



# Consumer Acceptance of Home Monitoring Solutions

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# Advanced Home Healthcare Products and Services

## What Are They

- Home-based
- Technology-enabled
- Based on components that already exist

## What They Are Not

- Durable, Home Medical Equipment
- PERS
- Difficult, Cumbersome, Need-an-IT-Degree to Use
- Clinical/Formal Provider Healthcare
- “Big Brother” for the Insurance Co’s or the Govt

# Product Categories Today

A/V Communication Solutions

Patient Monitoring Systems

Medication Compliance Tools

Telehealth

# A/V Communication Solutions

## Coordinated Care Team Communication

- With family (informal caregiver)
- With doctor/nurse agency  
(formal caregiver)
  - ✓ Phones
  - ✓ Internet
  - ✓ Wireless

## Healthcare-specific Cell phones

## Video and ID Phones

## Television-based Education and Care Management Solutions



# Patient Monitoring Systems

PERS+

Monitoring

Monitoring & Companionship

Monitoring, Companionship & Medication Management

Intelligent Sensor Networks

Wearable Monitoring Devices

Wireless Devices



# Medication Compliance Tools

Audio Reminders

Integrated Reminders

Tracking Devices

Integrated Dispensing Systems

Compliance/Insurance Integration

RFID-enabled



# Telehealth / Telemedicine

Central Device

2-Way Transmission w/Care Providers

Integrated with:

- Glucometers
- BP cuffs & ECG monitors
- Weight Scales
- Respiratory Devices
- Pulse Oximeters
- Thermometers
- Cameras

Communicate and Provide Care



# Research Findings

**Improved Patient Outcomes Serve as a Proxy  
for Consumer Acceptance and Satisfaction  
with Home Monitoring Systems**

**Case Studies Utilizing Medication Adherence  
Technologies**

**Why Medication Adherence Technologies?**



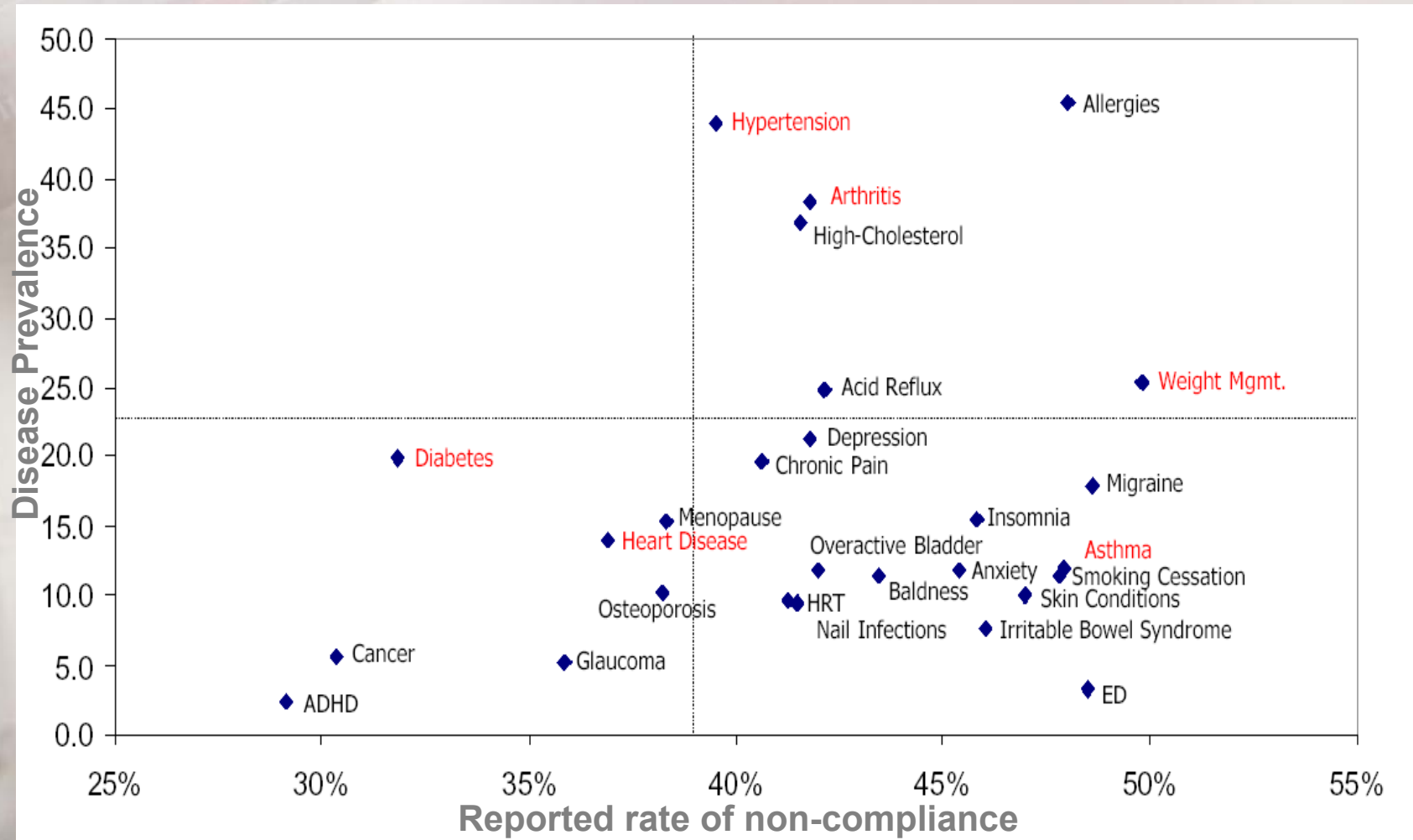
# Medication Non-Adherence is Driving Up Healthcare Costs

Failure to take medication as prescribed:

- Causes **10%** of total hospital admissions
- Causes **33%** of CHF hospital admissions
- Causes **75%** of Schizophrenia admissions
- Causes **68%** of NNRTI resistant/mutated HIV virus
- Results in **\$100 billion/year** in unnecessary hospital costs
- Causes **22%** of nursing home admissions
- Costs the U.S. economy **\$300 billion/year**

(N Engl. J Med 8/4/05, National Pharmaceutical Council, Archives of Internal Medicine, NCPIE, American Public Health Association, AIDS 2006 20:223-232)

# Average Reported Rate Of Non-Adherence Is 43%



# Patient Challenges:



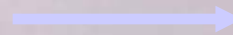
Too many medications at home

Old medications not destroyed

New prescriptions received: new dose, different medication, generic vs brand labeling

Inconsistent communication between multiple providers: pharmacies, PCP, Hospitalist, Specialist

Which pill is which?



# Please Help!!!!

“What medication do I take?”

“What did the doctor say?”

“What is the correct dose?”

“What is the correct time?”

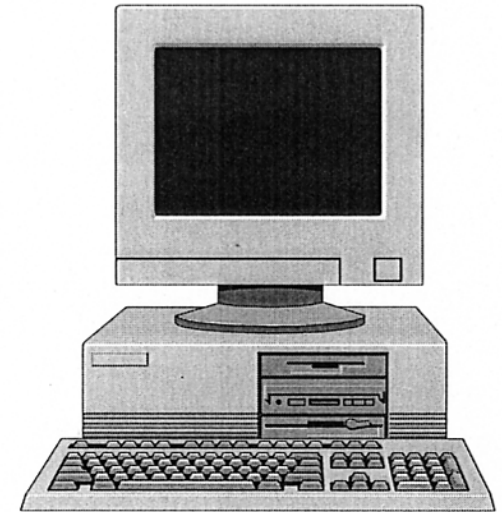
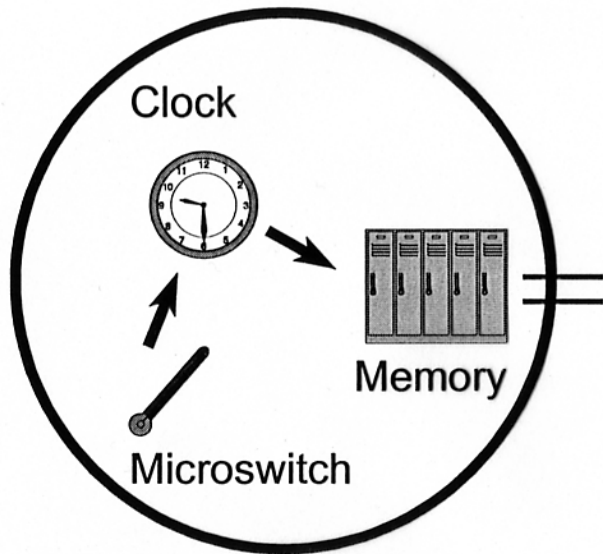
“What do each of these medications do?”

“Why are they important?”

“Why do I need them, I feel better”?”



# Electronic Monitoring

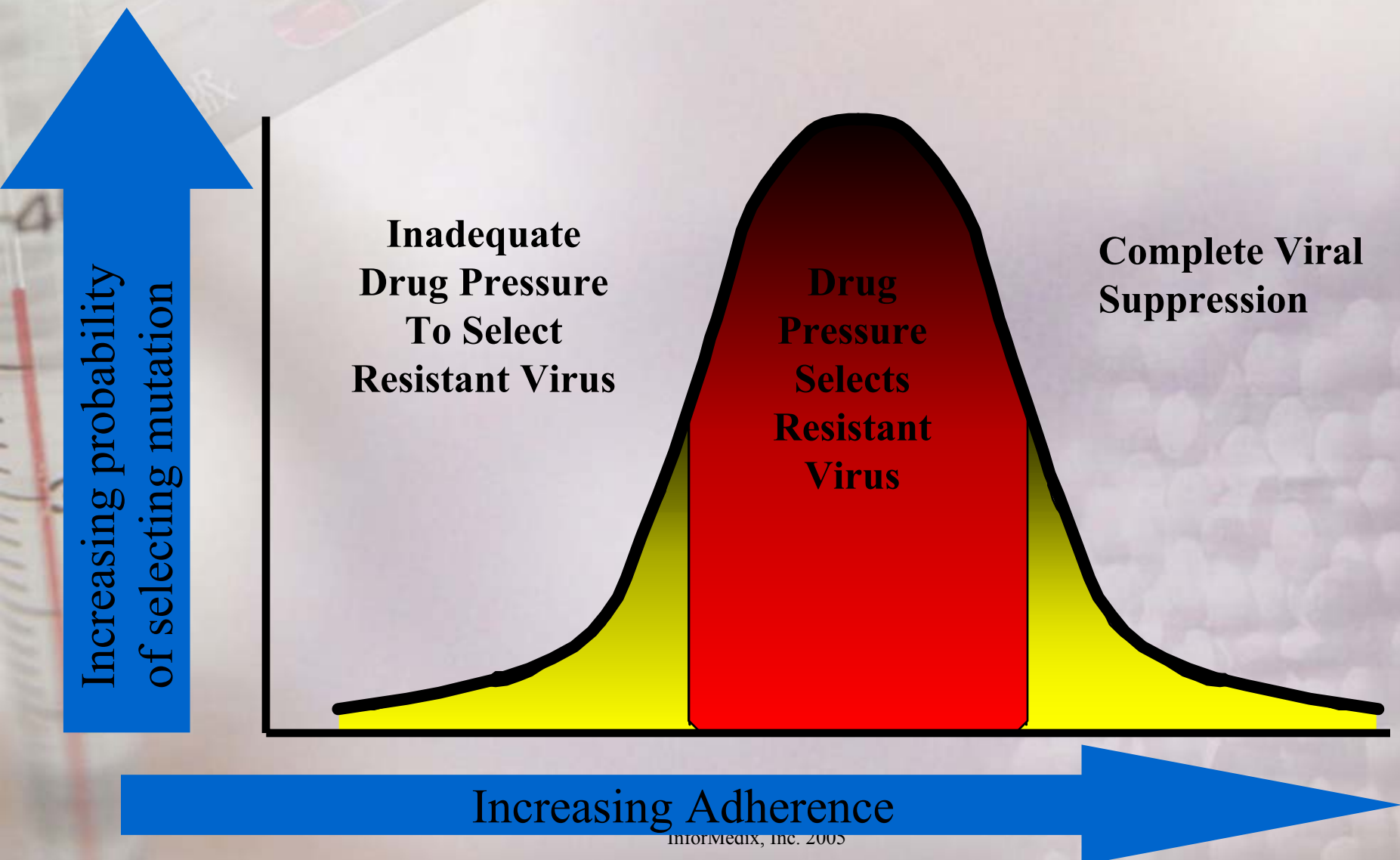


Personal Computer



**Medication Event Monitoring System** ©; AARDEX Ltd.

# Bell-shaped Adherence and Resistance Curve



# Adherence to HIV Therapy in the Industrialized North

San Francisco 67%  
Bangsberg AIDS 2000

Pittsburgh 74%  
Paterson Annals Int Med 2000

Los Angeles 63%  
Liu Annals Int Med 2001

New York City 57%  
Arnsten CID 2001

Hartford 53%  
McNabb CID 2001

Philadelphia 79%  
Gross AIDS 2001

## Africans Outdo U.S. Patients In Following AIDS Therapy

By DONALD G. McNEIL Jr.

Contradicting long-held prejudices that have clouded the campaign to bring AIDS drugs to millions of people in Africa, evidence is emerging that AIDS patients there are better at following their pill regimens than Americans are.

Some doctors, politicians and pharmaceutical executives have argued that it is unsafe to send millions of doses of antiretroviral drugs to Africa, for fear that incomplete pill-taking will speed the mutation of drug-resistant strains that could spread around the world.

The danger already exists: nearly 10 percent of all new H.I.V. infections

in Europe are resistant to at least one drug.

For Africa, the issue is particularly touchy because it is tinged with racism. In 2001, for example there was an outcry when the director of the United States Agency for International Development said that AIDS drugs "wouldn't work" in Africa because many Africans don't use clocks and "don't know what Western time is."

Now surveys done in Botswana, Uganda, Senegal and South Africa have found that on average, AIDS patients take about 90 percent of their medicine. The average figure in the United States is 70 percent, and it is worse among subgroups like the homeless and drug abusers.

Compliance has become easier because drugmakers from India and elsewhere are beginning to make triple-therapy cocktails that come in as few as two pills a day. (These are not available in the United States yet because of patent problems — no Western company makes all three drugs for an ideal cocktail.)

After nearly a decade of watching Africans die because AIDS drugs cost \$10,000 or more a year per patient, rich nations began pledging aid after generic competition in 2001 drove prices down to about \$300 a year. Last week the World Trade Organization agreed to alter its rules to give poor nations more access to life-saving medicines.

But as with any epidemic moving

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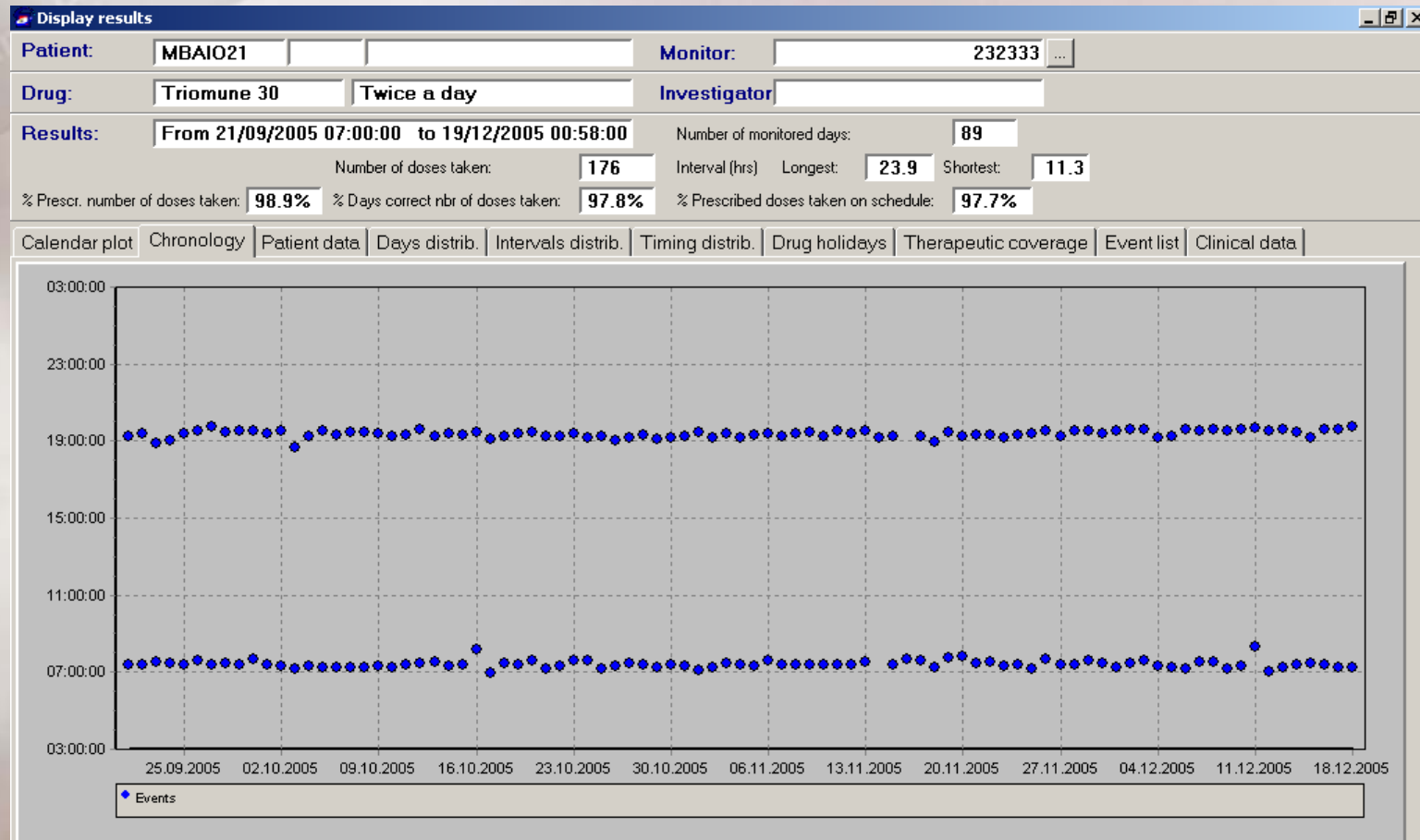
### Focus o

New York  
pushing to  
experience  
graduates.

Continued on Page A5



# Electronic medication monitor record of time of bottle openings for am and pm doses.





**US FAMILY  
HEALTH PLAN**  
*Caring for our Uniformed Services Family*

# TeleWatch: Automated telemedicine in the outpatient treatment of heart failure

Johns Hopkins HealthCare

# Effective treatment of Heart Failure and other chronic diseases

1. Close outpatient management and monitoring
2. Patient education/feedback
3. Appropriate medications
  - Up-titration to goal doses
  - Limiting side effects



# Difficulty in patient education

**In patients with Heart Failure and recently discharged from the hospital**

- 40% don't know to weigh themselves daily**
- 38% thought they should drink “lots of water”**

**57% of Heart Failure readmissions considered “preventable”**

- 42% due to poor treatment adherence**
- 24% due to medication non-adherence**

Hagenhoff. J Adv Nurs 1994 19:685-690

Humboldt-krankenhaus. Heart. 1998;80:437-41

# Poor outpatient treatment of chronic conditions

In patients with Heart Failure:

- 41% on beta-blocker
- 39% on ACE-inhibitor
- Slow rate of up titration of medications
- Inappropriately low doses of medications– 38% of those on ACE-I, on inadequate dose

Stafford. JACC 2003. 41:56-61

Echemann. Am Heart J. 2000;139:624-31

# Johns Hopkins Disease Management Program for Heart Failure

Increased outpatient monitoring

- Frequent nurse-patient contact

Education

- Medication/adherence
- Diet

Feedback

- Medication questions
- Symptom questions

Coordination of care





## TeleWatch

Development of a telemedicine system was a joint project between:

- JHU- School of Medicine, Division of Cardiology
- JHU- Applied Physics Laboratory



Goals of the telemedicine system:

- Easy to use
- Inexpensive
- Employ widely available technology

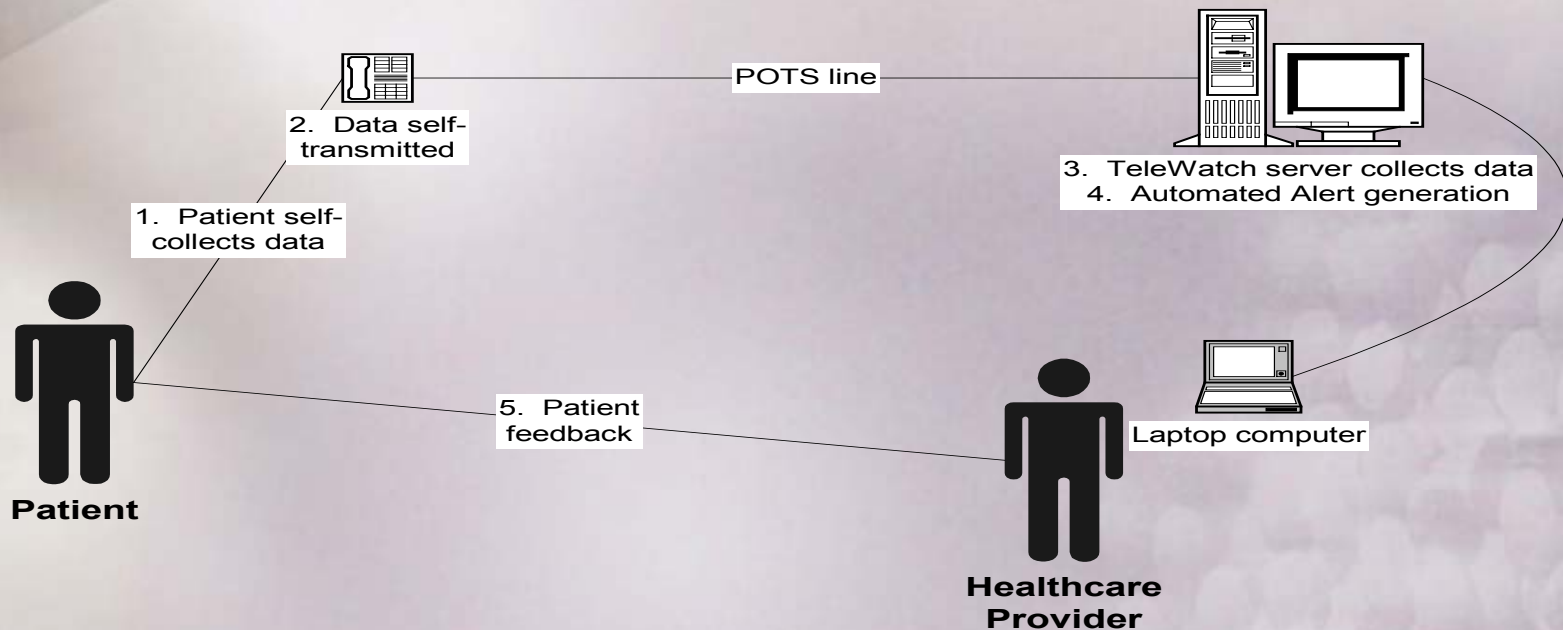
# TeleWatch Telemedicine System

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- Automated, telephone-based telemonitoring system
- Patients self-report physiologic parameters (using durable medical equipment) and answer pre-recorded, disease-specific questions
- Algorithms designed to detect worrisome trends or responses which automatically alert the nurse
- Validation algorithms ensure data integrity



# Automating Disease Management: TeleWatch Version 1.0



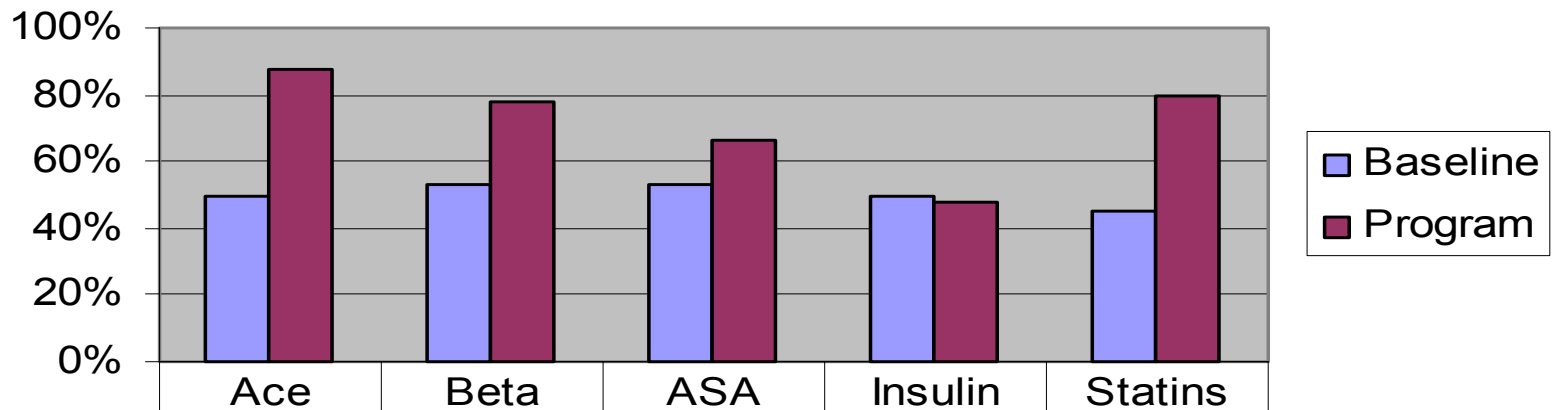
# Summary of TeleWatch utilization

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- 70% of patients call into the system at least 3 times/week
- High level of patient acceptance
- ~4 calls/week/patient
  - Similar to other studies
  - But significantly larger number of patients
  - Broader sampling of population
  - More efficient

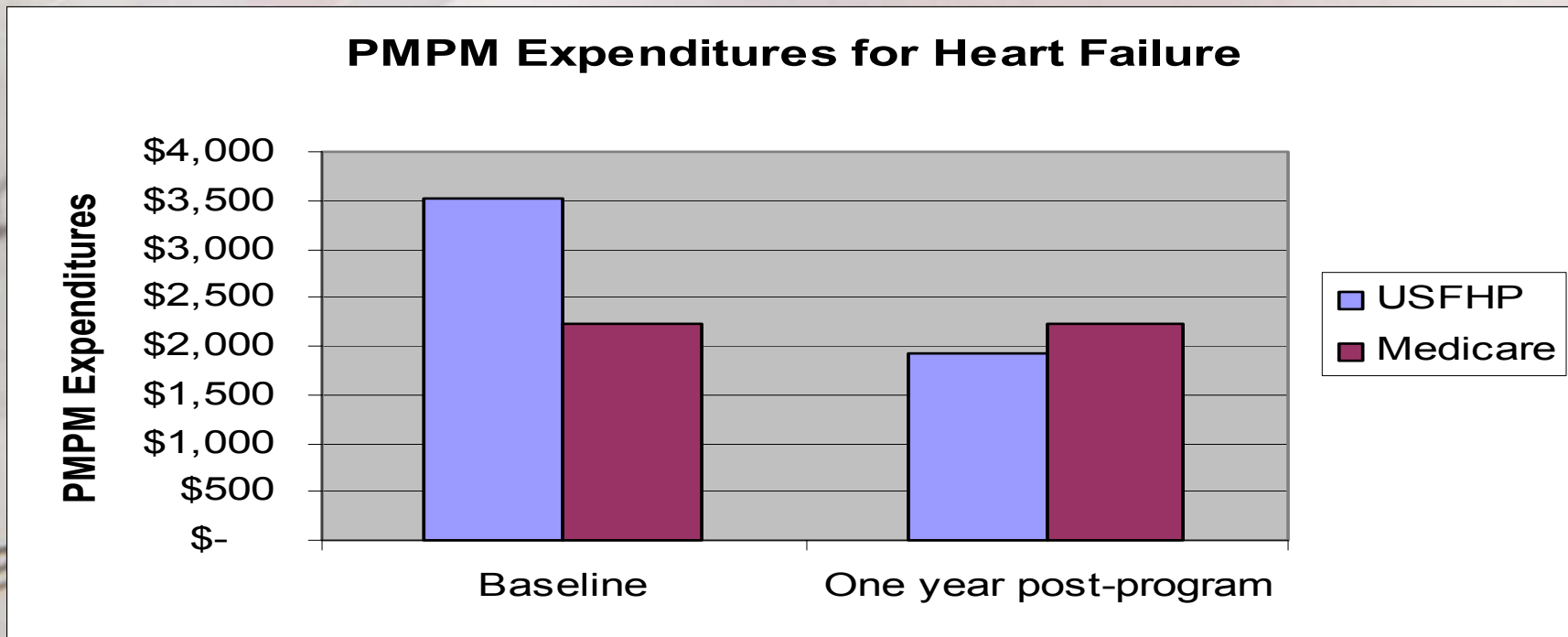
# Heart Failure: Medication Management

Percentage of patients on Medications



Baseline	50%	53%	53%	50%	45%
Program	88%	78%	66%	48%	80%

# Heart Failure: Financial Outcomes



Zhang et al 1996 data in J Am Geriatrics Soc 2003.

Healthcare inflation from BLS Medical Care item. Sept. 2003

# Conclusions from Johns Hopkins program experience

TeleWatch decreases total expenditures mainly through

- Decreased hospitalizations
  - Admissions PMPM decreased 52% compared with baseline year
- Decreased length of stay
  - Length of stay per admission decreased 71%
    - 3.5 ALOS in baseline year compared to 1.0 ALOS post-program enrollment

# Patient perception of TeleWatch

Easy connectivity (7.9)

Adequate sound quality (7.5)

Questions easy to understand (7.8)

Easy to input data (7.4)

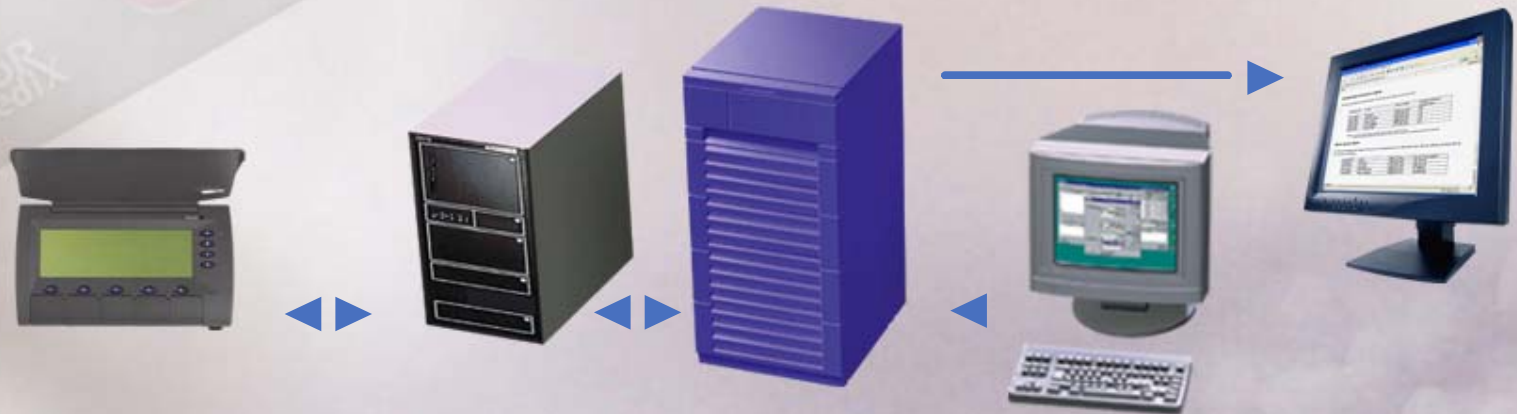
Too complicated to use (1.6)

Don't like putting data into computer (1.8)

8=strongly agree

1=strongly disagree

# InforMedix, Inc. Med-eMonitor System Overview



Med-eMonitor

Portable Patient Device

Manages 30 different drugs

Database software and networked communications

Database software and networked communications

Med-eXpert

Web-enabled real-time design tool

Web-enabled reporting

*The Medication Adherence Solution*

# Simplified Care Plan Development



**Medications**

**Daily Schedule**

**Questionnaires**

**Daily Regimen**



**Protocol Manager**

Time	Event
6:00 am	
7:00	
8:00	
9:00	<ul style="list-style-type: none"> <li>Take Medication A from Drawer 1</li> <li>Take Medication B from Drawer 2</li> <li>Alarm - No Dairy Products until 11:00</li> </ul>
10:00	
11:00	
12:00 pm	
1:00	
2:00	
3:00	
4:00	Questionnaire - General Effectiveness
5:00	
6:00	
7:00	
8:00	
9:00	
10:00	
11:00	
12:00	

**The Regimens are Downloaded to the Med-eMonitor**







# DIABETES PROGRAM: St. Vincent Med-eMonitor Protocol

Prompt and record adherence to oral diabetes medications

EDIC questionnaire at beginning and end of study

Prompt and record glucose levels

- Fasting morning
- Evening
- Random once per week at 3:00AM, pre-lunch, 2:00PM, 9:30PM
- If glucose below 50 prompt to take glucose tablet or drink glass of juice
- If glucose too high (specific number patient dependent) then prompt to take insulin per prescribed sliding scale (only for those patients on insulin)

Prompt and record daily systolic, diastolic BP

Reminders about proper care per ADA guidelines once or twice during protocol

- Encourage regular exercise program
- Schedule yearly eye exam
- Check feet for cracks or sores
- Annual cholesterol check
- Check kidneys and urine for protein
- Schedule doctor visit for HgA1C blood test (education on what the HgA1C measures)
- Remind to stay on diet and read labels on food

Reminder to schedule end of protocol clinic visit

*Medication Adherence Solutions*

Confidential

InforMedix, Inc. 2005

# DIABETES PROGRAM: REMOTE, UNDERSERVED RURAL PATIENTS

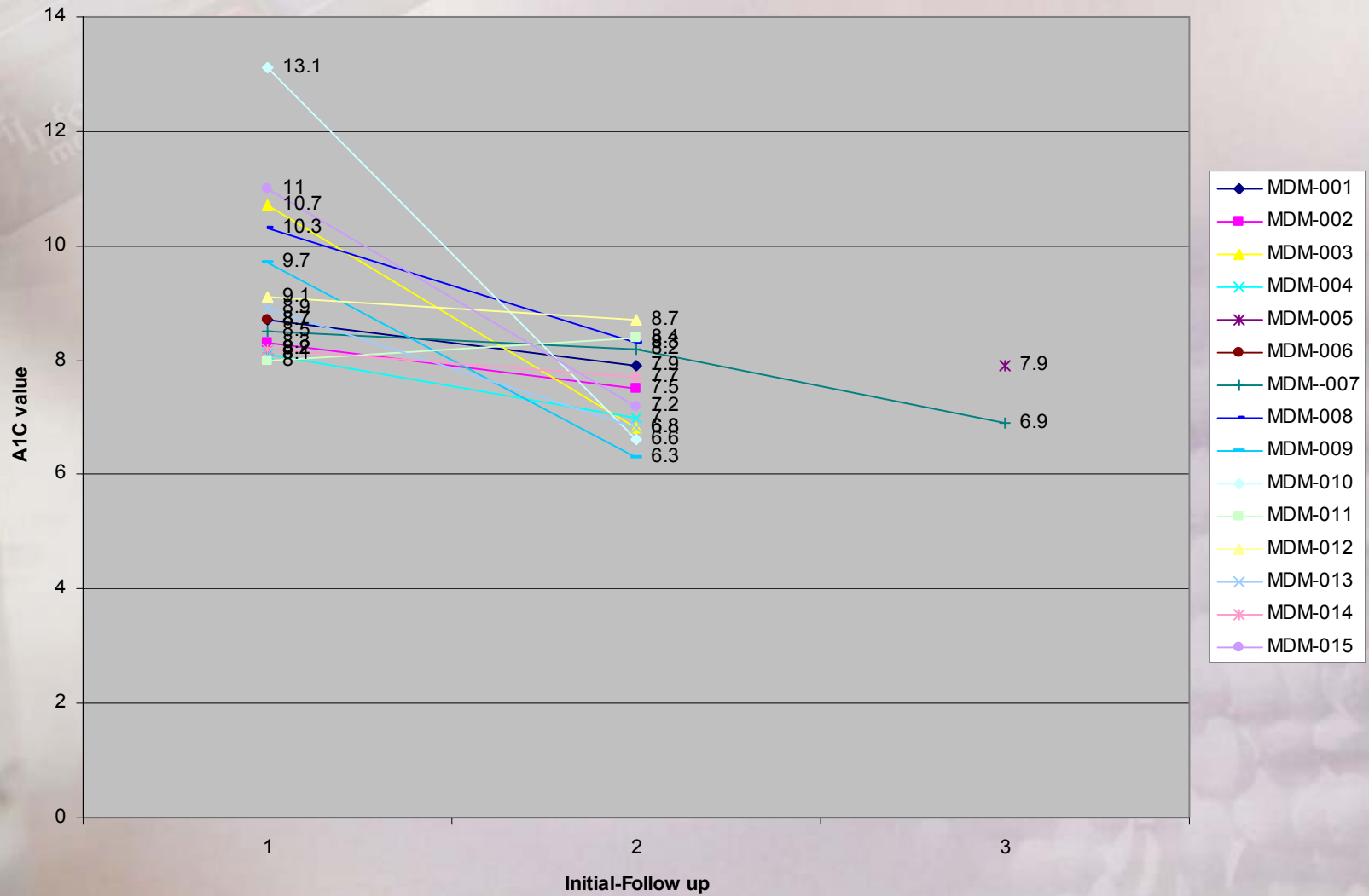
## Saint Vincent Hospital, Billings, Montana:

- Patients located 150 – 250 miles from clinic, pharmacies
- Geographic and climatic barriers to healthcare
- Type II Diabetics
- Med-eMonitor Protocol
  - Monitor medication adherence with hypoglycemic medications
  - Frequent glucose monitoring, diabetes education
  - Remote regimen change based on Internet reporting
- Goals: reduce clinic visit frequency by 2/3, remotely monitor and manage patients' response to medication and diabetes care management
- Adherence Rates: 92% medication and protocol adherence.
- HbA1c reduced by 18.5% in three months,  $p < 0.002$
- Frequency of clinic visits reduced from once a month to once every three months
- Presented at The Disease Management Congress, September 2005

*Medication Adherence Solutions*

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InforMedix, Inc. 2005

# The Data:



## End User Results in Four Academic Center Programs:

- **100% satisfaction** of caregivers,
- **97% satisfaction** of patients in schizophrenia trials
- **95% Medication adherence** rate in schizophrenics
- **94% Medication adherence** rate in CHF patients
- **96% Protocol adherence** rate in CHF patients
- **92% Medication and protocol adherence** rates in diabetics
- **HbA1c reduced by 18.5%** in three months ( $p < .002$ )

## Med-eMonitor System



*The Medication Adherence Solution*

# Older Americans and Technology

**If we build it,  
will they come?**

# Older Americans and Technology

## National survey results:

“Older Americans have a high interest in having high tech information-oriented services available as soon as possible.”

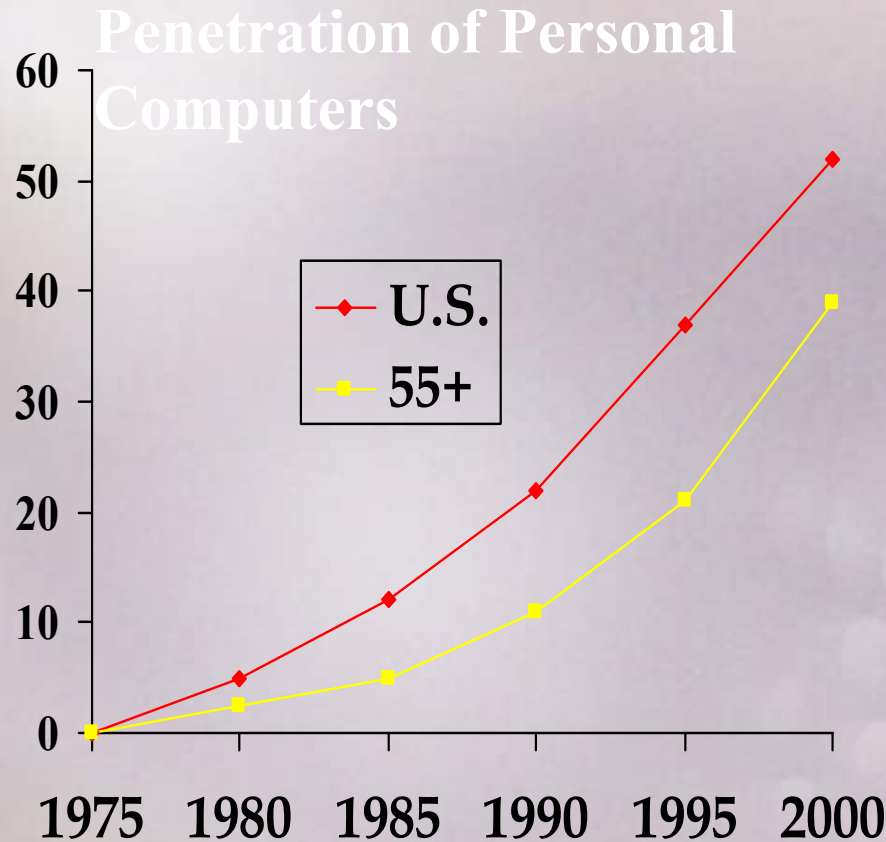
# Older Americans and Technology

## ATA National survey results:

90 % feel that information age services can help older Americans remain independent and that older adults are likely to use the services if they are reasonably priced and easy to use.



# Older Americans and Technology



# Older Americans and Technology

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## The misperception

Older people are anti-technology

## The reality

Older people are “late adopters”