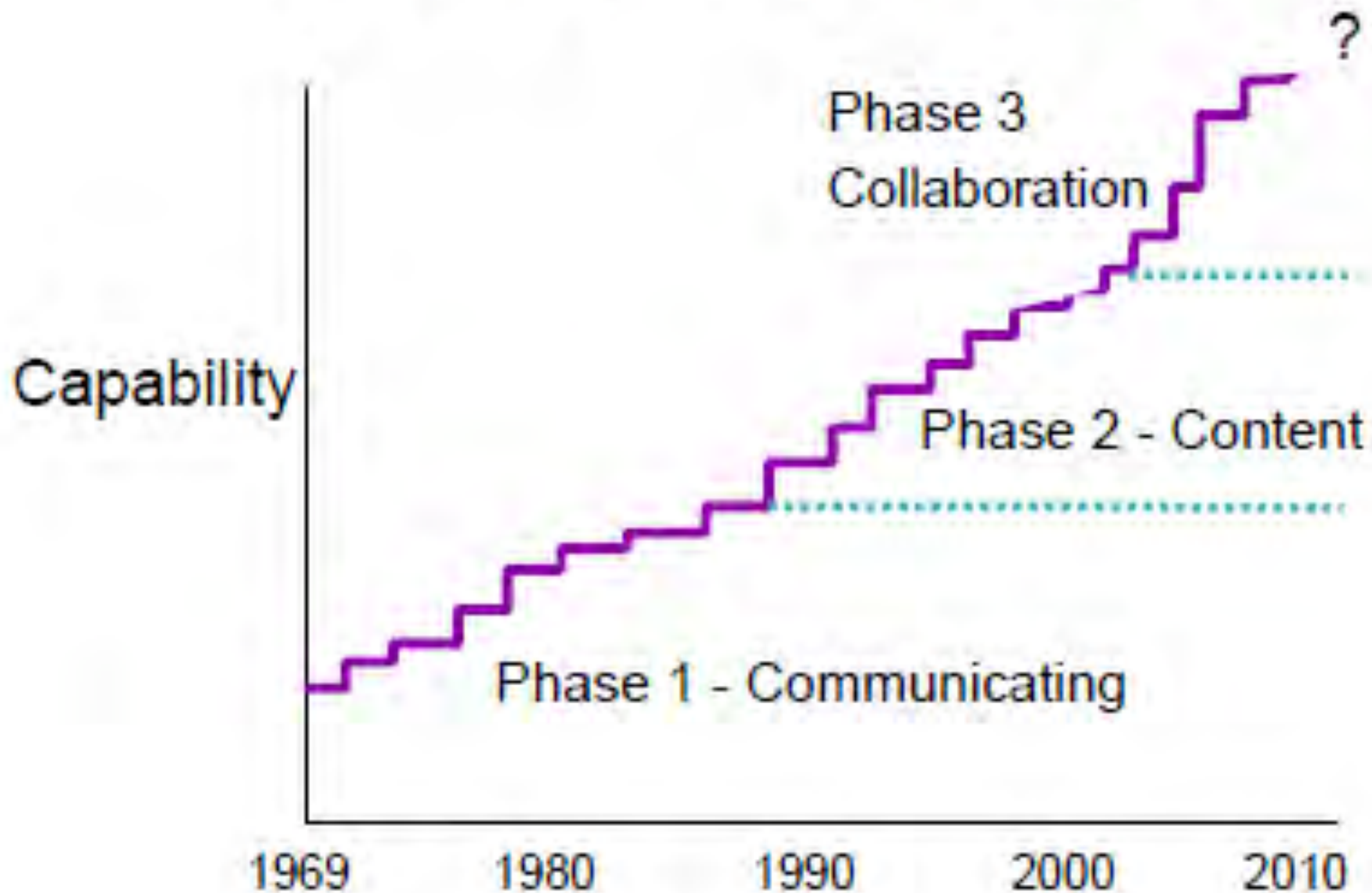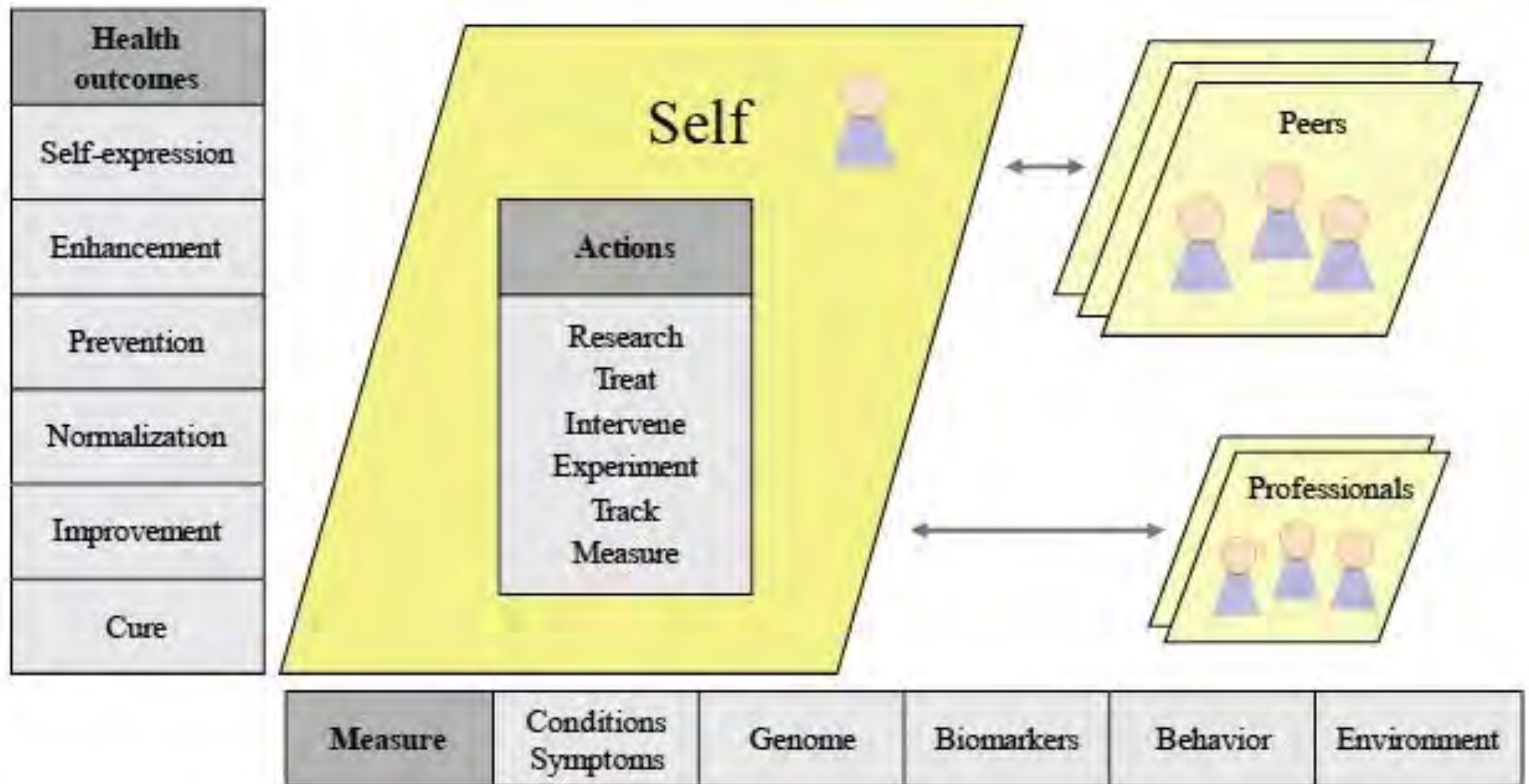
A key concept is that patients themselves should have greater insight and control into information generated about them.

Deloitte.

Connected Care

*Technology-enabled
Care at Home*

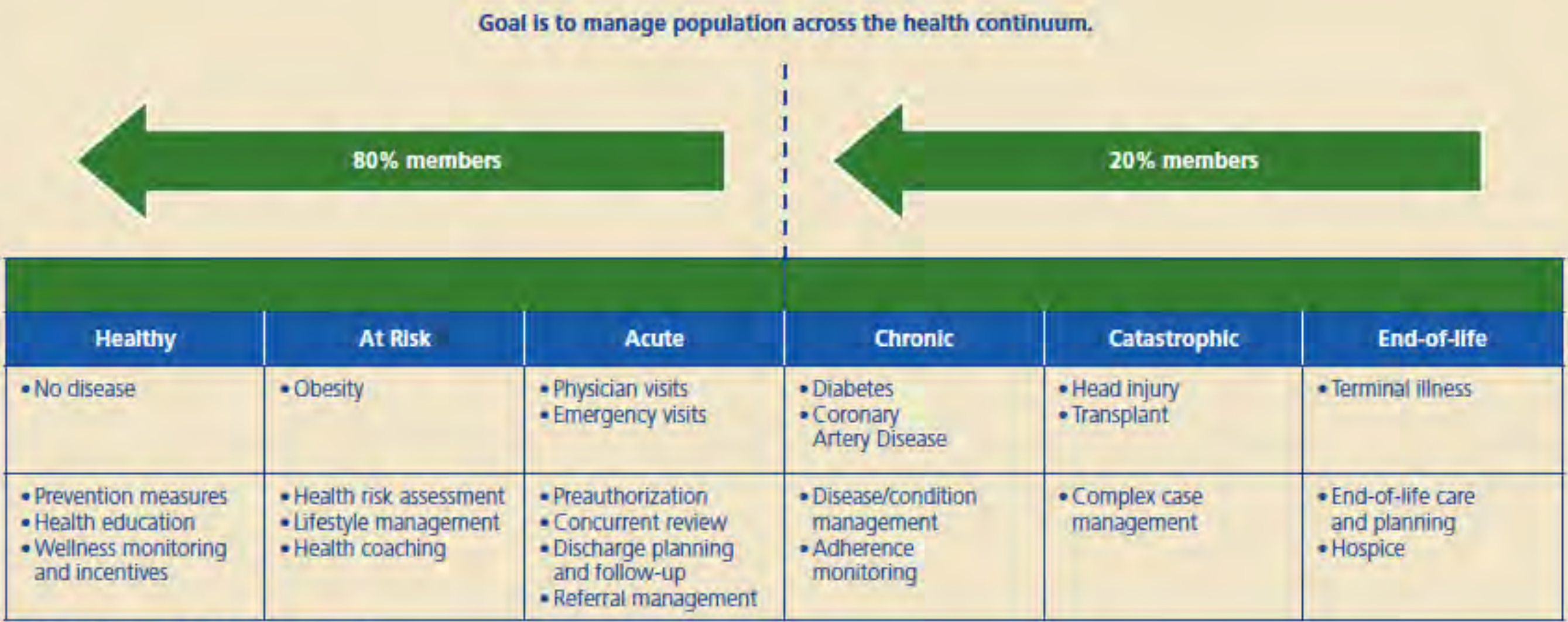**Figure 1: Transformational Themes for the U.S. Health Care System**

U.S. Health System Transformation: Five Essentials

Improve quality
Safe and effective care
Personalized medicine

Reduce demand
Coordinated care – Preventive,
Chronic, Acute, Long Term

Leverage information technology
Clinical, operational, financial
Community-based

Change incentives
Value-based purchasing
Pay for performance

Engage consumers
Guided self-care management
Financial participation

Public-private collaboration

Figure 4: Technologies for General Health Behavior Monitoring

Sensor	Description
Weight Scale	Electronic scale that measures body weight. Tracks excess fluid retention in patients with chronic heart failure or pregnancies at risk for eclampsia after hospital discharge or clinic visit.
Body Fat Analyzer	Device that estimates the fraction of the total body mass that is adipose tissue (fat) to counter the deficiencies of BMI (Body Mass Index) for being overweight or obese. Used to monitor diet progress or as a measure of physical fitness.
Pedometer	Portable device that counts each step a person takes. Used as an exercise measurer and motivator. Active exercisers should target 10,000+ steps daily.
Physical Activity Accelerometers	Devices that can measure both the intensity and duration of physical activity to track effectiveness of an exercise program.
Digital Health Assistant	A two-way communication device that allows a health care professional to communicate with a patient; typically used to ask health questions on a regular basis. Artificial intelligence could be incorporated in the device to push warnings and alerts between the patient and provider as a sentinel monitor to identify care opportunities.
Air Quality Monitoring	A device to monitor and improve indoor air quality and thermal comfort, and to lower the levels of pollutants within the house. Examples include carbon monoxide and smoke detectors.
Sleep Monitoring	Heart rate, temperature, sound, respiratory and movement monitors to track sleep apnea.
Medication Tracking and Reminders	Electronic device to remind a patient to take medication and/or to determine whether medications have been taken according to prescription or have achieved therapeutic effectiveness.
Sphygmomanometer	Device used to measure blood pressure. Uses range from the medically curious to hypertensive patients to assure effectiveness of high blood pressure treatment.
Glucometer	A medical device for determining the concentration of glucose in the blood to monitor the effectiveness of diabetic treatment.
Insulin Pump	A medical device worn to administer insulin in diabetic patients.
Thermometer	Device used to measure body temperature to determine whether a fever is present. Critical tool for parents and cancer patients undergoing chemotherapy to detect systemic infection.
Electrocardiograph (Holter Monitor)	Device that records the electrical activity of the heart over time to detect life-threatening cardiac arrhythmias.
Intelligent Toilet	Toilet that monitors body composition and waste for sugar levels in urine, dietary fiber, blood pressure, body fat and weight.
Fetal Monitor	Devices that measure fetal heart rate, fetal position, and/or uterine activity to monitor fetal health and detect preterm labor.

Figure 5: Components of Population Health Management

Goal is to manage population across the health continuum.

← 80% members   ← 20% members

Healthy	At Risk	Acute	Chronic	Catastrophic	End-of-life
• No disease	• Obesity	• Physician visits • Emergency visits	• Diabetes • Coronary Artery Disease	• Head injury • Transplant	• Terminal illness
• Prevention measures • Health education • Wellness monitoring and incentives	• Health risk assessment • Lifestyle management • Health coaching	• Preauthorization • Concurrent review • Discharge planning and follow-up • Referral management	• Disease/condition management • Adherence monitoring	• Complex case management	• End-of-life care and planning • Hospice

Figure 6: Use of Technology-enabled Connected Care across the Continuum of Care

Technology-enabled Connected Care Applicability

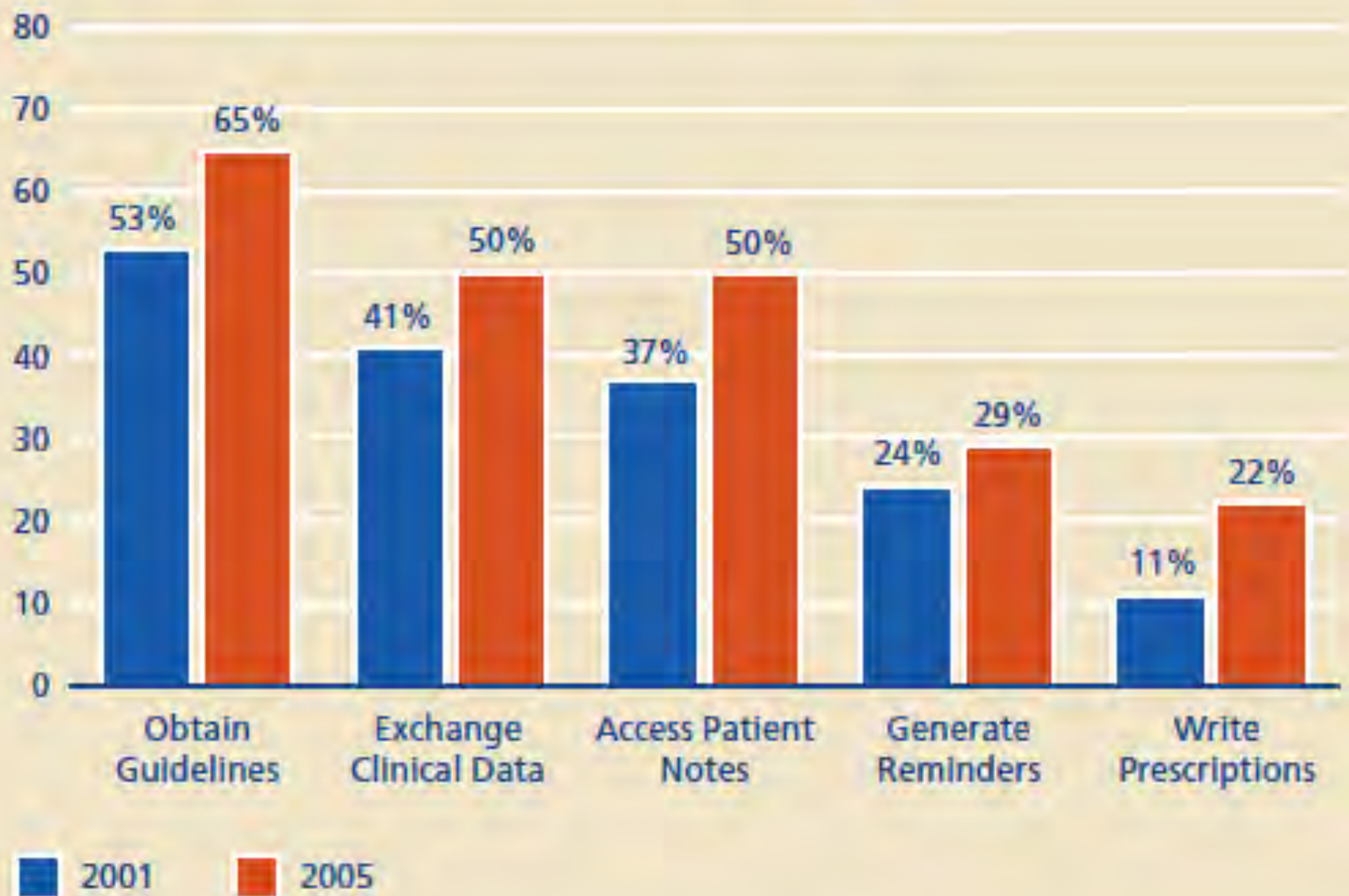|	
Healthy	• Educational • Prevention • Wellness monitoring
At Risk	• Health assessment • Lifestyle management • Health Coaching
Acute	• Pre-treatment/Pre-testing • Treatment compliance monitoring
Chronic	• Disease management • Compliance monitoring
Terminal	• Lifestyle assistance • Monitoring, alerting
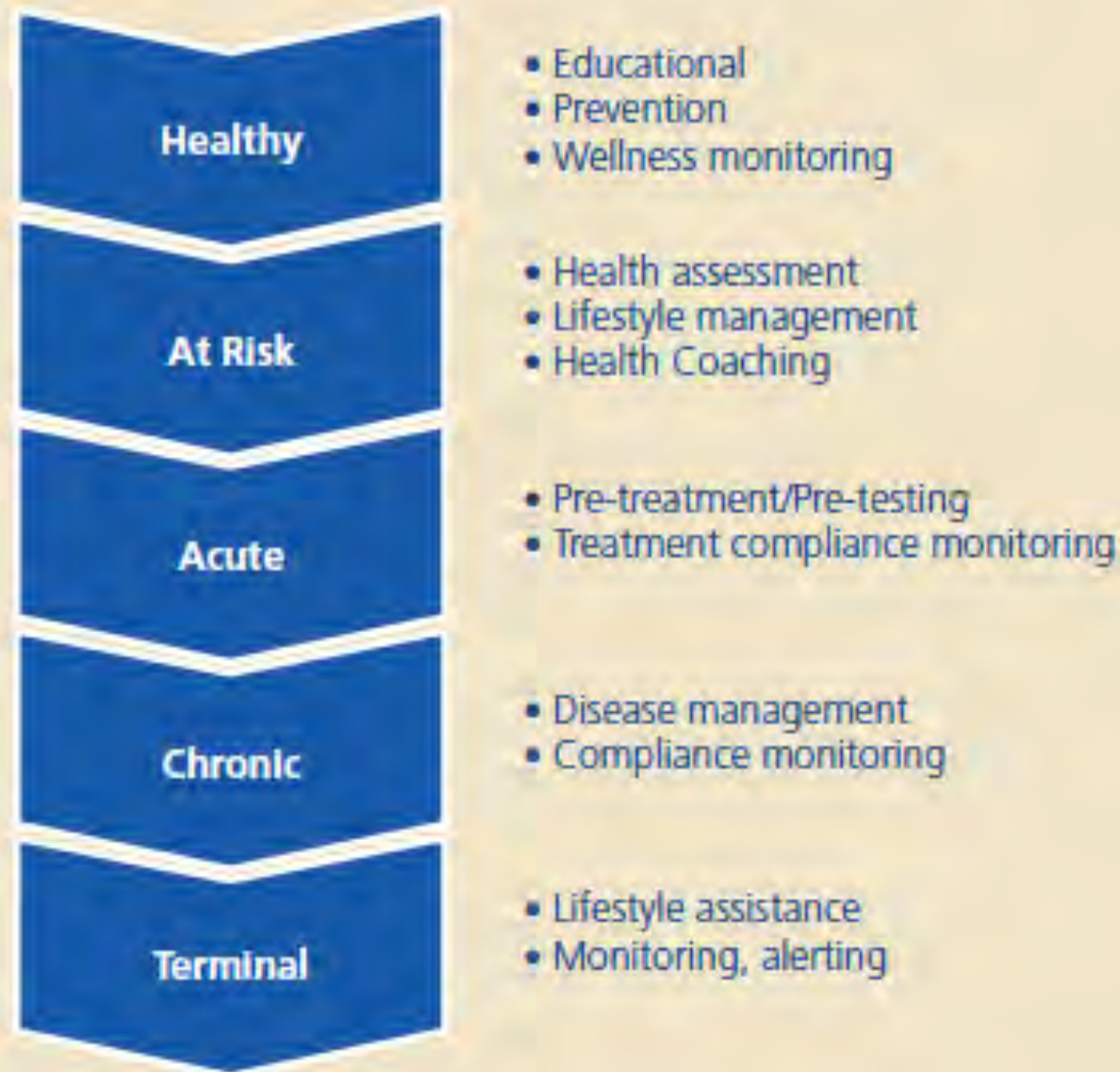
Figure 9. Hype Cycle for Emerging Technologies, 2006

Connected Home Technologies

Mashup
IPv6
Web 2.0
Speech Recognition for Mobile Devices
Folksonomies
Corporate Semantic Web
Digital Paper/E-Paper
RSS Enterprise
Social Network Analysis
Model-Driven Architecture
Collective Intelligence
RFID (Item)
Event-Driven Architecture
Telepresence
Speech-to-Speech Translation
Grid Computing
Office Ajax
Augmented Reality
Ajax
Predictions Markets
RFID (Case/Pallet)
Biometric Payments
Wikis
Corporate Blogging
Tablet PC
Quantum Computing
Mesh Networks: Sensor
Tera-architecture
Location-Aware Technology
DNA Logic
Mobile Phone Payments
Smartphone
Location-Aware Applications
Enterprise Instant Messaging
Internal Web Services
VOIP

Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity

Time

less than 2 years
2 to 5 years
5 to 10 years
more than 10 years
obsolete before plateau

Source: Gartner, July 2006

Figure 10. Physician Adoption of Information Technology

Chart showing percentages for 2001 and 2005:

- **Obtain Guidelines**: 2001 = 53%, 2005 = 65%
- **Exchange Clinical Data**: 2001 = 41%, 2005 = 50%
- **Access Patient Notes**: 2001 = 37%, 2005 = 50%
- **Generate Reminders**: 2001 = 24%, 2005 = 29%
- **Write Prescriptions**: 2001 = 11%, 2005 = 22%

Legend: ■ 2001 ■ 2005

Source: Community Tracking Study Physician Survey, 2006

09

The issue:

- Health plans are communicating on benefits, lifestyle

- More than 1,200 hospitals participate in nearly 4,200 social networking sites

- Elusive FDA guidance has inhibited pharma's full embrace of social media with consumers

Healthcare no longer social media's wallflower

What consumers say:

Nearly a third have used social media for healthcare.

Percent of consumers who have used social media for healthcare purposes

Any type of social media

32%*

- Facebook 18%
- Youtube 12%
- Blogs 9%
- Google+ 8%
- Twitter 6%
- MySpace 4%
- LinkedIn 4%
- Other, e.g. WebMD 4%
- foursquare 2%
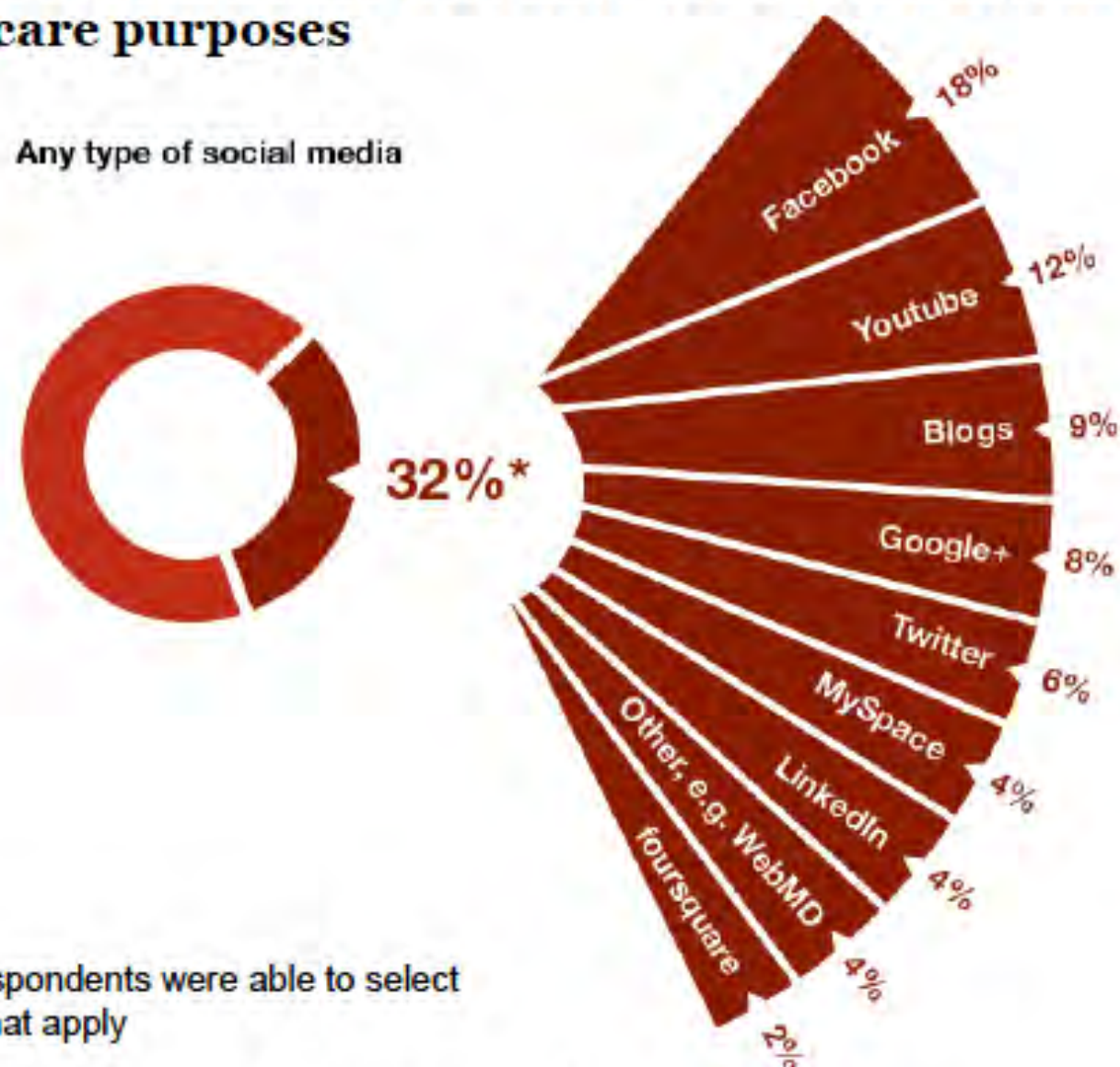
*Respondents were able to select all that apply

Source: PwC Health Research Institute Consumer Survey 2011
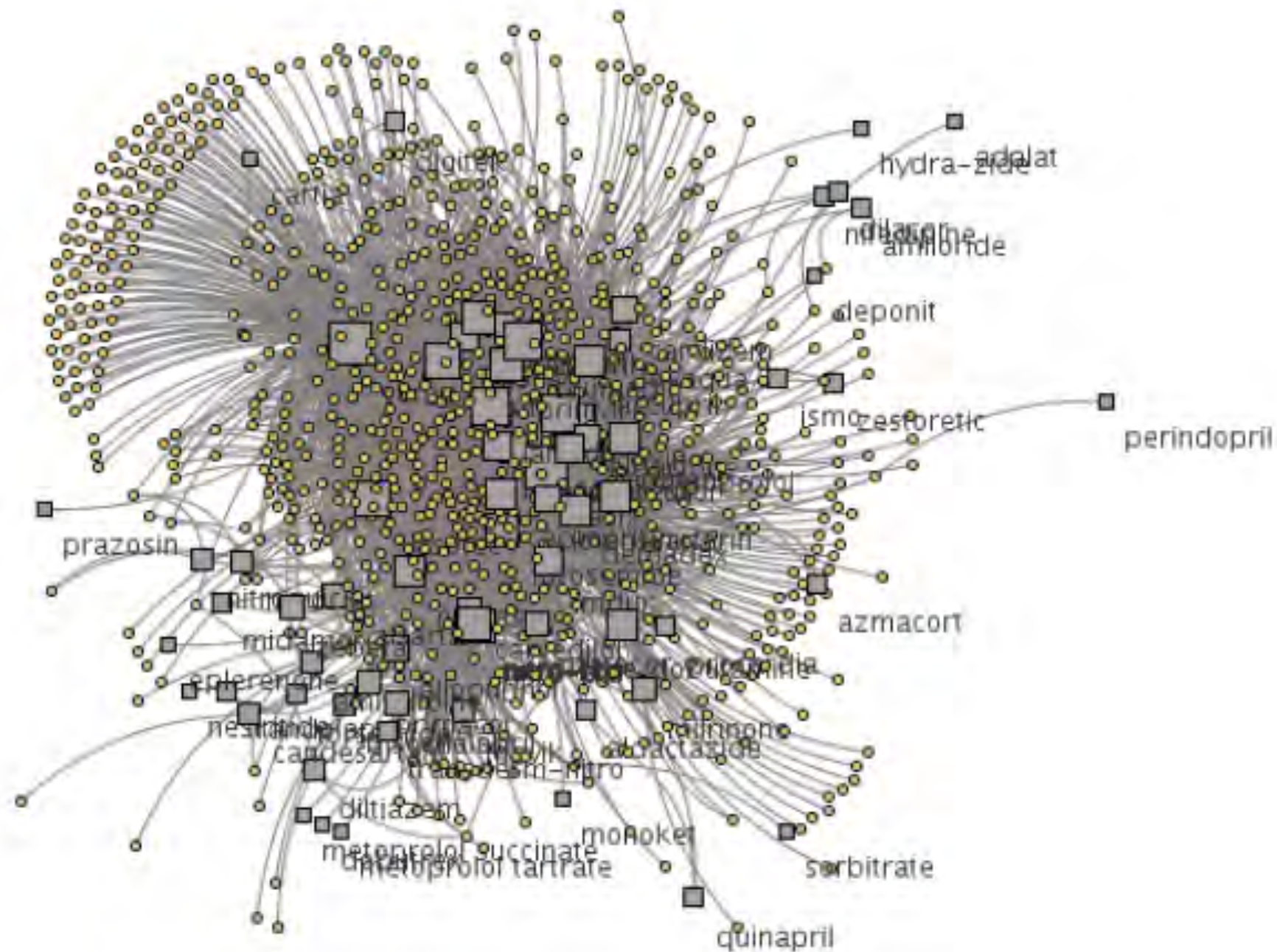
Figure 1. Overview of CHFpatients forum. Circular nodes represent users in the forum. Square nodes represent drugs. The size of the square nodes is proportional to the number of people discussing that drug.
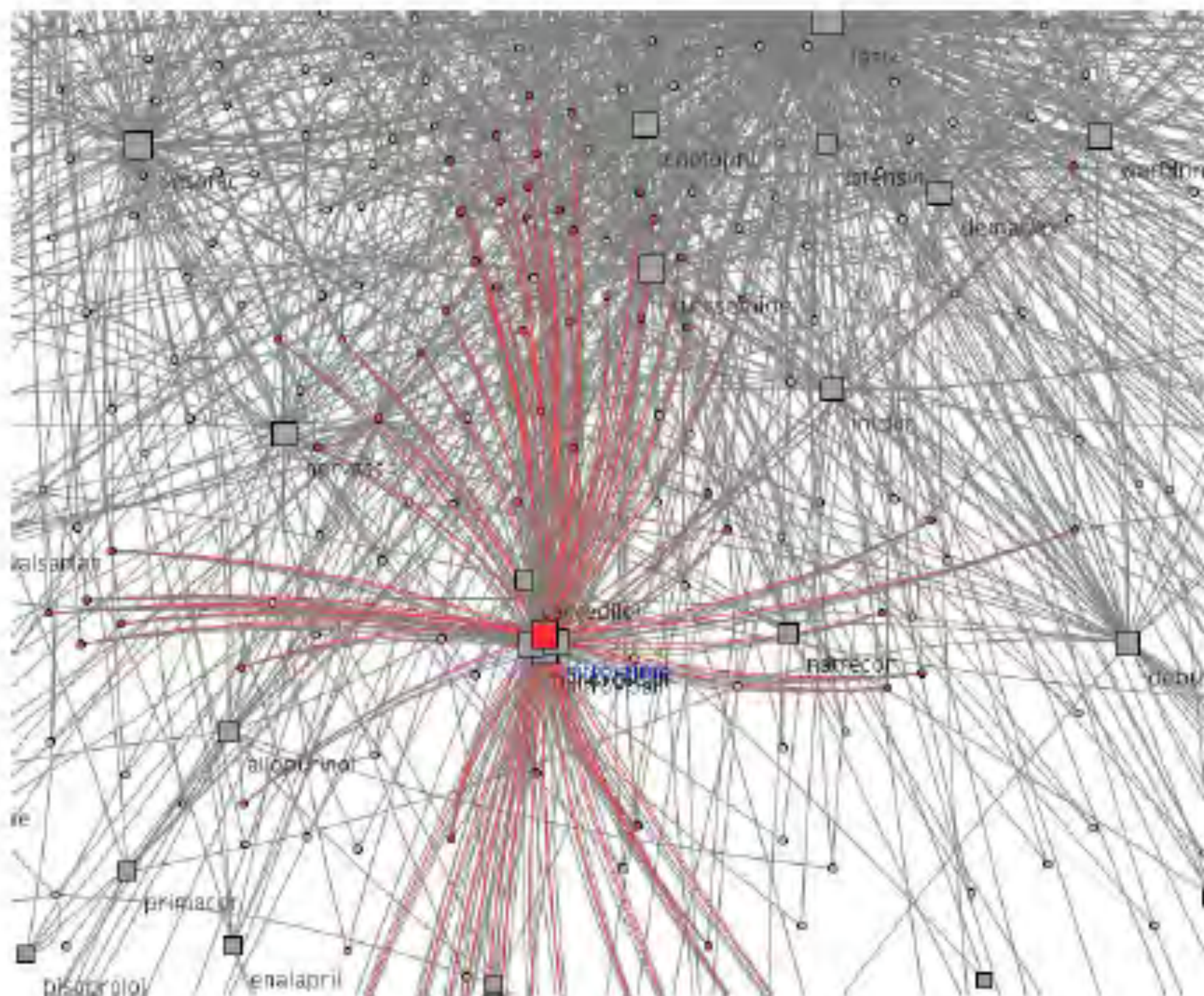
Figure 2. Zoomed view of Figure 1. When a drug is selected, in this case, Nitro-time, the user can see all the members who have discussed this drug in the forum highlighted in red.

Disease Management's Mixed Results to Date

Study	Conditions	Findings
http://www.soa.org/research/files/ pdf/Paper3-Literature-Review.pdf	Heart Disease, Diabetes, Asthma	ROIs range from 1.2-6.4:1. Highest savings in heart disease. Moderate savings in diabetes, and mixed (some results no savings) for asthma. A recent randomized control study showed no discernible savings.
Villagra, V. & Ahmed, T. (2004). "Effectiveness of a disease management program for patients with diabetes," *Health Affairs*, 23(4): 255-266	Diabetes	Overall costs for full-year participants in the pre-post analysis were $39 (8.1 percent) less per diabetic member per month when compared to non-participants. • In the parallel group comparison, overall costs for full-year participants were $137 (24.7 percent) less per diabetic member per month when compared to non-participants. • The most important source of savings was a 22-30 percent reduction in hospitalization.
Wheeler, J. (2003). "Can a disease self-management program reduce health care costs? The case of older women with heart disease," *Medical Care*. 41(6): 706-715	Chronic Heart Failure	Results demonstrated that hospital cost savings exceeded program costs by a ratio of nearly 5:1. • Program participants experienced 46 percent fewer inpatient days and 49 percent lower inpatient costs than the control group, but no significant differences between the two groups were reported in ER utilization.
Gold, W. & Kongstvedt, P. (2003). "How broadening DM's focus helped shrink one plan's costs," *Managed Care Magazine*. www.managedcaremag.com.	17 Chronic Conditions or Diseases	A return of at least $2.90 for every dollar invested in the program: • Average overall savings of $41 per program member per month • 14 percent fewer hospital admissions • 18 percent fewer ER visits • Significant improvement in diabetics' HbA1c levels • Absenteeism from work or school was reduced significantly (7-11 percent) among members participating in the program.

AHIP Survey http://www.ahipresearch. org/pdfs/3_DMCBO.pdf	Various	Disease management programs reduce utilization and costs associated with chronic conditions common in the Medicare population. For example:
		• Commercial and Medicare members enrolled in one health plan's program for congestive heart failure had total per-member, per-month costs that were 33 percent lower than those for members in the control group. Inpatient admissions and emergency room visits were reduced by 33 percent in the intervention group. Pharmacy costs were 5 percent higher in the intervention group.
		• A disease management program for patients with diabetes enrolled in a health plan and an employer's self-insured plan found that in one year, total costs fell 6.4 percent; inpatient costs decreased 14.4 percent; pharmacy costs were reduced 3.3 percent; inpatient admissions declined 5.9 percent; and total return on investment was estimated to be between 1.75:1 and 2:1.
		• In a disease management program for patients with lower back pain enrolled in a health plan and an employer's self-insured plan, return on investment was estimated to be between 1.3 and 1.5:1.
		• In a disease management program for commercial, Medicare, and Medicaid health plan members that addressed multiple chronic conditions (including diabetes, coronary artery disease, and asthma), preliminary analysis found a net savings of 90 cents per member, per month and an estimated return on investment of 2.94:1. While findings in these health plans may not be generalizable to the health sector as a whole, they provide examples of the magnitude of savings that can be achieved with disease management programs.
http://www.ajmc.com/Article. cfm?Menu=1&ID=2779	Asthma	Total costs for asthma and non-asthma care plus the cost of the program were $220.84 PMPM. Return on investment was calculated as follows: ($351.97 minus $179.17) divided by $41.67 equals $4.15.
Cousins, M. & Liu, Y. (2003). "Cost savings for a preferred provider organization population with multi-condition disease management: Evaluating program impact using predictive modeling with a control group," *Disease Management*. 6(4): 207-217	Asthma, Diabetes, and Coronary Artery Disease	Preliminary results show that the program produced a return on investment of $2.84:$1.00. Savings were calculated by comparing expected medical claims costs predicted by a model based on a control group (n=2,491) to actual medical claims costs for the study group (n=1,009). • Financial data used in the analysis included all claims costs for program participants; it was not limited to specific conditions.

Immediate opportunities

The mPHR has immediate utility in several areas where managing prevalent health problems currently show suboptimal results. Examples include:

- **Obesity:** Microsoft is piloting the MyLife for Windows Mobile Phones application, which leverages integrated MCD cameras, accelerometers and microphones to input a user's physical activity to Microsoft's PHR Health Vault.[36] "The dream," according to Eric Chang, Microsoft's director of technology strategy for Asia, "is that a user could photograph each meal with their phone, and have the application return data such as caloric content, food group and allergy information for each item."[37] In the future, consumers could use an MCD with integrated biosensors to longitudinally track activity and align them to diet and exercise goals in their mPHR. Also, with greater Internet operability, consumers could share data with their social network to gain peer support, advice and motivation.

- **Post-acute care:** At some point, patients with an mPHR might be discharged from a hospital sooner than before because of an enhanced ability to monitor progress without being in the hospital. For instance, Kiwok combines a smartphone, decision support software and an electrocardiogram (ECG) sensor to monitor non-hospitalized chronically ill CHF patients.[38] The product detects when patients may benefit from changing diet, increasing exercise, decreasing stress or changing medications. It alerts the medical team of abnormal readings and recommended changes to the consumer's treatment regime.

- **Home care:** In the future, patients may be able to avoid or delay moving to nursing home and long-term care (LTC) facilities by using an mPHR. For example, Control4 and CloseBy Network together offer a solution that combines sensor technology embedded in the home to monitor the elderly and alert caregivers and doctors to changes in status via their cell phones.[39] They can receive instant alerts via email or text when specified sensors are triggered or if normal behavioral patterns change. Patient health information also can be collected and imported to a PHR.

- **Asthma:** As MCDs continue to integrate environmental sensors, they could measure an asthmatic patient's immediate surroundings for triggers such as smog, pollen or other allergens and use an mPHR to issue alerts.[40] It is also possible to link the mPHR to devices that monitor the patient's respiratory metrics, creating alerts when the condition is sub-acute.

- **Diabetes:** Dexcom uses a biosensor inserted into the skin to continuously monitor blood sugar levels and transmit that data to an MCD, which distributes it to the mPHR and the provider's EHR. The medical team can then adjust insulin doses accordingly. If readings drop too low, the device sends an alert to the user's and provider's cell phones.[41]

At some point, patients with an mPHR might be discharged from a hospital sooner than before because of an enhanced ability to monitor progress without being in the hospital.

Figure 2. Priority Matrix for Healthcare Provider Applications and Systems, 2011

benefit   **years to mainstream adoption**

benefit	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Generation 9 Electronic Health Record Systems	Accountable Care	
high	Computer-Based Physician Order Entry	Advanced Clinical Research Information Systems Computer-Assisted Coding (Hospital) E-Visits	Home Health Monitoring Integrated Clinical/Financial BI Systems Patient Throughput and Logistics Management Patient-Centered Medical Home (Healthcare Providers) Video Visits	
moderate	E-Prescribing (Healthcare Provider) RAC Tracking (U.S.)	EHR-Integrated Critical Care IS Emergency Department Information Systems as Part of an EHR System Patient Portals (Clinical) Real-Time Temperature/Humidity Monitoring U.S. Ambulatory Electronic Medical Records Wireless Healthcare Asset Management	Advanced Disease Management Systems (Healthcare Providers) CDR Next-Generation Enterprise Patient Financial Systems (U.S.) Personal Health Record Remote ICU	
low			Patient Self-Service Kiosks Perioperative Charting and Anesthesia Documentation Within the EHR Personal Health Management Tools — Healthcare Providers	Patient Decision Aids (Healthcare Provider)

As of August 2011
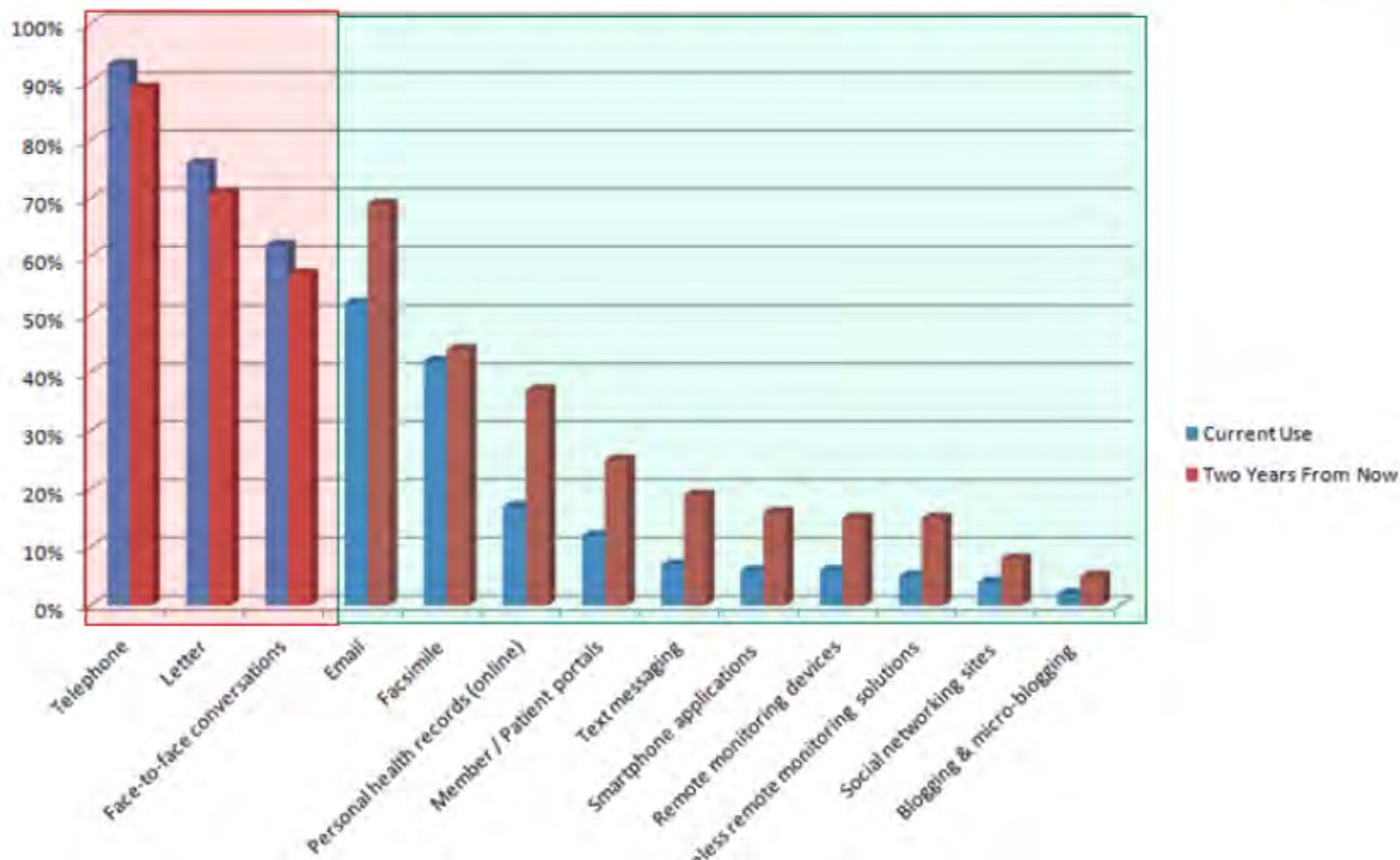
Source: Gartner (August 2011)

2010 Health Information Technology Survey

How Technology is Changing the Practice of Care Management

September 2010

Figure 11: Patient Communication Options
Currently & Two Years From Now

Table 18: SOURCES OF MEDICAL ADVICE

What sources of health information do most of your clients/patients typically rely on?

2010 Large Pool Results

(Respondents could select more than one option)

Type of health information	N = Respondents	Percentage of Respondents	Ranking
Advice from primary care physician (PCP)	520	79%	1
Advice from specialist	426	65%	2
Advice from case manager	422	64%	3
Advice from family or friends	369	56%	4
Health websites e.g., WebMD	298	45%	5
Print media e.g., magazines, books	266	40%	6
Electronic media e.g., television, radio	229	35%	7
Online video e.g., YouTube	40	6%	8
Not applicable / Not sure	79	12%	—
Other, please specify	22	3%	—

Consumer Access to Electronic Tools

Tool	Would Like to Access	Already Access	Would Pay Extra to Access
Online medical records and test results	78%	6%	26%
Online appointment scheduling	72%	10%	18%
Email to doctor	76%	9%	23%

SOURCE: DELOITTE. 2008 SURVEY OF HEALTH CARE CONSUMERS.[7]

Health Research Institute

Healthcare unwired:

New business models delivering care anywhere

Chart pack

September 2010

Figure 2: Early research shows mobile health reduces provider revenues

	Where	What	Result
Diabetes	Pennsylvania	Post discharge remote monitoring	42% drop in overall cost per patient[5]
	Cleveland	Cell phone size wireless transmitter transferring vital signs to electronic health record	71% increase in number of days between office visits[6]
Congestive heart failure	Trans-European Network-Home-Care Management System	Remote monitoring of patients who received implantable cardiac defibrillators	35% drop in inpatient length of stay; 10% reduction in office visits; 65% drop in home health visits[7]
Chronic obstructive pulmonary disease	Canada	Remote monitoring of patients with severe respiratory illness	Reduced hospital admissions by 50%; acute home exacerbations by 55%; hospital costs by 17%[5]

[5] Max E. Stachura, MD, and Elena V. Khasanshina, MD, PhD. "Telehomecare and Remote Monitoring: An Outcomes Overview." The Advanced Medical Technology Association, October 31, 2007, accessed July 29, 2010, http://www.advamed.org/NR/rdonlyres/2250724C-5005-45CD-A3C9-0EC0CD3132A1/0/TelehomecarereportFNL103107.pdf.

[6] Cleveland Clinic/Microsoft Pilot Promising; Home Health Services May Benefit Chronic Disease Management." March 1, 2010, accessed on August 25, 2010, http://my.clevelandclinic.org/media_relations/cleveland_clinic_pilot_with_microsoft_promising.aspx .

[7] John G.F. Cleland, MD, Amala A. Louis, Alan S. Rigby, PhD, Uwe Janssens, MD, Aggie H.M.M. Balk, MD, and others. "Noninvasive Home Telemonitoring for Patients with Heart Failure at High Risk of Recurrent Admission and Death," Journal of the American College of Cardiology 45,no.10 (2005): 1654.

Figure 4: Physician wanting patients to track/monitor health at home

88%: Yes

65%: Weight
61%: Blood sugar
57%: Vital signs (e.g., blood pressure, heart rate, respiratory rate)
54%: Exercise/physically activity
36%: Calories/fat content taken in
36%: Pain level
35 %: Sleep patterns
28 %: Cardiac rhythm
17 %: Bladder control
16 %: Acid reflux/indigestion
13 %: Digestive health

12%: No

Figure 5: What consumers and physicians want to track regarding health

Line chart comparing Physicians and Consumers.

	Weight	Vital signs	Calories/fat taken in	Exercise/ physical activity	Sleep patterns	Blood sugar	Acid reflux/ indigestion	Digestive health
Physicians	65%	57%	36%	54%	35%	61%	16%	13%
Consumers	40%	37%	32%	30%	23%	22%	13%	12%

○ Physicians
○ Consumers

Figure 6: Biggest obstacle when seeing patients or running practice

29%
43%
Accessing information when/where needed

27%
18%
Increasing face -to -ace time with patients

24%
16%
Increasing patient compliance

7%
12%
Decreasing communication between physicians

8%
5%
Obtaining easier communication channels to patients

5%
5%
Other

■ Specialists   ■ Primary Care Physician

Figure 7: Physician interest in performing various tasks wirelessly
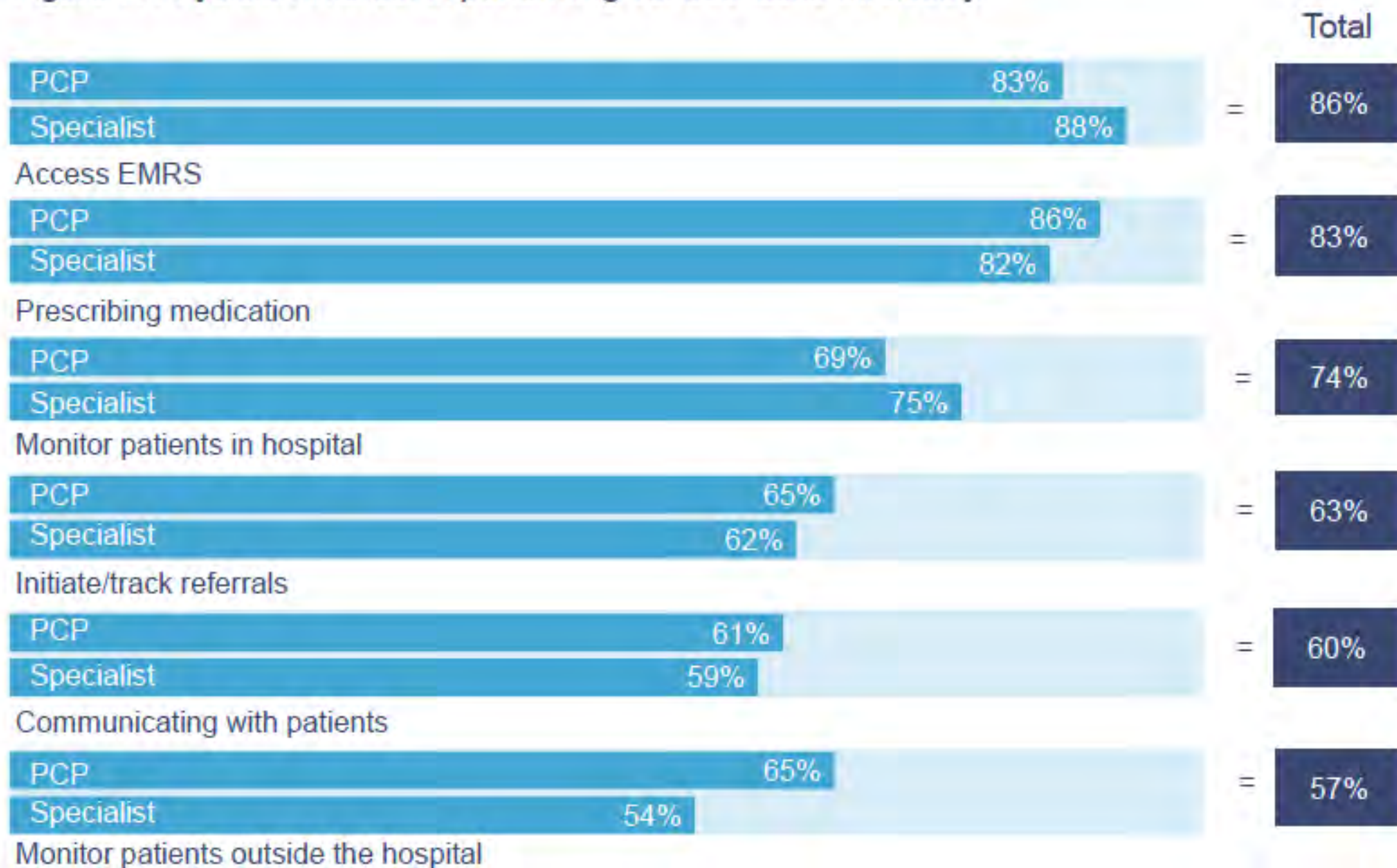
		Total
PCP	83%	
Specialist	88%	= 86%

Access EMRS

		Total
PCP	86%	
Specialist	82%	= 83%

Prescribing medication

		Total
PCP	69%	
Specialist	75%	= 74%

Monitor patients in hospital

		Total
PCP	65%	
Specialist	62%	= 63%

Initiate/track referrals

		Total
PCP	61%	
Specialist	59%	= 60%

Communicating with patients

		Total
PCP	65%	
Specialist	54%	= 57%

Monitor patients outside the hospital

Source: PricewaterhouseCoopers' HRI Physician and Consumer Surveys, 2010   PCP: Primary Care Physician

Figure 8: Percent of physicians surveyed who said mobile health would have these impacts
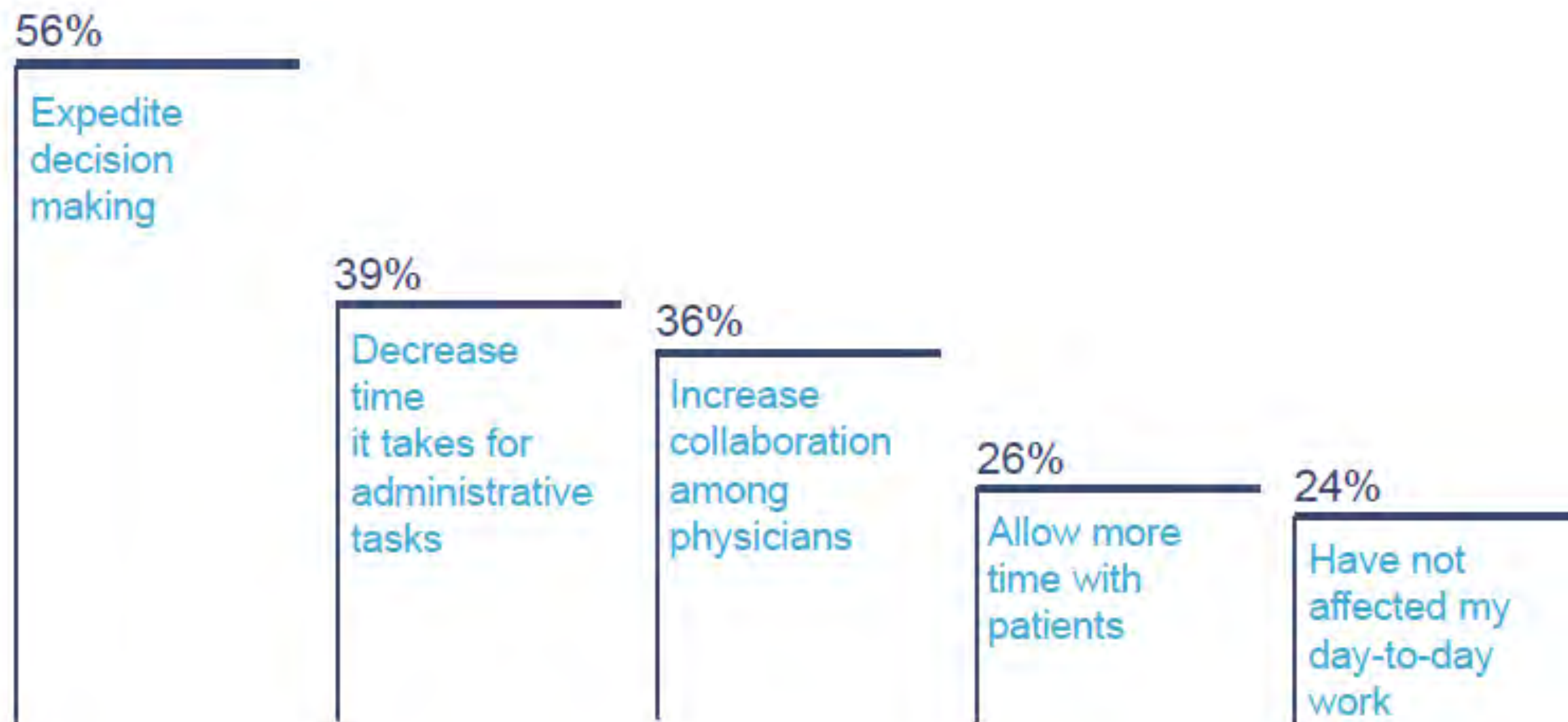
56%

Expedite
decision
making

39%

Decrease
time
it takes for
administrative
tasks

36%

Increase
collaboration
among
physicians

26%

Allow more
time with
patients

24%

Have not
affected my
day-to-day
work

Figure 10: Most important reasons consumers would buy mobile health technology

Monitor fitness/Wellbeing: 20%

18%: Have doctor monitor condition from afar

11%: Monitor previous condition

51%: I would not buy mobile health technology
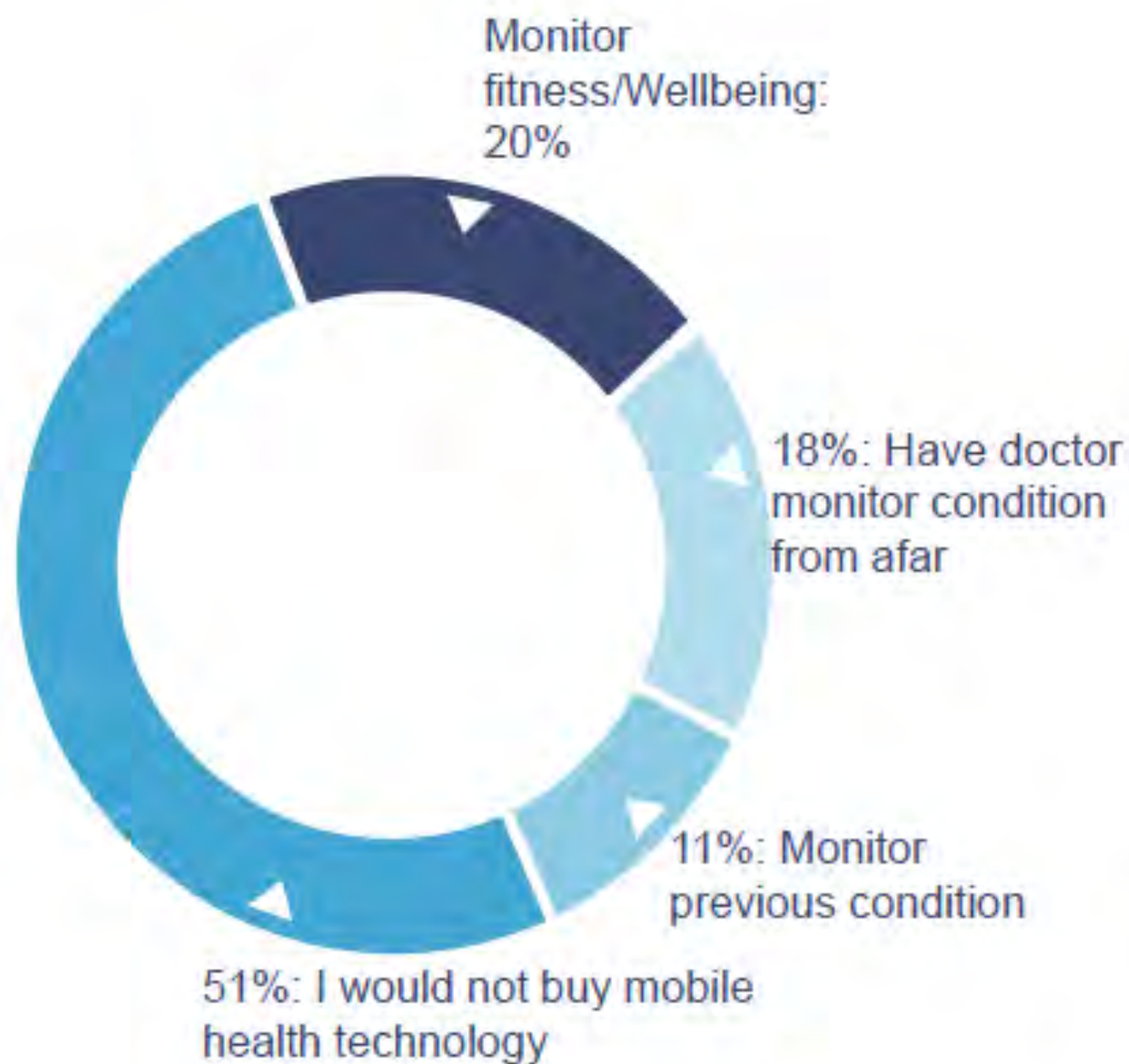
Figure 12: How integrated are physician mobile device apps with hospital IT systems?

Very integrated
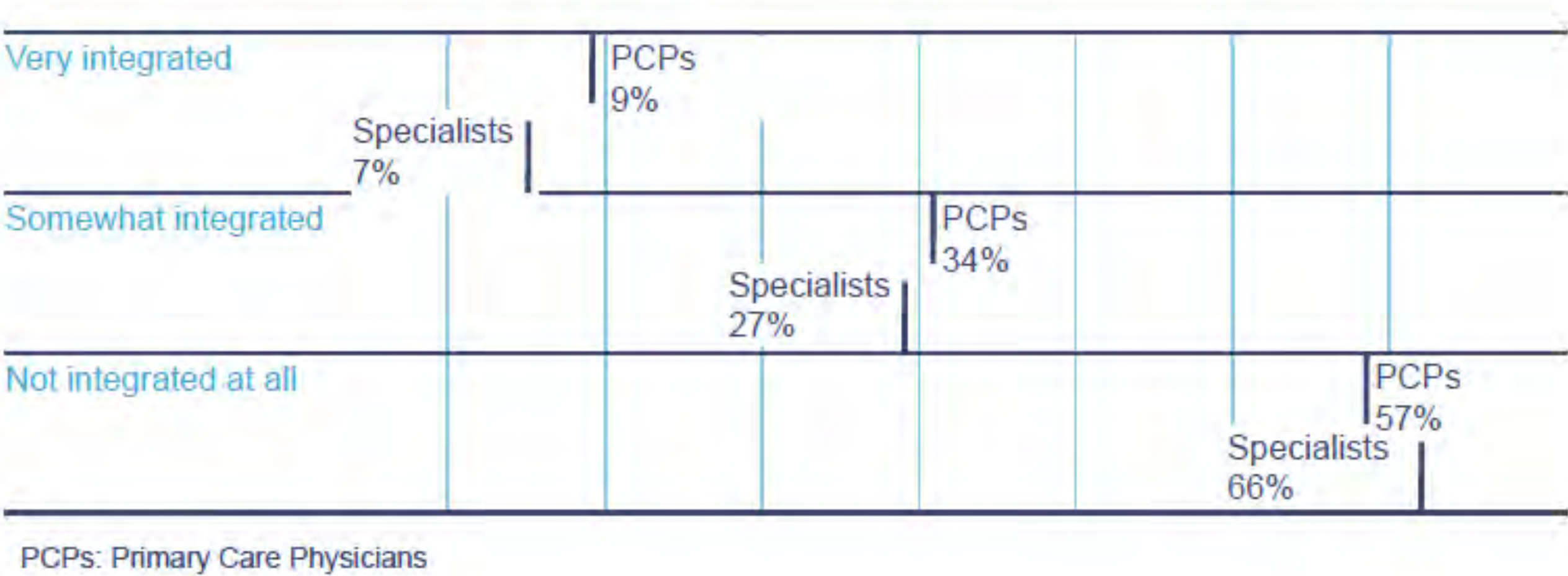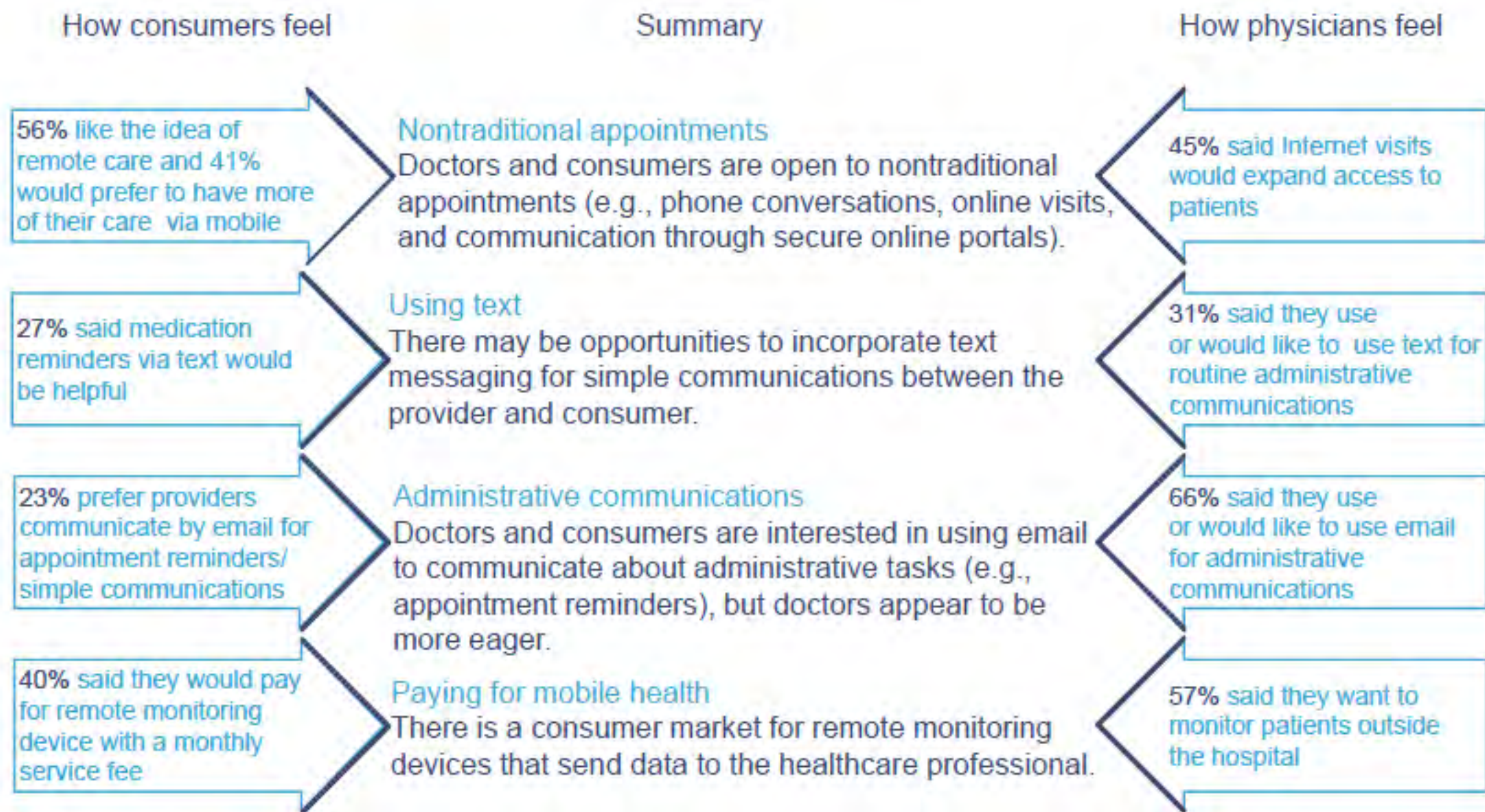
PCPs 9%

Specialists 7%

Somewhat integrated

PCPs 34%

Specialists 27%

Not integrated at all

PCPs 57%

Specialists 66%

PCPs: Primary Care Physicians

Figure 13: Where physicians and consumers meet

How consumers feel	Summary	How physicians feel

How consumers feel | **Summary** | **How physicians feel**

56% like the idea of remote care and 41% would prefer to have more of their care via mobile

Nontraditional appointments
Doctors and consumers are open to nontraditional appointments (e.g., phone conversations, online visits, and communication through secure online portals).

45% said Internet visits would expand access to patients

27% said medication reminders via text would be helpful

Using text
There may be opportunities to incorporate text messaging for simple communications between the provider and consumer.

31% said they use or would like to use text for routine administrative communications

23% prefer providers communicate by email for appointment reminders/ simple communications

Administrative communications
Doctors and consumers are interested in using email to communicate about administrative tasks (e.g., appointment reminders), but doctors appear to be more eager.

66% said they use or would like to use email for administrative communications

40% said they would pay for remote monitoring device with a monthly service fee

Paying for mobile health
There is a consumer market for remote monitoring devices that send data to the healthcare professional.

57% said they want to monitor patients outside the hospital

Figure 14: Mobile health business models
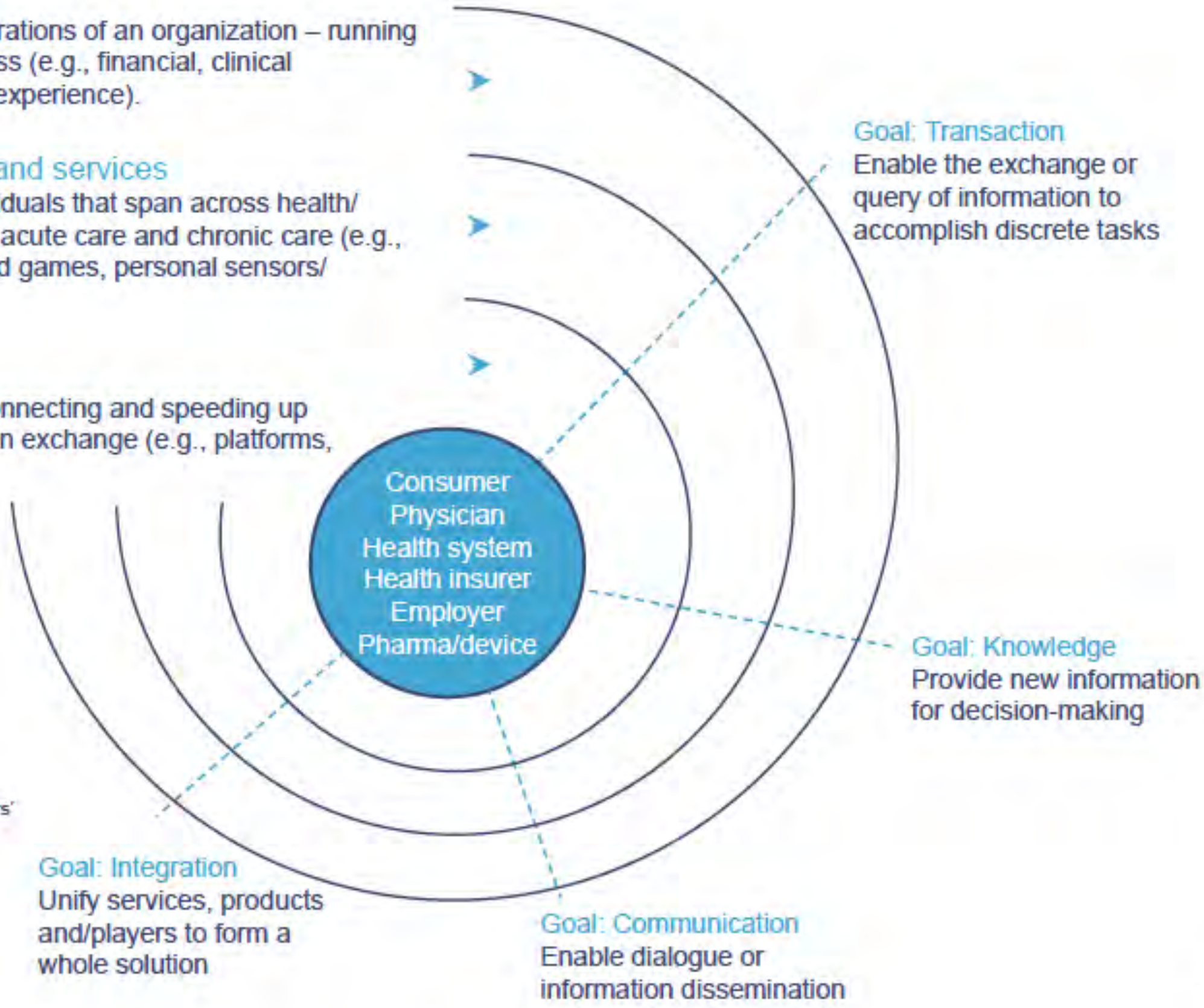
Business models

Operational/clinical
Focuses on internal operations of an organization – running and growing the business (e.g., financial, clinical performance, customer experience).

Consumer products and services
Services related to individuals that span across health/fitness, preventive care, acute care and chronic care (e.g., apps, fitness devices and games, personal sensors/monitoring).

Infrastructure
Focuses on securing, connecting and speeding up health-related information exchange (e.g., platforms, software, bandwidth).

Source: PricewaterhouseCoopers' Health Research Institute

Goal: Transaction
Enable the exchange or query of information to accomplish discrete tasks

Consumer
Physician
Health system
Health insurer
Employer
Pharma/device

Goal: Knowledge
Provide new information for decision-making

Goal: Integration
Unify services, products and/players to form a whole solution

Goal: Communication
Enable dialogue or information dissemination

What is Web 2.0 ?

"Web 2.0 is the business revolution in the computer industry caused by the move to the internet as platform, and an attempt to understand the rules for success on that new platform."
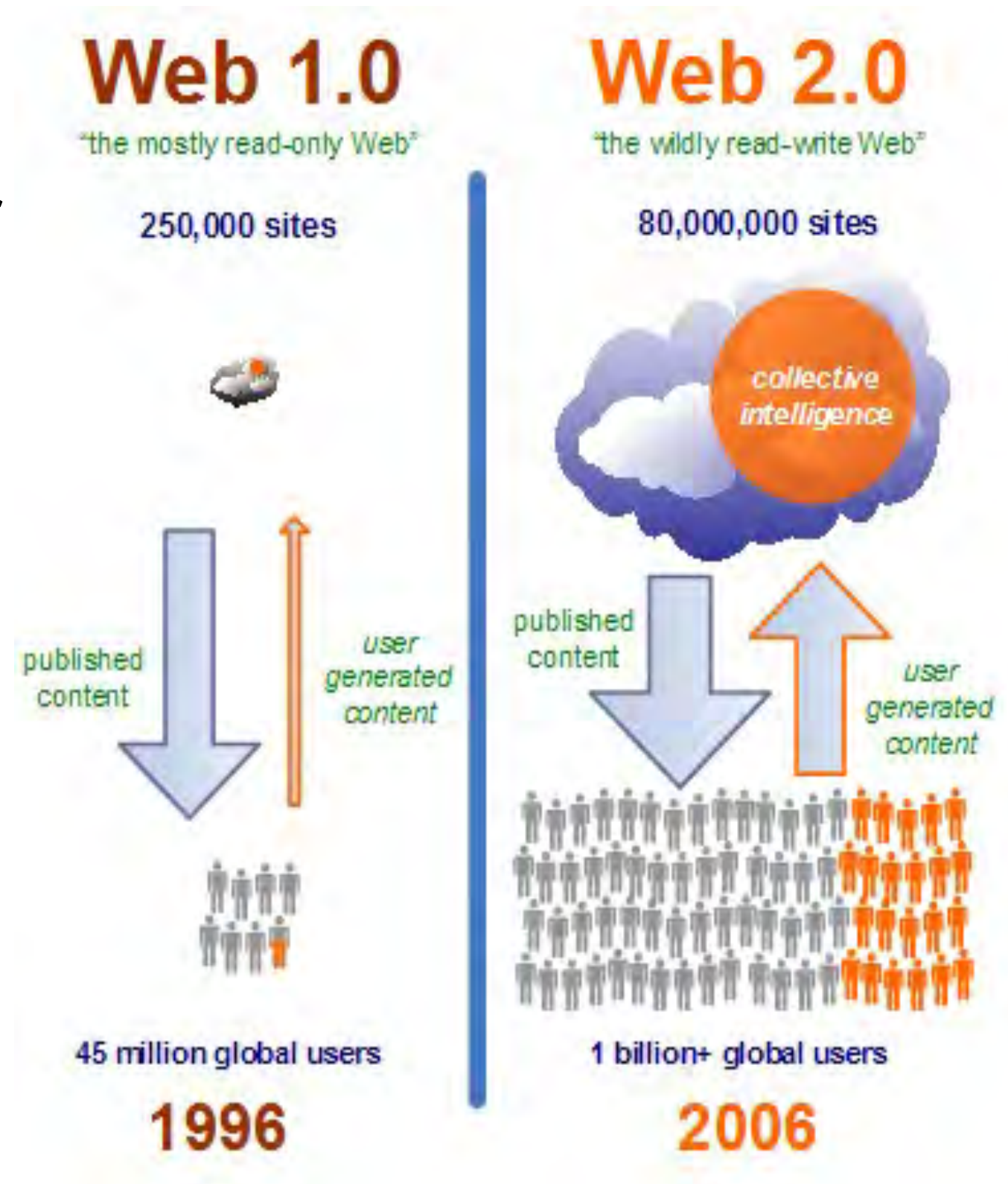
Tim O'Reilly (2006-12-10). Web 2.0 Compact Definition: Trying Again.

Comparison

Web 1.0	Web 2.0
Proprietary, closed access	Open access, data liberation
Yahoo, Google, MSN	Social search ie. Google health
Static websites; hierarchies	Participative, non-hierarchical "wisdom of crowds"
Standalone, firewalls	"The open web as platform"
Sticky sites "Pull" information	Syndication, RSS "push" Information comes to you
E-mail alerts, listservs	Blog posts, RSS readers
Medical directories, bookmarks, favorite sites	Social tagging ie. Connotea, del.icio.us
Disparate pieces	Integrated, virtual, mashed

FUNCTION	Physician EMR 1.0 -- 2008				
Health Information and Data[1] **Order Entry Management** **Results Management** **Clinical Decision Support**	Allscripts	GE	Misys	Next Gen	Many others...

[1] Functions adapted from DesRoches,C. et. al., C. "Electronic Health Records in Ambulatory Care -- A National Survey of Physicians" NEJM; July 3, 2008

FUNCTION	Clinical Groupware/ EHR 2.0 -- 2012
Health Information and Data[1]	Company A, B, C
Order Entry Management	Company D, E, A
Results Management	Company F, G, D
Clinical Decision Support	Company H, I, B
Clinical Groupware Platform[2]	Company J, K, I
Patient Connectivity (Panel Management)	Company L, M, N
Quality Improvement	Company N, O, F
Administrative Tools	Company P, Q, M
Communication	Company R,S,C
Public Health Reporting	Company T, U, R
Research	Company V, W, C
Advanced Decision Support	Company X, Y, N
...hundreds of future apps!	Company Z, D, Q

[1] Functions adapted from DesRoches,C. et. al., C. "Electronic Health Records
in Ambulatory Care -- A National Survey of Physicians" NEJM; July 3, 2008

[2] Functions adapted from Mandl, K. and Kohane, I. "No Small Change for the
Information Economy" NEJM; March 26, 2009

Current vs. Future EMRs

- Metaphor: Paper
  - Word, Excel, static data views
  - Document-centric

- Orientation: Tasks
  - Data silos, many clicks
  - Documentation as end product

- Control: Vendors
  - Tightly bound, client-server
  - Closed systems

- Metaphor: Web, iPhone
  - Graphical representation
  - Interactive, actionable data

- Orientation: Workflow
  - One click, context critical, sharing
  - Documentation as byproduct

- Control: Users, shared
  - Data separated from App
  - Open API

EMR 1.0 to EHR 2.0

- Today's Predominant EMR 1.0

  - client server based

  - proprietary

  - non-interoperable

  - no connectivity to patients

  - monolithic

- Tomorrow's EHR 2.0

  - web-based, cloud computing

  - open

  - interoperable

  - networked

  - platform/application (clinical groupware)