Improving the Aging Experience through Innovation & Technology

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CAST NIST Interoperability Summit
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Disruptive Demographics

U.S.: 300,004,982 & counting

U.S Population Growth by Age Over 100 Years From 1950 to 2050

Males (in millions)

Females (in millions)

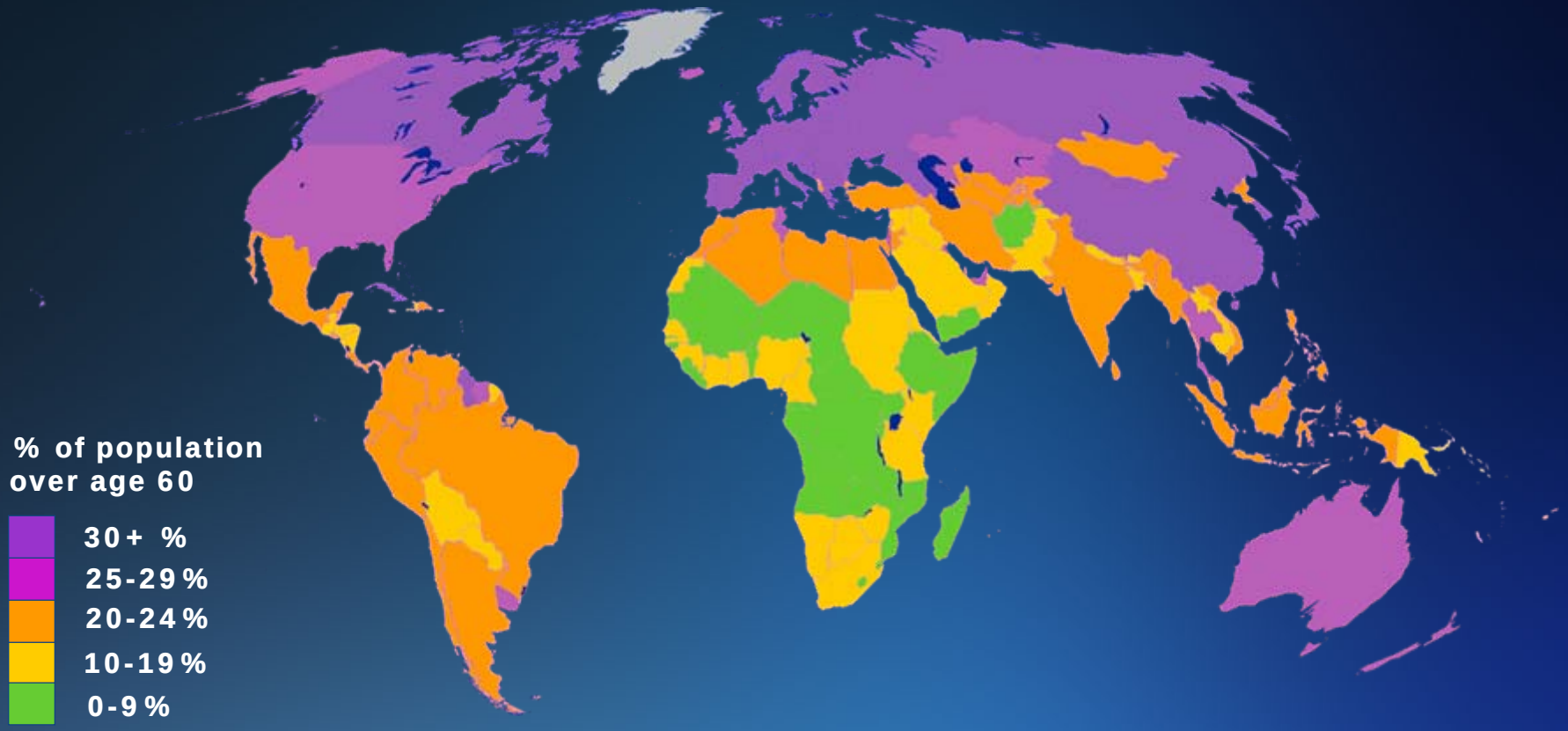
Global aging threat/oppt'y

2002

10% of the planet age 60+

Source: United Nations "Population Aging 2002"

Global aging threat/oppt'y



2050

21% of the planet age 60+

Source: United Nations "Population Aging 2002"

Keys to avoiding crisis

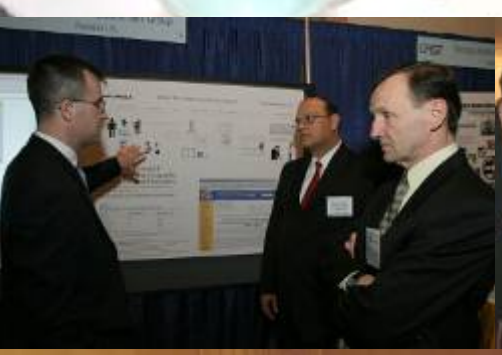
Focus innovation on 4 key areas to improve quality of life & save costs:

1. Prevention
2. Early detection
3. Compliance/Adherence
4. Caregiver Support (professional, family)

U.S. needs cross-agency, cross-industry commitment to accelerate innovation and technology development for the age wave. This is “Y2K + 10” as boomers begin retiring.

CAST drive tech-for-aging in U.S.

Center for Aging Services Tech: Accelerate technology R&D of systems that enable wellness, dignity, independence, choice, & quality of life for older adults



Community 500+ tech comps, providers, universities leading national vision & agenda

Advocacy for aging/home/personal health R&D; removing barriers to the marketplace

Standards catalyzing standards discussions for aging-in-place systems for interoperability

Tech Pilots promoting “living labs” to test new tech with aging services providers nationwide

www.agingtech.org

Intel worldwide aging tech R&D

Mission: Understand, invent, & test new health and wellness technologies by studying people/practices across the continuum of care and across the planet

People & Places

One year study of Alzheimer's families

Practices & Processes

How families cope/ help w/ memory loss

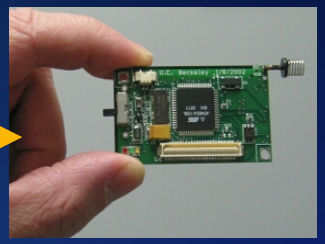
Prototypes

Early home sensor net prototype

Proof Points & Pilots

Research pilot to test in homes of seniors

Platforms & Products



New platform for independent living

Worldwide study of the aging—500+ homes, 18+ countries

Dozen real-world pilots of aging-in-place technology

Funding/collaborating with universities in U.S. and Europe

Focus on chronic disease, social isolation, falls, medication

1) Technologies that help with <u>prevention</u> of accidents/disease

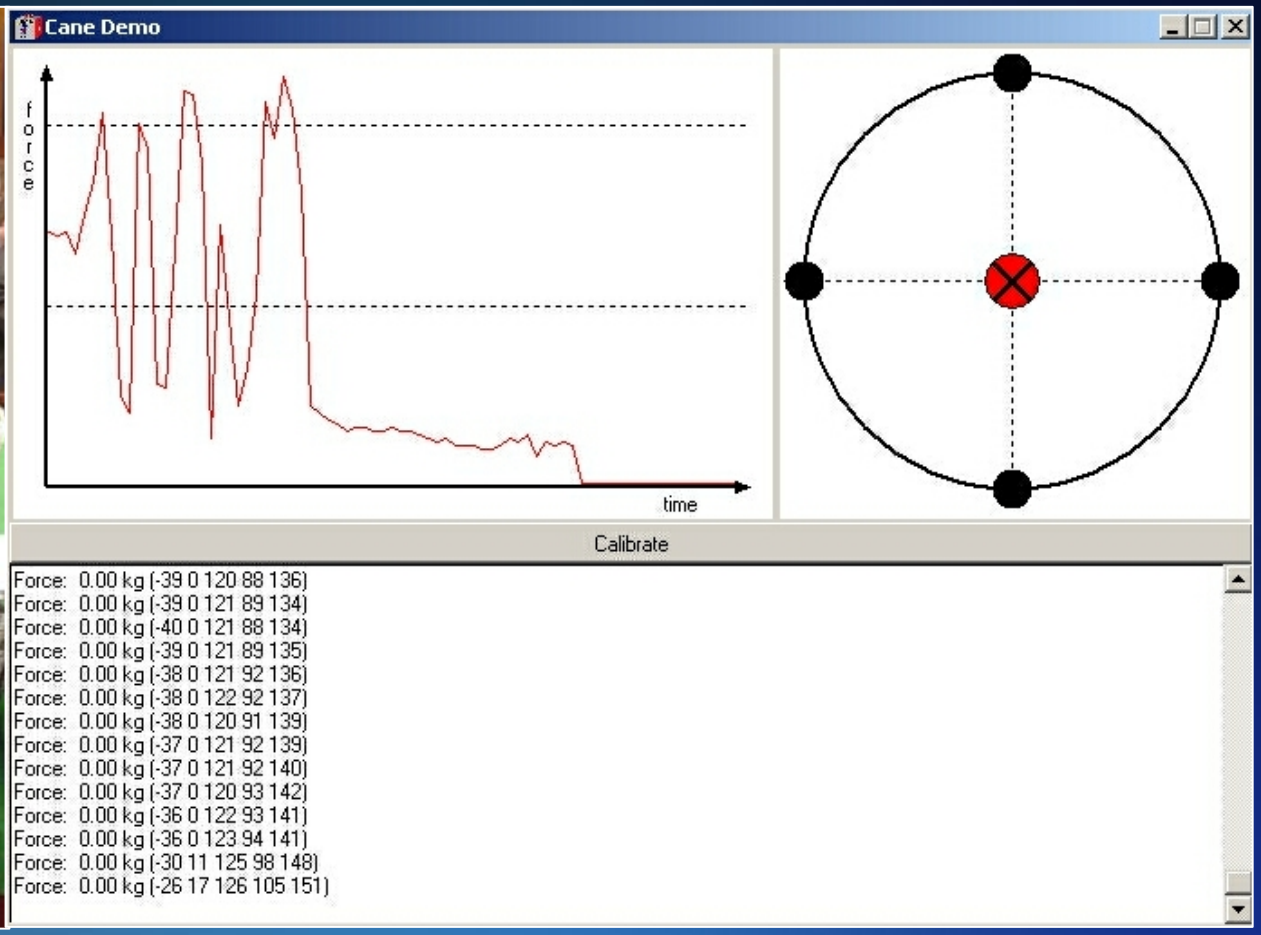
Example: preventing falls

Falls are one of the most common reasons why older adults can no longer maintain their independence in their own homes!

- More than 1/3rd aged 65+ years fall each year
- Older adults hospitalized for fall-related injuries 5X more often than for other injuries
- Fall injury costs $19,440 (hosp, nursing home, ER, home health care, but not physician services)
- Total cost of all fall injuries for people age 65+ in 1994 was $27.3 billion in U.S.
- By 2020, cost of falls to be $43.8 billion in U.S.

*Sources: http://www.cdc.gov/ncipc/factsheets/fallcost.htm; CDCReport: A Toolkit to Precent Senior Falls

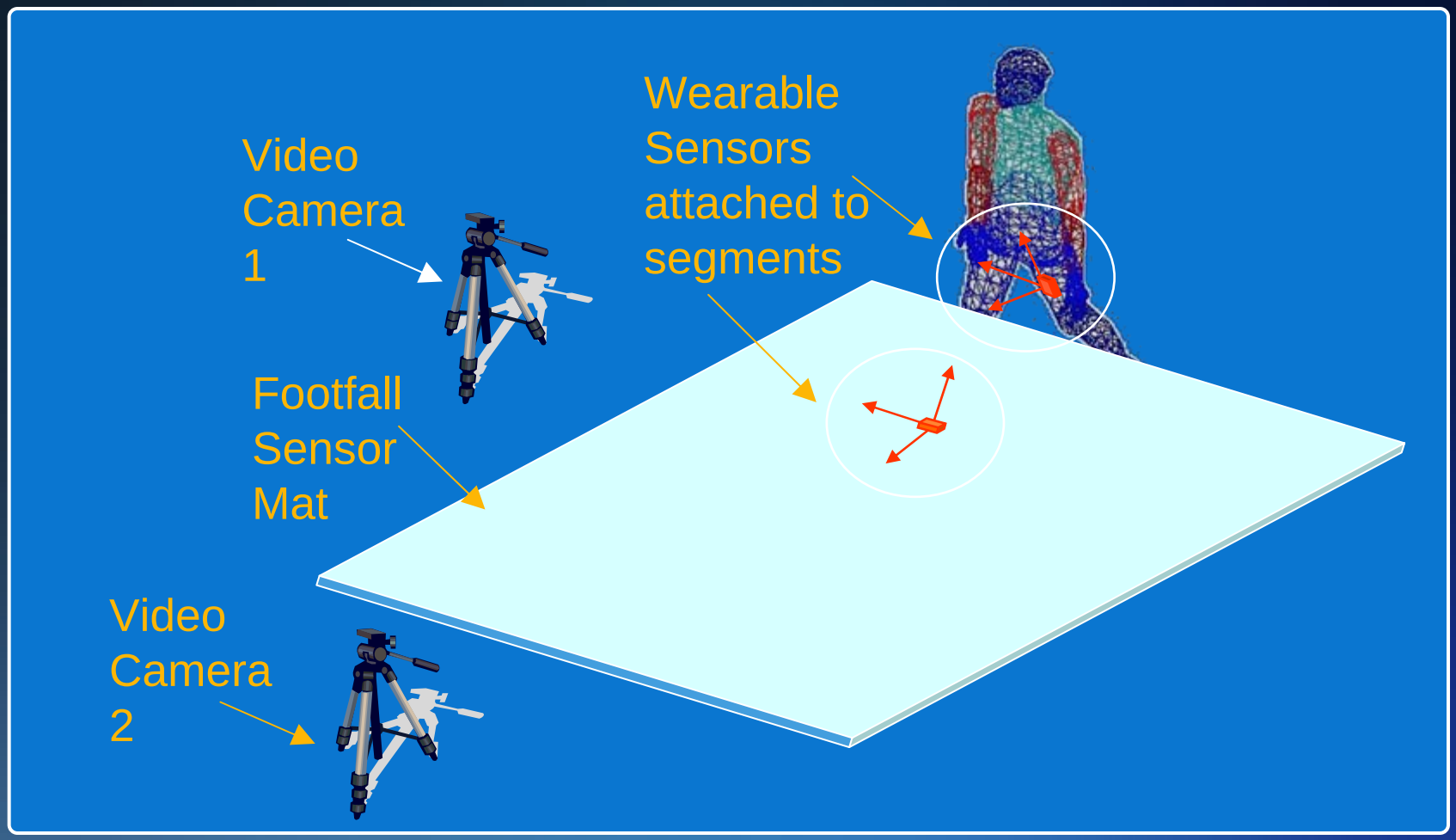
Early prototype: smart cane



Can a walking cane with a wireless force sensor detect changes in a senior's movement…and look for patterns indicating instability <u>before</u> they actually fall?

Actual data from OHSU prototype

Falls & gait hardware: 3 parts



Intel researchers building integrated falls and gait analysis platform: wearable sensors on multiple parts of body; video camera based gait analyzer; floor mat based analyzer; delivering first into clinical systems at Ireland hospital and Harvard Medical…eventually will shrink and integrated into a home based platform.

Intel prototype fall system: testing/building with 3 universities

2) Technologies that help with <u>early detection</u> of disease

Example: Parkinson's

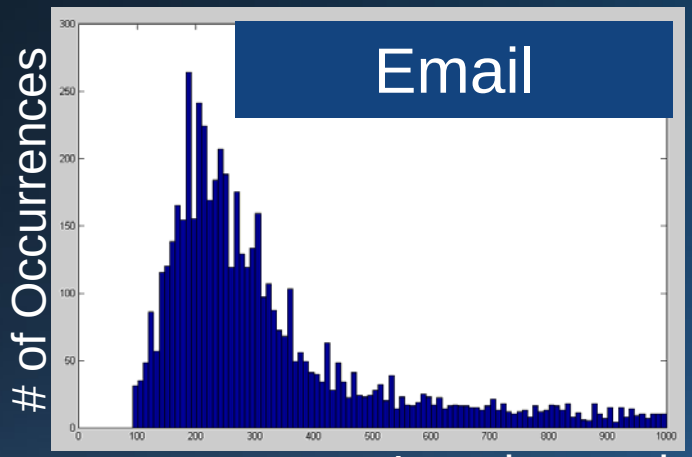
There are no real means—in the clinic or the home—to capture Parkinson's disease much earlier. By the time people are diagnosed today, they often have had it for years already.

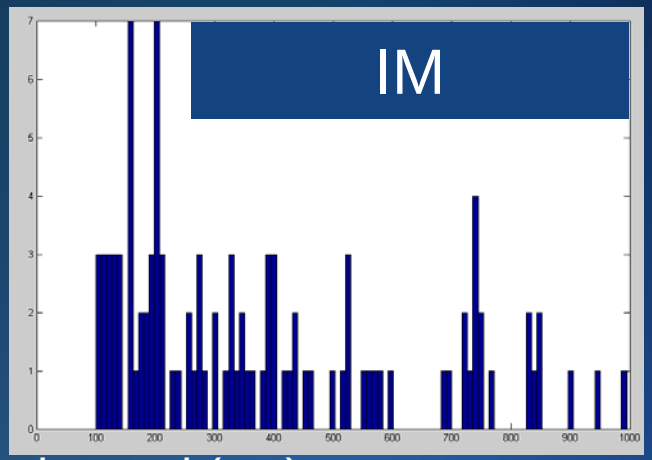
- 1 million Americans suffer from Parkinson's disease today
- 40,000 new cases diagnosed each year in U.S.
- 15% with Parkinson's are diagnosed before age 50
- Total cost to the Nation is estimated to exceed $5.6 billion annually
- Parkinson's drugs costs patients $2500+ each year
- Therapeutic surgery costs up to $100k per patient

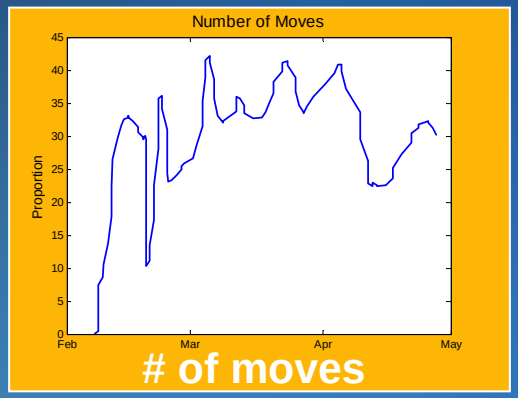
Source: http://www.pdf.org/AboutPD/index.cfm

Embed tests in everyday actions

Can we detect changes in Carl's progression by analyzing his keyboard usage, remote controls, even game playing?







Real research data and prototypes from OHSU, Intel

Intel Parkinson's home pilot

Can we collect objective measures for Parkinson's regularly & accurately from patient's home for earlier detection?

Intel prototype/pilot with 5 universities and foundation

3) Technologies that help with <u>compliance/adherence</u>

Example: meds assistance

Lack of medication adherence is a fundamental healthcare issue, rooted in behavior, that leads to hospitalization, institutionalization, and death.

- 66% of patients don't adhere to meds regimen
- ~125K people die each year because of non-adherence
- 10% of hospital admissions are associated with non-adherence
- Hospital admissions due to non-adherence totals $15.2 Billion
- Nursing home admissions due to non-adherence totals $31.3 Billion

*Sources: Compliance Packaging: A Patient Education Tool, American Pharmacy, Vol. NS29, No 2 February 1989
Standberg, L.R., Drugs as a Reason for Nursing Home Admissions, American Health care Association Journal, 10,20 (1984).
Osterberg, L., and Blaschke, T. (2005). Adherence to medication. *N. Engl. J. Med., 353*, 487-497.

BLACK PEPPER

Intel CAMP pilot with seniors

How can we help people take the right pill at the right time using technologies they are familiar with?

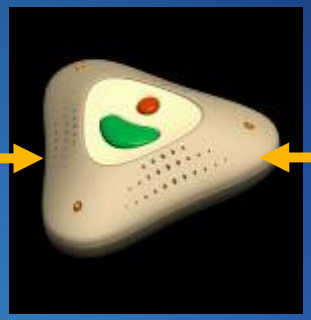
Wireless meds caddy

Bottles w/ sensors

Watch prompts

TV prompts

Phone prompts



Audio prompts

Voice badge

Research pilot w/ OHSU and Pacific Retirement Services

4) Technologies to provide caregiver support, for professionals and family

Resident ____________ Numeric Identifier ____________

MINIMUM DATA SET (MDS) - VERSION 2.0
FOR NURSING HOME RESIDENT ASSESSMENT AND CARE SCREENING
FULL ASSESSMENT FORM
(Status in last 7 days, unless other time frame indicated)

SECTION A. IDENTIFICATION AND BACKGROUND INFORMATION

1. RESIDENT NAME — a. (First) b. (Middle Initial) c. (Last) d. (Jr/Sr)
2. ROOM NUMBER
3. ASSESSMENT REFERENCE DATE — a. Last day of MDS observation period (Month – Day – Year); b. Original (0) or corrected copy of form (enter number of correction)
4a. DATE OF REENTRY — Month – Day – Year
5. MARITAL STATUS — 1. Never married 2. Married 3. Widowed 4. Separated 5. Divorced
6. MEDICAL RECORD NO.
7. CURRENT PAYMENT SOURCES FOR N.H. STAY — (Billing Office to indicate; check all that apply in last 30 days)
   - Medicaid per diem a. / VA per diem f.
   - Medicare per diem b. / Self or family pays for full per diem g.
   - Medicare ancillary part A c. / Medicaid resident liability or Medicare co-payment h.
   - Medicare ancillary part B d. / Private insurance per diem (including co-payment) i.
   - CHAMPUS per diem e. / Other per diem j.
8. REASONS FOR ASSESSMENT — a. Primary reason for assessment
   1. Admission assessment (required by day 14)
   2. Annual assessment
   3. Significant change in status assessment
   4. Significant correction of prior full assessment
   5. Quarterly review assessment
   6. Discharged—return not anticipated
   7. Discharged—return anticipated
   8. Discharged prior to completing initial assessment
   9. Reentry
   10. Significant correction of prior quarterly assessment
   0. NONE OF ABOVE

   b. Codes for assessments required for Medicare PPS or the State
   1. Medicare 5 day assessment
   2. Medicare 30 day assessment
   3. Medicare 60 day assessment
   4. Medicare 90 day assessment
   5. Medicare readmission/return assessment
   6. Other state required assessment
   7. Medicare 14 day assessment
   8. Other Medicare required assessment
9. RESPONSIBILITY/LEGAL GUARDIAN — (Check all that apply) Legal guardian a.; Other legal oversight b.; Durable power of attorney/health care c.; Durable power attorney/financial d.; Family member responsible e.; Patient responsible for self f.; NONE OF ABOVE g.
10. ADVANCED DIRECTIVES — Living will a.; Do not resuscitate b.; Do not hospitalize c.; Organ donation d.; Autopsy request e.; Feeding restrictions f.; Medication restrictions g.; Other treatment restrictions h.; NONE OF ABOVE i.

SECTION B. COGNITIVE PATTERNS

1. COMATOSE — (Persistent vegetative state/no discernible consciousness) 0. No 1. Yes (if yes, skip to Section G)
2. MEMORY — (Recall of what was learned or known) a. Short-term memory OK—seems/appears to recall after 5 minutes: 0. Memory OK 1. Memory problem; b. Long-term memory OK—seems/appears to recall long past: 0. Memory OK 1. Memory problem
3. MEMORY/RECALL ABILITY — Current season a.; Location of own room b.; Staff names/faces c.; That he/she is in a nursing home; NONE OF ABOVE are recalled
4. COGNITIVE SKILLS FOR DAILY DECISION-MAKING — 0. INDEPENDENT—decisions consistent/reasonable; 1. MODIFIED INDEPENDENCE; 2. MODERATELY IMPAIRED; 3. SEVERELY IMPAIRED—never/rarely made decisions
5. INDICATORS OF DELIRIUM—PERIODIC DISORDERED THINKING/AWARENESS — a. EASILY DISTRACTED; b. PERIODS OF ALTERED PERCEPTION OR AWARENESS OF SURROUNDINGS; c. EPISODES OF DISORGANIZED SPEECH; d. PERIODS OF RESTLESSNESS; e. PERIODS OF LETHARGY; f. MENTAL FUNCTION VARIES OVER THE COURSE OF THE DAY
6. CHANGE IN COGNITIVE STATUS — 0. No change 1. Improved 2. Deteriorated

SECTION C. COMMUNICATION/HEARING PATTERNS

1. HEARING — 0. HEARS ADEQUATELY; 1. MINIMAL DIFFICULTY; 2. HEARS IN SPECIAL SITUATIONS ONLY; 3. HIGHLY IMPAIRED
2. COMMUNICATION DEVICES/TECHNIQUES — Hearing aid, present and used; Hearing aid, present and not used regularly; Other receptive comm. techniques used (e.g., lip reading); NONE OF ABOVE
3. MODES OF EXPRESSION — Speech; Writing messages to express or clarify needs; American sign language or Braille; Signs/gestures/sounds; Communication board; Other; NONE OF ABOVE
4. MAKING SELF UNDERSTOOD — 0. UNDERSTOOD; 1. USUALLY UNDERSTOOD; 2. SOMETIMES UNDERSTOOD; 3. RARELY/NEVER UNDERSTOOD
5. SPEECH CLARITY — 0. CLEAR SPEECH; 1. UNCLEAR SPEECH; 2. NO SPEECH
6. ABILITY TO UNDERSTAND OTHERS — 0. UNDERSTANDS; 1. USUALLY UNDERSTANDS; 2. SOMETIMES UNDERSTANDS; 3. RARELY/NEVER UNDERSTANDS
7. CHANGE IN COMMUNICATION/HEARING — 0. No change 1. Improved 2. Deteriorated

= When box blank, must enter number or letter a. = When letter in box, check if condition applies

SECTION D. VISION PATTERNS

1. VISION — 0. ADEQUATE; 1. IMPAIRED; 2. MODERATELY IMPAIRED; 3. HIGHLY IMPAIRED; 4. SEVERELY IMPAIRED
2. VISUAL LIMITATIONS/DIFFICULTIES — NONE OF ABOVE
3. VISUAL APPLIANCES — 0. No 1. Yes

SECTION E. MOOD AND BEHAVIOR PATTERNS

1. INDICATORS OF DEPRESSION, ANXIETY, SAD MOOD — VERBAL EXPRESSIONS OF DISTRESS; SLEEP-CYCLE ISSUES; SAD, APATHETIC, ANXIOUS APPEARANCE; LOSS OF INTEREST
2. MOOD PERSISTENCE
3. CHANGE IN MOOD
4. BEHAVIORAL SYMPTOMS
5. CHANGE IN BEHAVIORAL SYMPTOMS — 0. No change 1. Improved 2. Deteriorated

SECTION F. PSYCHOSOCIAL WELL-BEING

1. SENSE OF INITIATIVE/INVOLVEMENT — NONE OF ABOVE
2. UNSETTLED RELATIONSHIPS — NONE OF ABOVE
3. PAST ROLES — NONE OF ABOVE

SECTION G. PHYSICAL FUNCTIONING AND STRUCTURAL PROBLEMS

1. (A) ADL SELF-PERFORMANCE — 0. INDEPENDENT; 1. SUPERVISION; 2. LIMITED ASSISTANCE; 3. EXTENSIVE ASSISTANCE; 4. TOTAL DEPENDENCE; 8. ACTIVITY DID NOT OCCUR during entire 7 days
   (B) ADL SUPPORT PROVIDED — 0. No setup or physical help from staff; 1. Setup help only; 2. One person physical assist; 3. Two+ persons physical assist; 8. ADL activity itself did not occur during entire 7 days
   a. BED MOBILITY; b. TRANSFER

SECTION H. CONTINENCE IN LAST 14 DAYS

SECTION I. DISEASE DIAGNOSES

SECTION J. HEALTH CONDITIONS

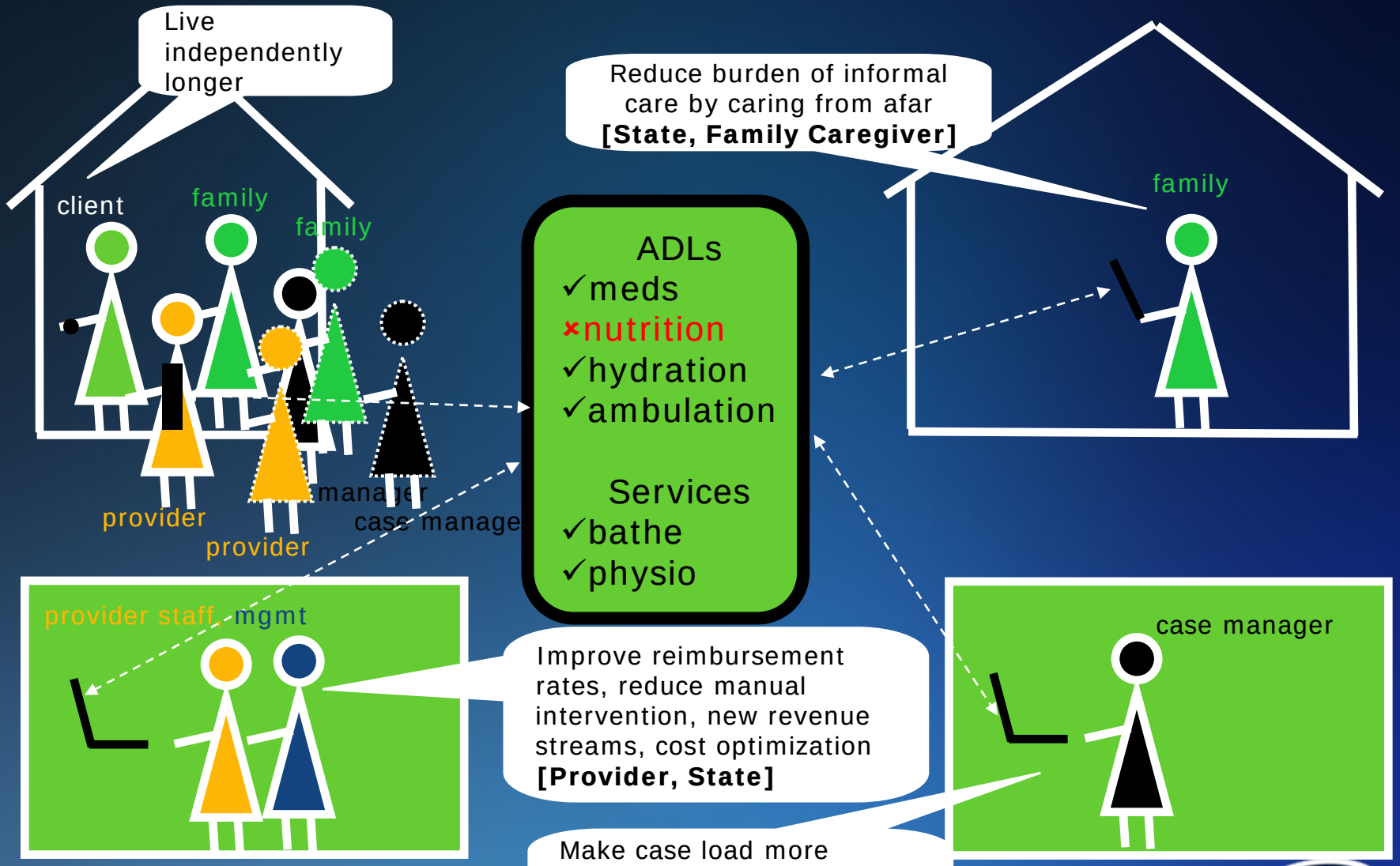
SECTION K. ORAL/NUTRITIONAL STATUS

SECTION L. ORAL/DENTAL STATUS

SECTION M. SKIN CONDITION

SECTION N. ACTIVITY PURSUIT PATTERNS

Intel long-term care pilot



Concluding Thoughts

Intel Findings: Design Themes

Two global needs:

1) Chronic disease assistance
2) Caregiving for aging parents

Proactivity: proactive, not reactive healthcare; pilot of my *own* body; technologies work proactively on my behalf

Personalization: my data, my body, my needs, my family, my preferences, my finances, my spirituality, my style

Connectivity: with other people as a "care network"; across all my personal technologies (home PC, cell phone, TV…)

Continuity: care across all of my conditions / diseases; across all of my providers, locations, & types of care

Bionics: no one is old or sick…make me better than human, even as I get "less young" and face chronic diseases

Call to action: small steps

CAST Technology Consortium Legislation Introduced June, '06

S. 3739 & H.R. 5906 jointly issued in Senate/House: Congressionally mandated Consortium to evaluate the potential of technologies for our aging population

Go to CAST www.agingtech.org to click on an automated letter to send to your Congressional members ASAP!

Thank you…

Disruptive demography…

- 6.5B people worldwide today…
  - Developed world 1.2B today
  - Less developed world 5.3B today
- Developed countries flat

- To 9.1B people worldwide in 2050!
  - Developed world 1.2B in 2050
  - Less developed world 7.8B in 2050
- 50 least developed will double

- Global life expectancy is 65…
  - Developed world is 75

- To global life expectancy of 75!
  - Developed world is 82

- 672M people 60 years+
  - 86 million oldest old…
  - 42 million in developed world…
- 60 year olds account for 20% of people in dev world…
- 8% in developing world…

- Triples to 1.9B people over 60!
  - To 394 million oldest old.
  - To 278 million in developed world.
- To 32% of people in developed world by the year 2050!
- To 20 % in developing world!

Spock from Star Trek: “Live long, and prosper.”
We are “living long” at any cost, but not always living well!

Market Data

- **260M** elders – planet is aging
- **860M** Chronic Disease patients, 50% co-morbidity
- **75-85%** spent on chronic disease management
- **278M** Worried Well
- **15%** US GDP growing to 25% ($1.5T with 1/3 waste)
- **~10%** country GDP globally, issue of national competitiveness
- **UK invests $4B** to date on £12B forecast for National Health System redesign
- **200K** hospitals, 18M hospital beds
- **6000 new hospitals** in China by 2010
- **"Destination Surgery"** a new trend in Thailand; Indi
- **195** tals

Undeniable Market Need

A Booming Market

Worldwide:

- 860 million chronic disease patients
- 1 billion adults overweight
- 260 Million elders
- 75-85% of healthcare spending on chronic disease management

Undeniable Needs

Emerging tech trends will help

- Personal Health Records
  - Personal, private, portable…proactive systems
  - Record > Content > Community > Coaching

Empowered Residents

- Converged Electronic Devices
  - Medicalization of consumer electronics (diabetes phone)
  - Consumerization of medical equipment (home AED)
  - Every device is a computer, communication device

"Home" Platform

- Cheap, Unobtrusive Sensors
  - Data in, on, and around the body
  - New data means new discoveries (behavioral markers)

Trends/Quality Autodocumented

- Wireless Broadband
  - Everyone and everywhere (South Korea example)
  - Bandwidth far greater than what we know today

Distributed "Campus"

- Manageable, Self-Healing Systems
  - IT support from a distance—no truck roll required
  - Redundant, self healing systems—IT department in a chip

Reliablity ?
Scalability ?

ADL sensing/reporting system

iBracelet

Inputs:
RFID, accelerometers, base station signal strength
Aggregation:
Motion
Storage:
RFID, accelerometer, radio signal strength

Wireless sensing system in home (Bluetooth, WiFi)

shake sensor

Inputs:
Accelerometers
Aggregation:
Shake thresholding
Storage: None

MSP

web/DB server

Aggregation:
activity inference, learning trending, visualization, notification
Storage:
Activity data, service agreements

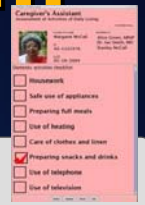
Internet:
DB sync, commands

home PC

Aggregation:
activity inference, learning, rating, cueing

Storage: Client activity/state data

Cell phone network & WiFi: audio prompts, controls



case mgmt view

Inputs: DB views

Internet:
SQL queries, data

WiFi
activity, schedule data

family display

Inputs: http, sms
Aggregation: interactive UI, scheduling

client prompter

Inputs: audio, on/off

Outline of this talk

- Quick intro to age wave efforts: Intel, CAST, ETAC, ORCATECH
- Worldwide demographics age wave = “the new old” (if not already covered)
- Overview of findings from Intel 5 years of fieldwork in consumer homes around world…7 themes
  - Chronic disease assistance
  - Caregiving assistance (usually for aging parents)
  - Proactivity
  - Personalization
  - Connectivity/Community
  - Continuity
  - “Bionics”/Super Me
- Call out 4 focus areas with examples of how seniors/boomers are reacting to our current in-home pilots
  - Prevention (either fall prevention…or encouraging 10,000 steps a day)
  - Early detection (Parkinson’s in home testing)
  - Compliance/adherence (context aware meds prompting)
  - Caregiver support (presence lamp)
- A quick note on “Privacy” and “Payment” issues (based on CAST & Intel focus groups with boomers)