

Activity and Weight Home Monitoring:

Utilizing new technologies to
deliver automated, low-cost,
effective interventions to
improve activity levels



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Connected Health

Delivering care remotely, with technology as an enabler.



Connected Health links patients and providers in a process that augments clinical care.



Center for Connected Health - Our Goals

- To use consumer technologies and online resources to deliver quality care to patients outside the medical setting
- To create new ways to deliver care *when* and *where* it is needed
- To work with clinicians, patients and payers to develop novel, sustainable models of care delivery

Four Cornerstones of Connected Health

- **H**arness accurate physiologic and behavioral data
- **E**ngage patients to view and understand their health information
- **A**chieve care goals via data driven coaching
- **L**everage providers when needed

Background: “The Obesity Epidemic”

- Over 65% of US citizens are overweight or obese (NCHS)
 - The obesity rate in Massachusetts has risen by 80% between 1990 and 2004 (Mass Dept of Public Health)
- In 2000 the cost of obesity in the US was \$117 billion (Surgeon General)
- Management of obesity is complex
 - Medical therapy
 - Surgical therapy
 - Psychological support
 - Behavioral therapy

Connected Health Opportunity

More than 2/3 of Americans do not get enough exercise (Surgeon General)

Poor adherence to exercise and diet are major barriers to patients successfully losing weight

Effective tools to bring about long term change in behavior:

- Motivational coaching
- Sustained personalized feedback
- Patient education

Delivering all elements of care through traditional means is costly, leaving many without access.

Computer avatars have been shown to be effective in building relationships with patients

Synergy between social networking & connected health can create mass engagement

Nike+

- “iPod-simple” tool records running data to use and share
- Friends and family can be updated on user’s progress toward goals
- Mass aggregate data has led to novel insights
 - Most popular day for running (Sunday)
 - Most popular time for running (evenings)
 - More than 1.2 million runners have tracked more than 130 million miles
- Magic number for Nike+ is 5: Once a runner uploads 5 runs, the user sticks with the system



Source: Wired Magazine Issue 17.07

Two studies designed to engage overweight patients through remote monitoring

1. Virtual Coach Research Study

- Wireless pedometer
- Computer avatar plays role of activity coach
 - **Harness accurate physiologic and behavioral data**
 - **Engage patients to view and understand their health information**
 - **Achieve care goals via data driven coaching**
 - Leverage providers when needed

2. Home Weight Monitoring Pilot study

- Wireless scale in patient's home
- Patient and provider views of data
 - **Harness accurate physiologic and behavioral data**
 - **Engage patients to view and understand their health information**
 - **Achieve care goals via data driven coaching**
 - **Leverage providers when needed**

Virtual Coach Research Study: Does coaching need to be delivered by a person?

1. Wearable monitor records subject's activity levels



2. Activity data sent wirelessly to central server



Poor adherence

Good adherence

3. Personalized coaching to improve adherence to activity regime



I'm sorry you've found it tough to meet your targets this week. Let's try and work out a solution

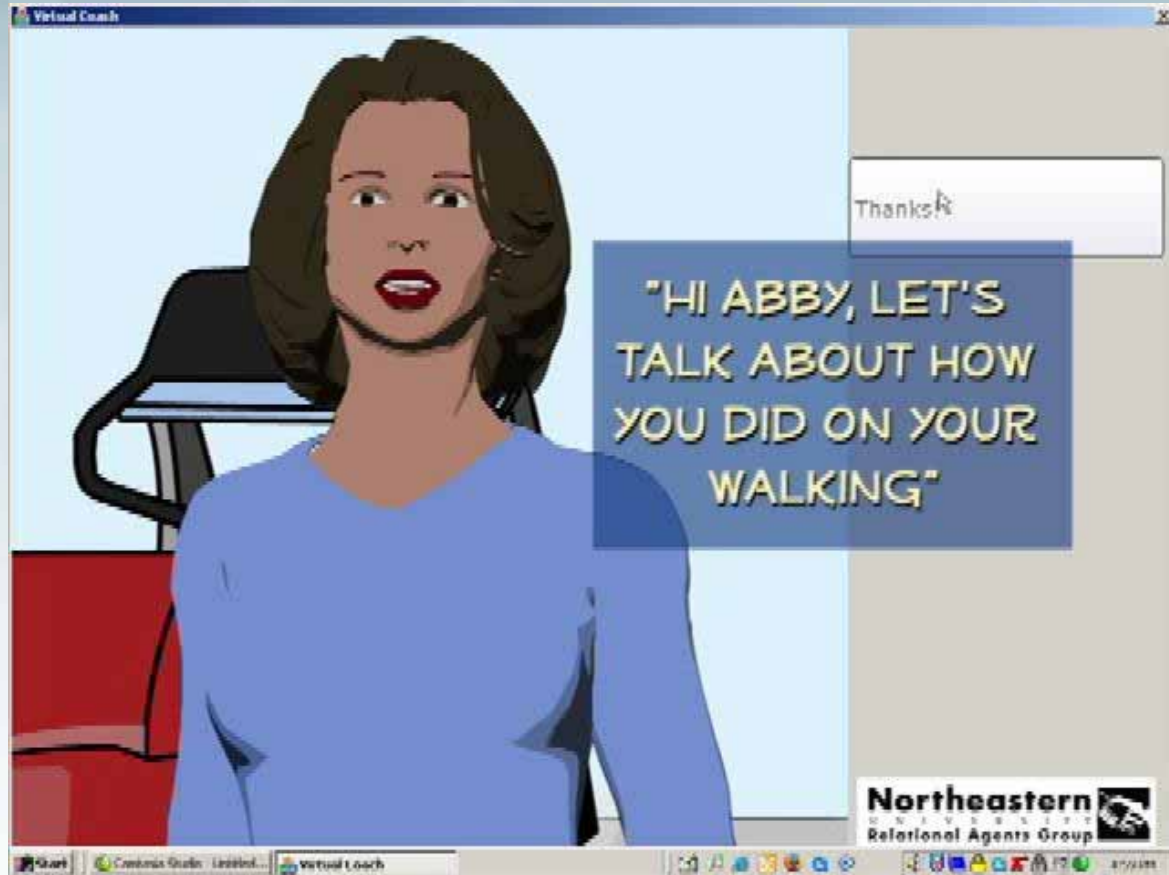


You've done a great job this week! Let's review the calories you've burned.

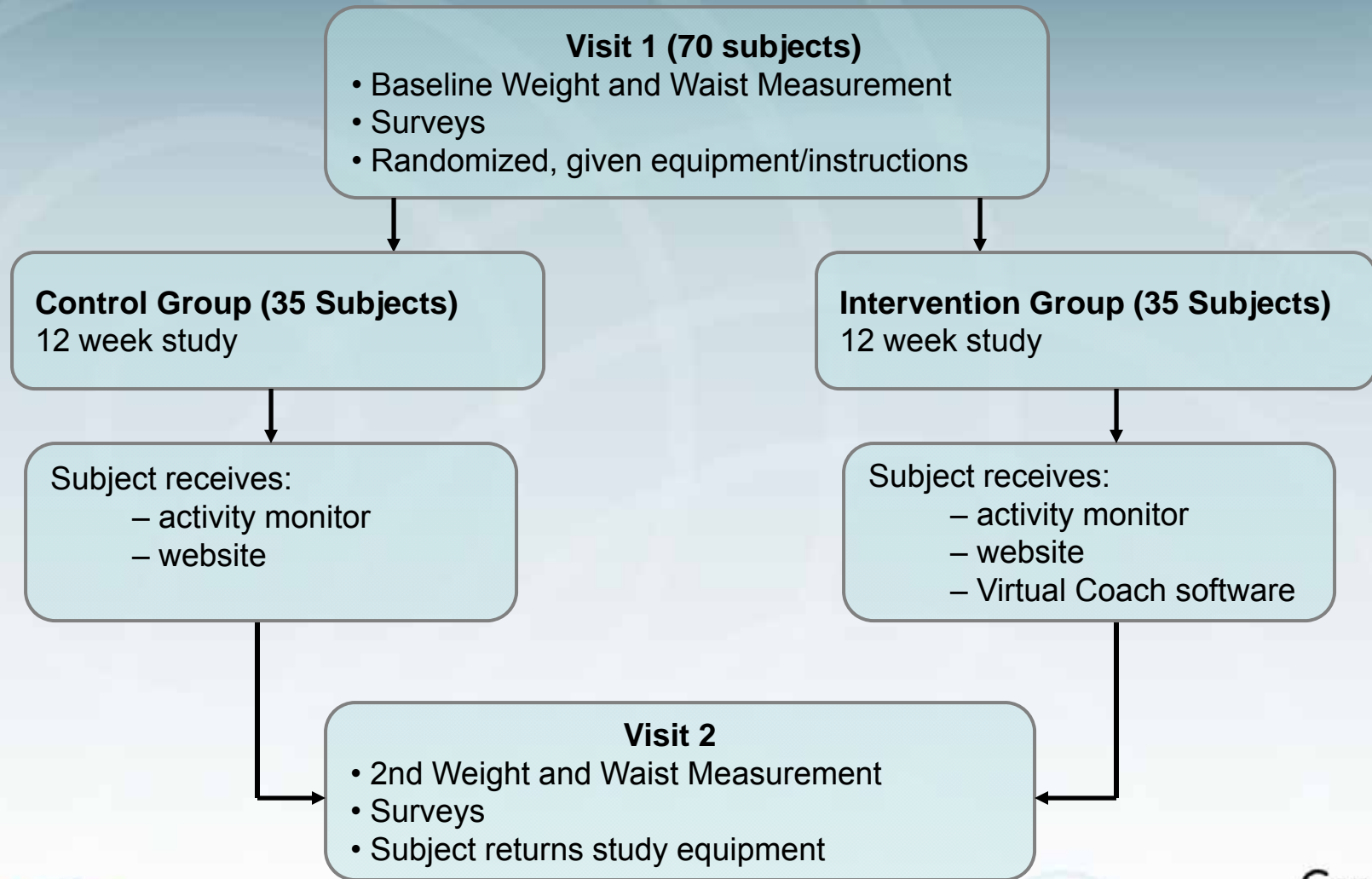
Virtual Coach and Patient work together

Activity is objectively measured, and conversation is customized

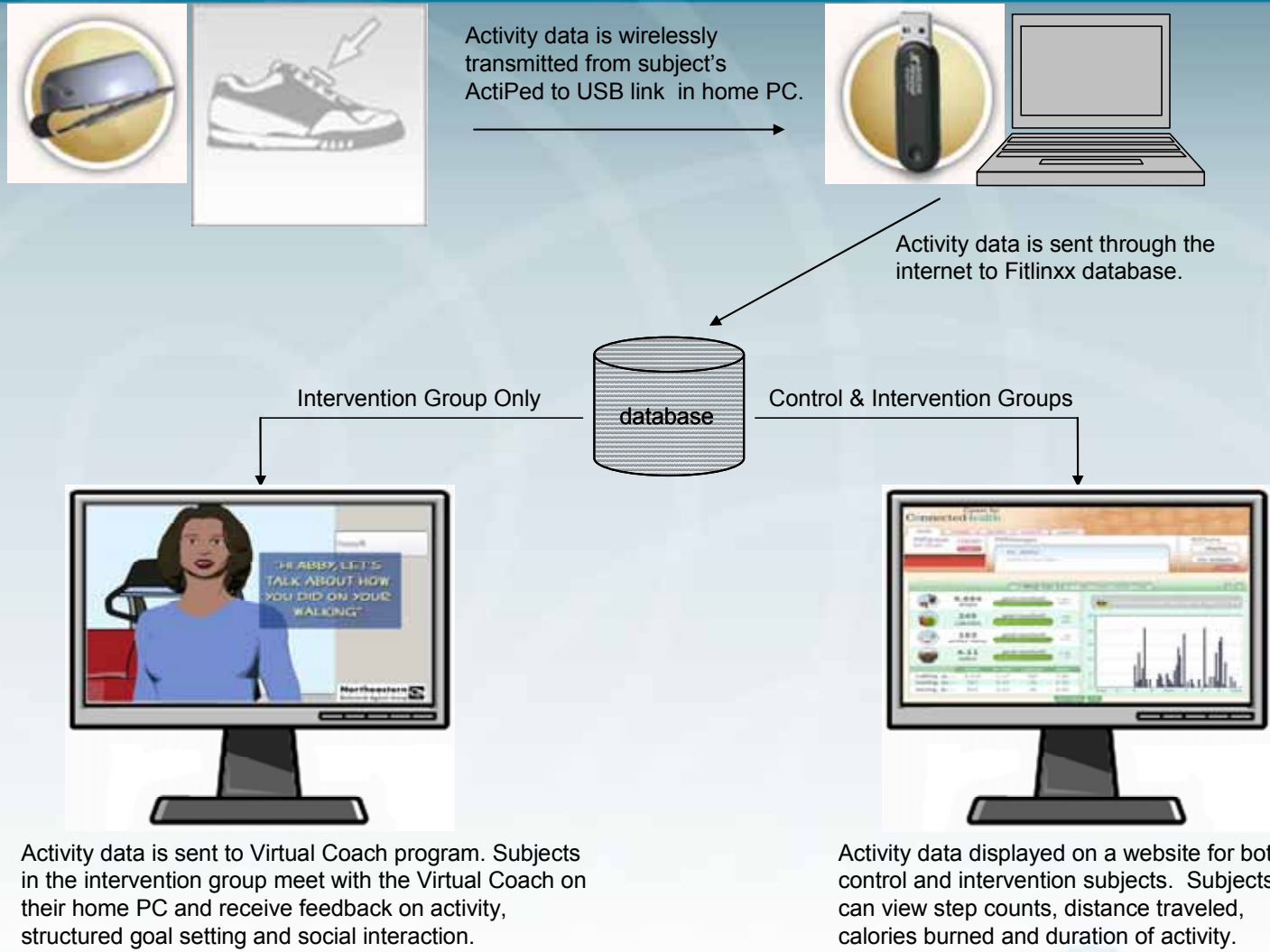
- Coach's responses depend on patient's adherence
- Goal setting
- Non-verbal behavior and gestures
- Potential interactions scripted with input from multi-disciplinary team



Virtual Coach Research Study: Study Design



Virtual Coach Research Study: Data flow



Virtual Coach Research Study: Pedometer use was high throughout study

Average days pedometer worn per week

Control	6.048
Intervention	5.884

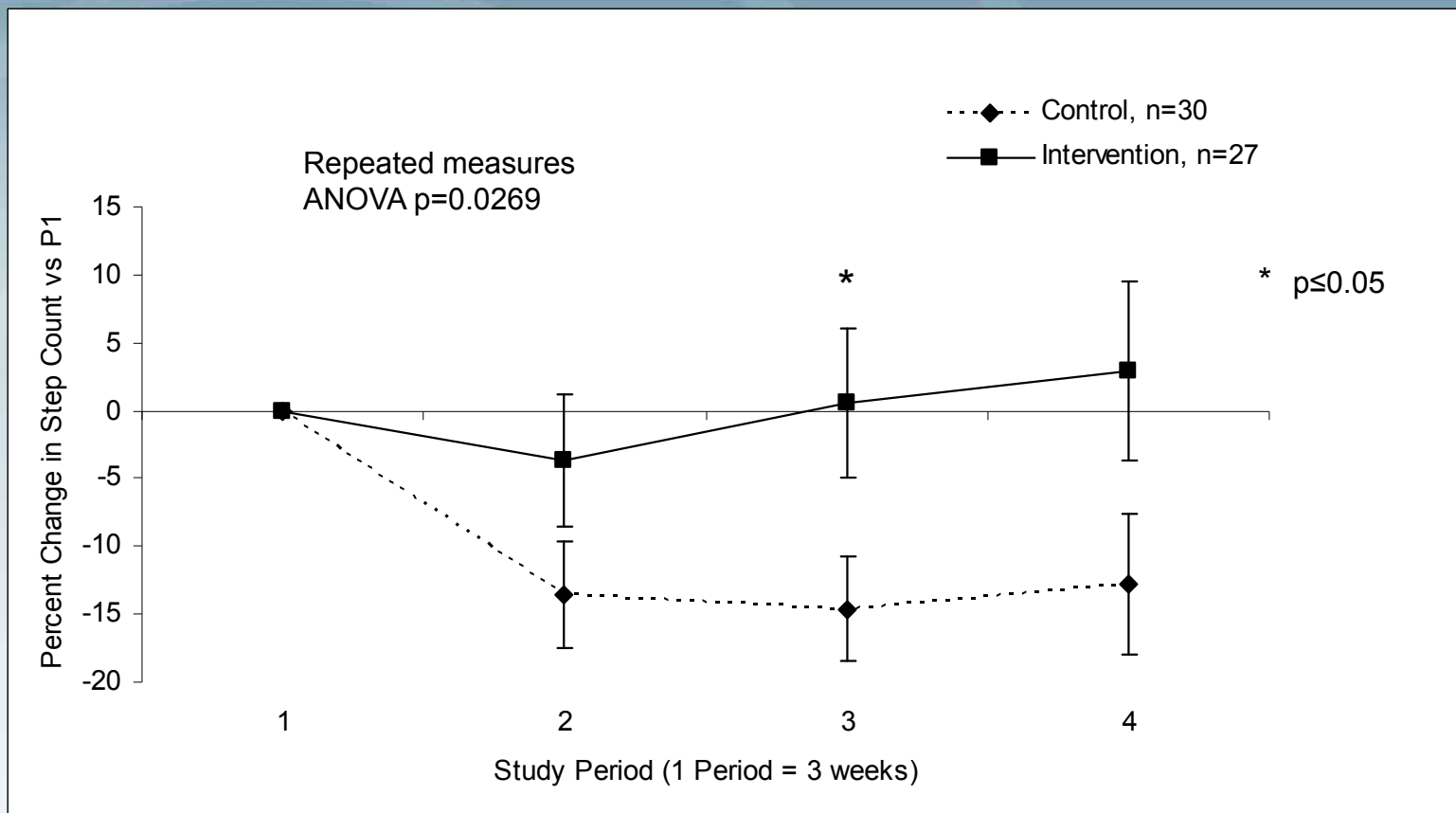
Pedometer use throughout entire study

Control	83.70%
Intervention	81.40%

Average Daily Steps Entire Study

Control	6461
Intervention	6852

Virtual Coach Research Study: Step Data Analysis



Percentage change in mean activity levels for each period relative to period 1. This figure only includes subjects with data for each period. A repeated measures ANOVA test, incorporating all data points from this figure, demonstrated a significant difference in activity levels between control and intervention group over the course of the study ($p = 0.0269$).

Virtual Coach Research Study: Subjects had positive experience

Do you feel you benefited from participating?

	Response Percent
Intervention Group	
Yes	93.3%
No	6.7%
Control Group	
Yes	90.3%
No	9.7%

"It raised my awareness about exercising and forced me to think if I had exercised or not and why. Also I lost weight." (Intervention Subject)

"I made new friends: my left and right foot. They are not just for putting on shoes and hitting the brake and gas pedals." (Control Subject)

Home Weight Monitoring Pilot Study

- Joint project with the Massachusetts General Hospital (MGH) Weight Center
- 30 patients undergoing Roux-en-Y gastric bypass surgery at MGH
- Fitlinxx Weight Scale and USB access point

Phase I: Development

- Create home-based monitoring infrastructure to transmit weight data via the internet to the Patient Weight Profile tool used by clinicians at the Weight Center.
- Validation and storage in the LMR (Partners EMR)

Phase II: Pilot Study

- Determine the acceptance, use and clinical efficacy of home-based weight monitoring

Home Weight Monitoring Pilot Study

Study goals

- Implement a home-based weight monitoring infrastructure to collect accurate, frequent patient weights
- Send weight data from patient's home to the LMR
- Provide real time weight feedback to patients
- Determine if patients and providers find this system unobtrusive and valuable

Lessons Learned/Room for Improvement

- Initial Set-Up of System – at least 50% of patients have needed technical assistance/troubleshooting
- Other household members also use scale, sending information about the wrong person into the system


Home Weight Monitoring: patient view

Powered By **FitLinx** home | feedback | about us | log out

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myDevices
last offload:
10:02 27/10/08 [view all](#) [info](#)



myMessages

Hi, Victor!
activity data updated 0 min ago
check for new data

myHome


[display](#)

[my widgets](#)

[info](#)

activeScale

◀ 2008 ▶ day | week | month | **year**



Average: **201.4**
Current: **213**
Target: **195**

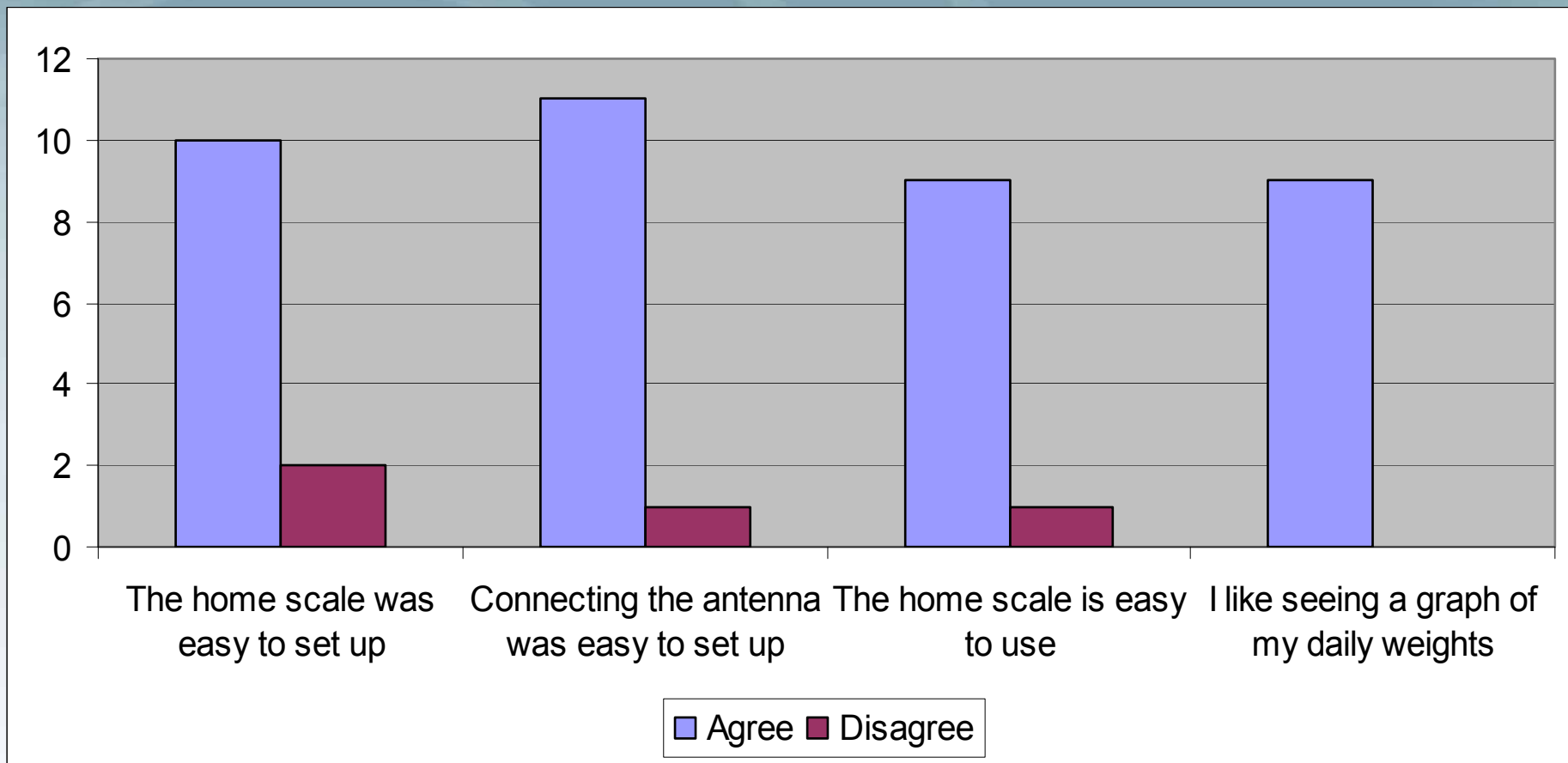
Details

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27/10/08	09:37am	220.5	29.9	add	<input type="checkbox"/>
27/10/08	10:01am	213	28.9	add	<input type="checkbox"/>

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Home Weight Monitoring: Patient satisfaction is high



Preliminary survey data from pre-op patients

Home Weight Monitoring: Patient experience

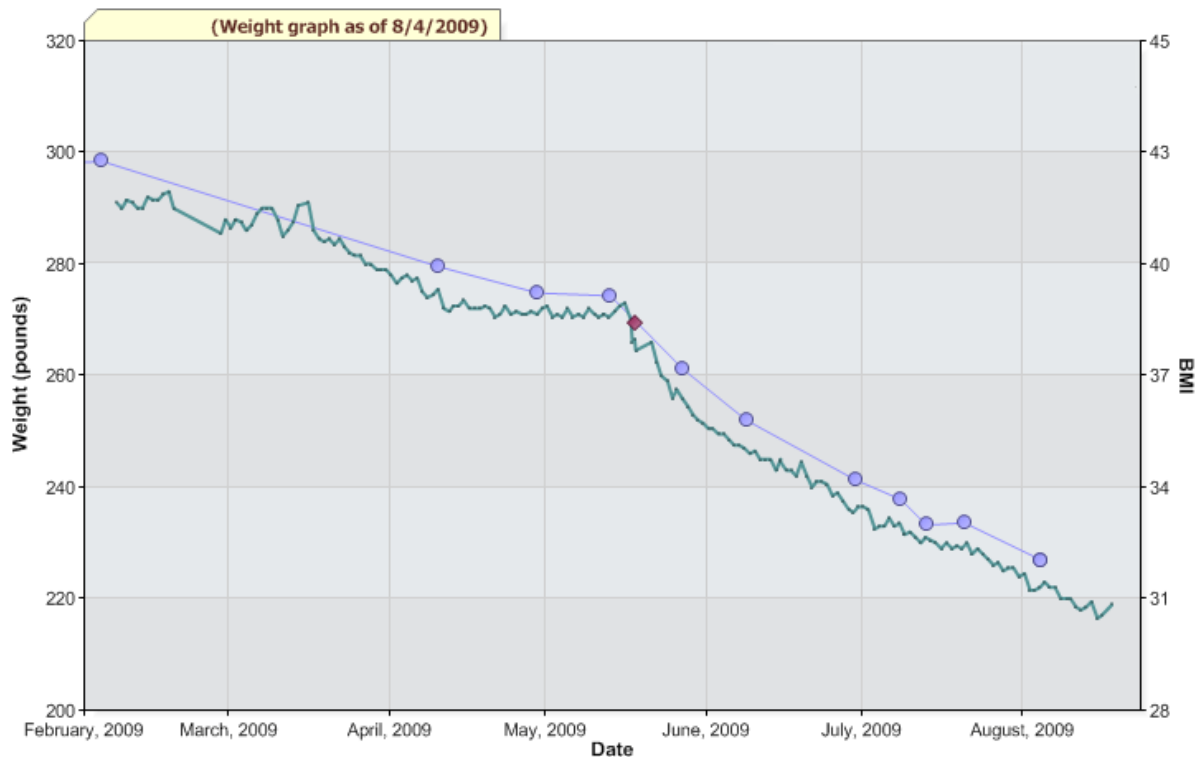
Preliminary survey data from pre-op patients

	Not often enough	Just the right amount	Too often
Being asked to weigh myself everyday was:	0%	82%	18%

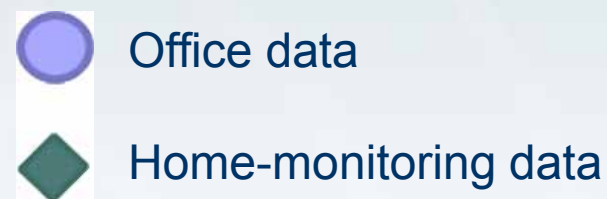
	Every day	More than 3 times/week	Less than 3 times/week
On average, I weighed myself:	67%	25%	8%

Home Weight Monitoring: Provider view

PWP
Patient Weight Profile



- Provider view of a subject in the pilot
- Vastly more data available compared to a patient only being weighed at office visits



Take Home Points

- Coaching is a powerful tool in the context of ongoing physiologic information
- Coaching can be effectively automated
- Some consumers are motivated to improve activity when armed with simple tracking of weight and/or steps.

Contact Information and Acknowledgments

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www.ccs.neu.edu/home/bickmore

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(Actiped, Actilink, Weight Scale)

www.fitlinxx.com

Massachusetts General Hospital Weight Center

<http://www.weightcenter.org/>