Democratization of Health Care:
The Promise of Mobile Technology

Malinda Peeples

Population Health and Care Coordination Colloquium

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Agenda

- Global challenge for chronic disease management
- Mobile technology
- mHealth solutions
- Case Study

Chronic Disease: the Global Challenge

- **25.8 million** children and adults in the US with diabetes (8.3% pop 2011)
- **246 million** people worldwide in 2009, growing to **500 million by 2030**
- **83 million** are in the WHO's Asia-PAC region; figures will double by 2030
- In 2009, the 5 countries with the largest **numbers** of people with diabetes are India (40.9 million), *China* (92.4 million), the United States (25.8 million), Russia (10.7 million) and Germany (6.3 million)
- In 2007, the 5 countries with the highest diabetes **prevalence** in the adult population are Nauru (30.7%), United Arab Emirates (19.5%), Saudi Arabia (16.7%),
- Diabetes causes about **5% of all deaths** globally each year
- Diabetes deaths are likely to increase by more than **50%** in the next 10 years without urgent action
- 80% of people with diabetes live in **low and middle income countries**
- Most people with diabetes in low and middle income countries are **middle-aged** (45-64), not elderly (65+).

IDF Atlas 2009

Clinical Evidence: Mobile Phone Use

- **Dietary Intervention (***Japan, US***)**
  - 12 week Weight Reduction Program (i-exerM) – daily text messaging Japan (Kubota 2004) – reduced body weight
  - Welnavi (Wang 2006) – food assessment via mobile camera phone – effective method but need better digital quality of photos
  - Weight Loss (Patrick 2009) - RCT- automated text messages with topics on behavioral and dietary strategies, goal setting, weight monitoring, and weight reporting; intervention group lost more weight than control group at 4 months
  - Weight Loss (Haapala 2009) – RCT(12 mon)- tailored messages to reduce food intake, increase activity, encourage daily weight recording, and provide instant feedback; intervention group lost more weight & greater increase in weight circumference
- **Smoking Cessation Intervention** *(New Zealand, US)*
  - Oberymayer 2004 – US college students – 43% made at least one attempt to quit
  - Lazev 2004 –smoking cessation in HIV population – 75% abstinence rate at the end of 2 weeks
  - Bramley 2005 – New Zealand – positive effect for short term quitting rates
- **Physical Activity Intervention** *(US)*
  - Consovlo 2006 – Houston- coaching toward daily step count – positive effect
  - Hurling 2007- RCT- physical activity program- useful and could increase and maintain activity
- **Health Monitoring & Disease Management** (Europe, US, Korea)
  - Cancer - Bielli 2004 –Wireless Monitoring System – health status questions sent via phone
- **Asthma** – AhoJ 2004 - Diary data collection – self-management support
- **Diabetes** – Spain (Gimenez-Perez 2002), UK (Farmer 2005), Australia (Rami 2006), Korea (Kim 2007), Norway (Gammon 2008), US (Carroll, 2007), (Quinn 2008)

Why Mobile Technology?
Everywhere, personal, anytime

- United States cellphone ownership[1]
  - English-speaking Hispanics - 87%
    - White Americans - 80%
    - Black Americans - 87%
    - < $30K Income -71%
    - > $75K Income - 93%
    - Rural - 72%
    - No high school degree - 72%
    - College graduates - 90%
- Global cellphone ownership (4 billion)
  - Over 100% subscription in Europe
  - 50% population own a phone
  - Jan 1, 2008 – 43 billion text messages sent globally[2]

[1]http:***pew***research.org; [2] *Acision (Nieuwegein, Netherlands)*

Why Mobile Technology?
Everywhere, personal, anytime

- Personal
  - 25% under age 30 have cell phone only
  - 41% fill in free time when they are traveling or waiting for someone by making phone calls
  - "trusted device"
  - attachment

- Access
  - Portability – "never leave home without it"
  - Contextual – surveillance & immediacy of action
  - Two-way communication – engagement opportunity
  - Text, audio, video – options for addressing health literacy
  - Geographical positioning – messaging opportunities

- *Homeless Person in DC: "A cellphone is the only way you can call to keep up with your food stamps, your housing application, your job," says Rommel McBride, who spent six years on the streets. (Marvin Joseph - The Washington Post 3/26/09)*

Mobile Ownership Demographics

Young adults lead the way in the use of mobile data applications

	18-29	30-49	50-64	65+
Own a cell phone	90%**	88%**	82%*	57%
% of cell owners within each group who do the following on their phones				
Send/receive text messages	95***	82**	57*	19
Take a picture	93***	83**	67*	34
Access the internet	65***	43**	18*	10
Play music	64***	36**	13*	6
Play a game	60***	37**	17*	9
Record a video	60***	39**	14*	5
Send/receive email	52***	37**	22*	11
Use a social networking site	48***	23**	8*	3
Send/receive instant messages	46***	35**	17*	10
Watch a video	40***	20**	6	4
Post a photo or video online	33***	15**	5	2
Use a status update service	21***	9**	3	2
Make a purchase	20***	11**	4	5
Mean number of cell activities	**6.9**	**4.7**	**2.5**	**1.2**

Source: Pew Research Center's Internet & American Life Project, April 29-May 30, 2010 Tracking Survey. N=2,252 adults 18 and older, including 1,917 cell phone users. *** = significant difference compared with all other age groups; ** = significant difference compared with 50-64 and 65+; * = significant difference compared with 65+; n/a = sample size too small to analyze

Pew Internet
Pew Internet & American Life Project

WOW

Macroeconomic trends

- ◉ **Shifting norms in cell phone communication**
  - *Y U Luv Text H8 Calls (Wall Street Journal October 14, 2010)*
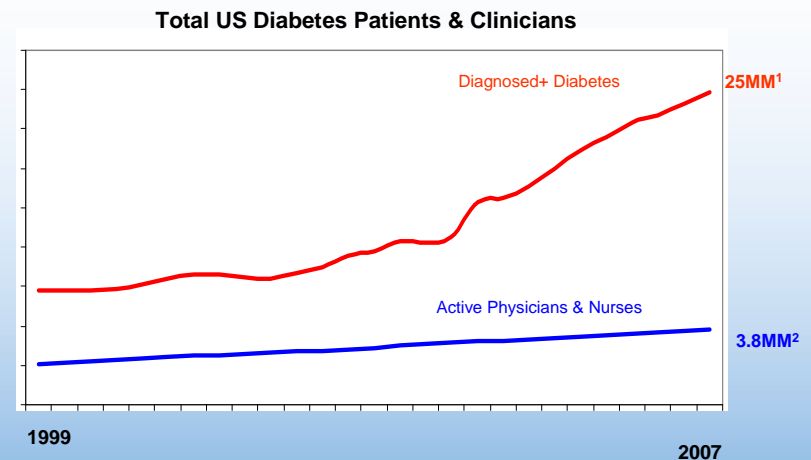 - *"If I were to call someone it would have to be urgent otherwise it is sort of rude and invasive."*

- ◉ **Shifting norms on attitudes towards mobile phone use**
  - Alarm clock
  - Banking tool
  - Calendar
  - E-mail
  - Games
- • Social networking
  - ….and yes, it makes calls

- ◉ **Shifts in ubiquity and pervasiveness of cell phone among all populations**
  - 2/3 adults sleep with cell phone next to their beds
  - Voice calls decreased 25% while text messaging in 45 – 54 yr old increased 75%
  - Average user sends & receives 10 texts per day

- ◉ **Shifts in human resources available to provide services**

Total US Diabetes Patients & Clinicians

Diagnosed+ Diabetes 25MM[1]

Active Physicians & Nurses 3.8MM[2]

1999 2007

An example of current health care communication

Claims identification

Direct Referral

CDE/RN makes admission visit → **CDE/RN conducts Edu. sessions** → **SW conducts lifestyle sessions** → **SW provides care management [Via Phone]**

CDE RN

Child/Family

Physician

CDE RN

Child/Family

Physician

SW

Child/Family

School

Hospital/Pharm/Lab/Other Medical

Ideally, communication/data transfer is occurring at point of care and on a continual basis for these key relationships

Person-Centric mHealth Solution/Intervention

DMO (Employers)
Health Plans
Pharma

MD, NP, PA

Health Care System

Knowledge skills

Healthy Behaviors

Psychosocial

Medication Adherence

Medication Monitoring

Symptom Tracking

Treatment Guidance

Self-Management

Peer Support

behavioral

clinical

Therapeutics

Healthy Lifestyle Coaching

Social Networks

Data collection

Public Health Campaign

Program Monitoring & Evaluation

Family & Workplace
Online social networks
Social networks
Social support groups
Religious community

Community & Public Health

Adapted from M. Peeples Presidential Address
AADE 33rd Meeting, 2006

Department of Health
Health care clinics
CHWS

Clinically Driven Solutions

2009 Contemporary Clinical Trials

- Very strong interim glucose, lipids, BP and cost savings outcomes
- Primary Aim – A1c Decrease

2007/2008 Diabetes Technology & Therapeutics

- 2.03-point drop in HbA1c (p < 0.003)
- Physicians with WellDoc's action plans 5X more likely to titrate/add drugs

A Case Study
Carl registers on the system

- **Demographics**
  - 64 year old male
  - Skilled laborer, 10th Grade literacy
  - Health history: Type 2 diabetes & Hypertension
- **Treatment Regimen**
  - Glucovance 500mg 1 pill at breakfast
  - Januvia 100mg 1 pill at breakfast
  - Lantus Insulin 10 units bedtime
  - Lisonpril 10mg 1 pill at breakfast
- **Healthcare Team**
  - PCP & Diabetes Educator
- **System Preferences**
  - Chooses phone and web portal
  - Grants PCP web access
  - Invites wife as support person
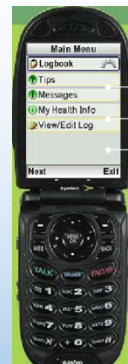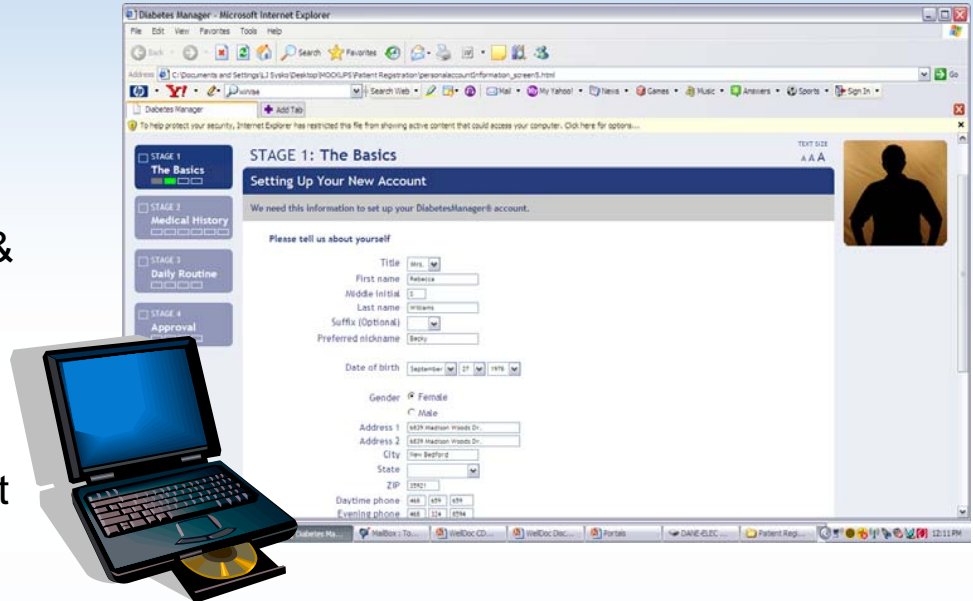
Carl Activates Diabetes Manager®Phone

- Text message is sent to Carl's phone & application is downloaded over-the-air (OTA)
- Carl logs in with *authentication code* and starts to use the application
- Carl is instructed to log in to web portal www.diabetesmanager.com

Carl Starts To Use The System

Measure. Monitor. Message. Manage
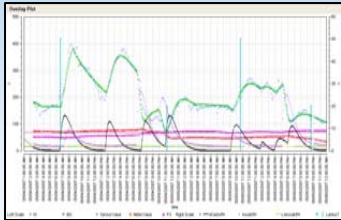

Virtual Coach
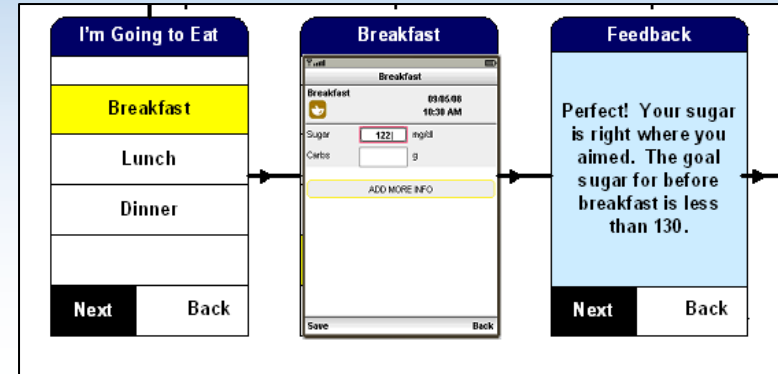
Measure (Using the Phone)

- Enters blood glucose & receives feedback

- Enters carbohydrates

- Enters medication taken

- Adds notes ("ate more than usual")

- Saves to the logbook

# The System Monitors Carl's Data

Measure. *Monitor*. Message. Manage

Event/Alert Management

Evidence-based Rules Engine

Longitudinal Tracking

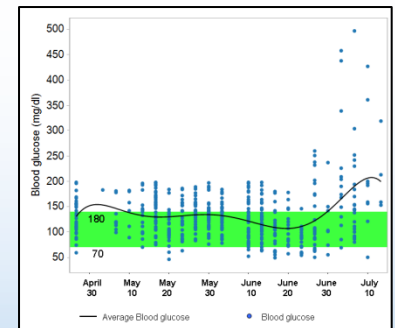**Pattern Analyses**

Monitor

- Events
  - Above, below and within prescribed targets
  - Recovery using retest indicator

- Tracking
  - Time-based changes (ex.insulin titration)
  - Frequency-based changes (ex.hypo/hyper)

- Patterns
  - Rise/fall in parametric curves
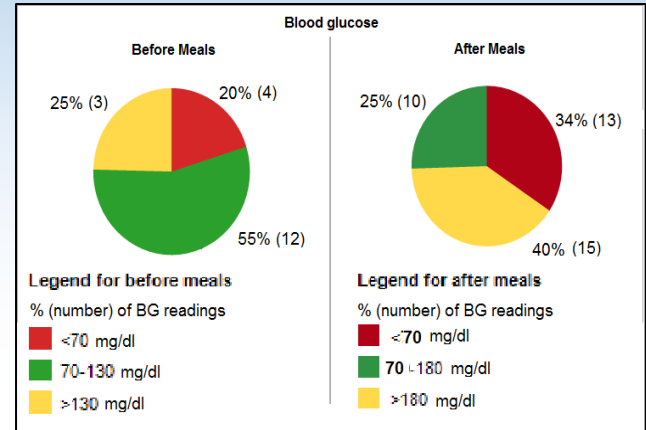
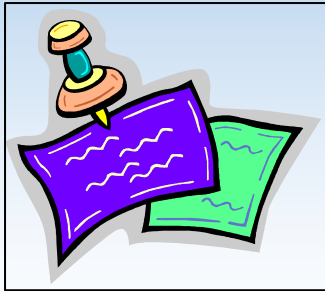
Distribution BG values
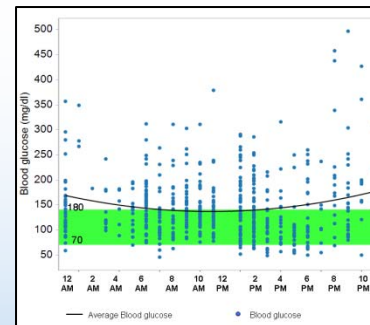
Standard day BG

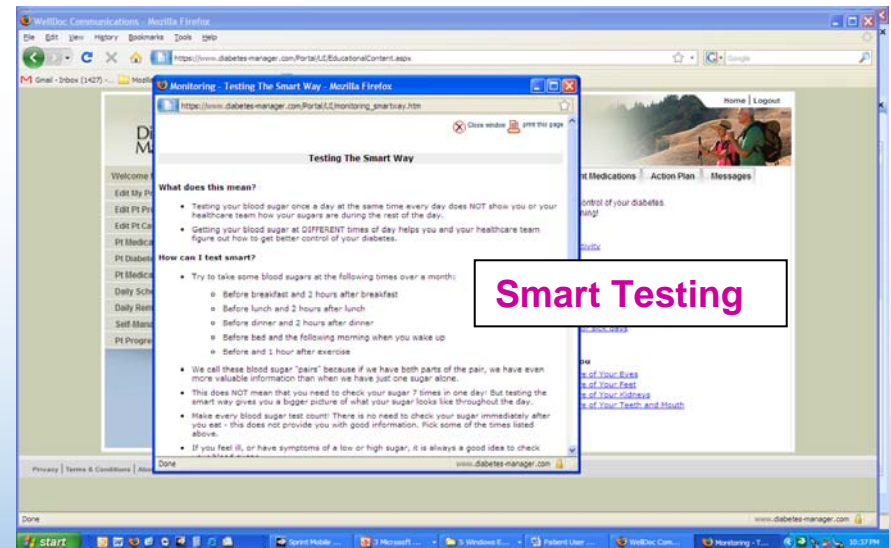2 weeks BG

The System Messages Carl

Measure. Monitor. *Message*. Manage

Feedback

Communication

Self-Management

Message

- Feedback
  - Real-time
  - Trending messages
  - Behavioral coaching
  - Self-Management
- Content types
  - Knowledge & skills
  - Behavioral
  - Safety
  - Treatment specific
- For example, "Smart testing"
  - "Pairs"
  - Effective testing

Real-time

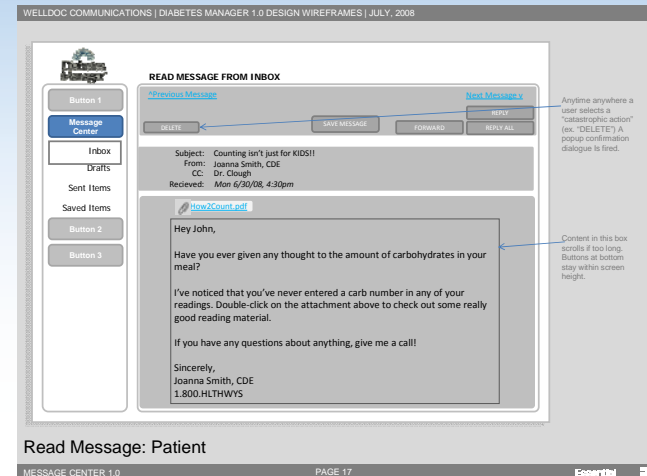**Trending**

Smart Testing

Carl Starts To Use The System
Measure. Monitor. Message. *Manage.*

Clinical Decision Support

Self-management Support

Peer & Community Support

MANAGE

- HCP can send message to Carl or a group of patients
- HCP can administer surveys
- Carl can message his HCP through the phone and/or web

❖ Survey results via message center

– I have a prescription plan through Aetna Medicare

– I take my medication daily on a regular basis

– I don't skip taking it and no, I do not have any side effects

– I try to exercise at least four or five times a week but I'm having a problem with my knees

– I'm getting ready to shampoo the carpets and do some painting; does this count as exercise?

– As for counting carbohydrates, I try to keep this in mind when eating but I'm finding that there are many contributing factors at work here
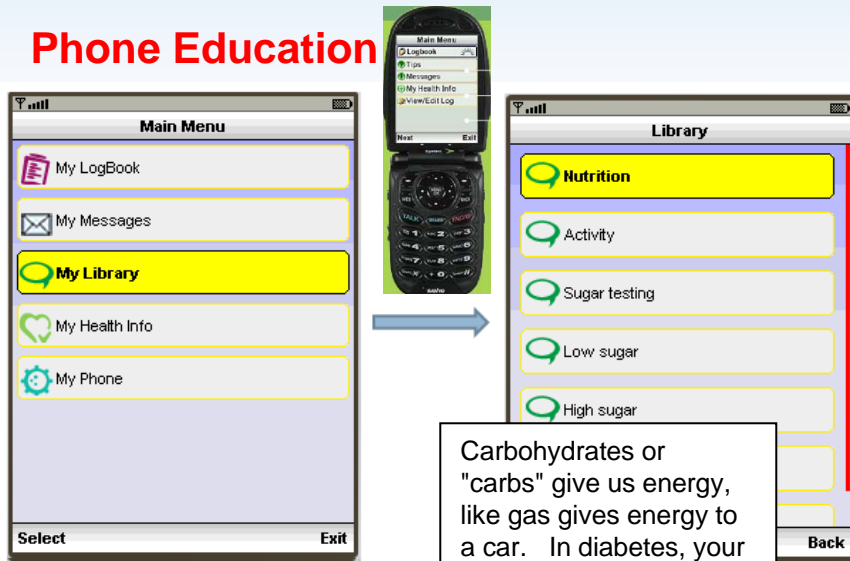
Carl Learns Self-Management
Measure. Monitor. Message. *Manage.*

HCP messages Carl to check education on his phone and web portal

Phone Education

Main Menu
- My LogBook
- My Messages
- My Library
- My Health Info
- My Phone

Select / Exit

Library
- Nutrition
- Activity
- Sugar testing
- Low sugar
- High sugar

Back

Carbohydrates or "carbs" give us energy, like gas gives energy to a car. In diabetes, your body has trouble handling carbs if there is too much at one time (causes a high sugar).

Counting Carbohydrates
Once you understand which foods have carbs, you can then start counting carbs! All people with diabetes can benefit by learning how to count, but it is very helpful for those who use short acting insulin before they eat.

What is carbohydrate counting?
Carb counting focuses on just the carbohydrate in food. This is because carbohydrate turns into sugar, which affects the blood sugar. Protein and fat are still important, but they don't affect your sugar the same way carbs do.

How carb counting helps you
. if you take the same amount of diabetes medication every day (even if you are eating different amounts of food or your sugar is high)
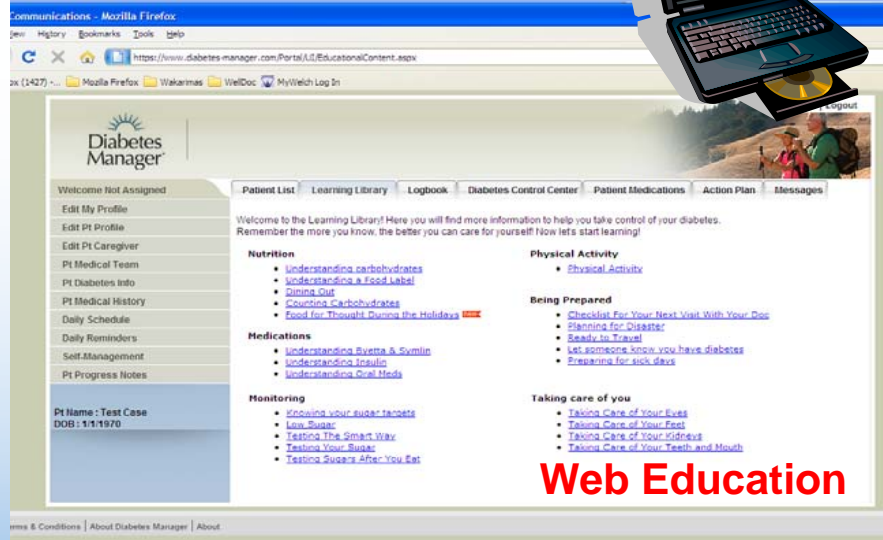You can aim for carbohydrate consistency:
Give your body about the same amount of sugar every time you eat breakfast
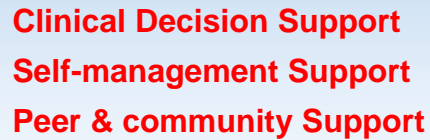Give your body about the same amount of sugar every _____ lunch
Give your body about the same amount of sugar every _____ _____
If you are consistent with how many carbs you eat at each _____

Web Education

Managing Diabetes: A Coordinated Effort
Measure. Monitor. Message. *Manage.*

Clinical Decision Support

Self-management Support

Peer & community Support

MANAGE

- After 3 months on the system:
  - Patient Action Plan sent to Carl:
  - HCP Action Plan sent to health care provider
- Preparation for MD visit done by Carl
  - Care coordination with specialists and community resources

Patient Action Plan

HCP Action Plan

Control Center™: Carl's Outcomes
Measure. Monitor. Message. *Manage.*

- Clinical Outcomes
  - Baseline A1c: 9.2%
  - End of Study A1c: 6.7%
  - Weight lost 16 #
  - No change in therapy
  - Eye exam done
- Behavioral & Psychosocial Outcomes
  - Following medication regimen (self-report)
  - Empowerment

Welcome, Thomas O'Malley   Logout
Last Login: June 25, 2008, 11:43 am (EST)

Diabetes Control Center

TEXT SIZE A A A

Overview

▼ Type 2 Diabetes is like a puzzle... there are lots of little pieces that all fit together into a bigger picture of health.

Explore the sections of the control center so you can understand all the pieces. See how you can put them all together and take control of your own health!!

If you want to add data or make any changes, head on over to your Personal Health Record!

There's tons more to discover in the Learning Library! Check it out!

Print

Legend: ☑ In target ❗ Out of target ❓ Missing ☐ Overdue

Category	Value	Patient Status	Target ◉	Are You Improving?	Trending Report
A1c	7.0 % (05/05/08)	❗	< 7.0 %	No	
Blood Pressure		❓	< 130/80 mmHg	Yes!	
Total Cholesterol	200 mg/dL (05/08/07)	☑ ☐	< 200 mg/dL	No	
LDL	100 mg/dL (05/08/07)	❓	< 100 mg/dL	No	
HDL	50 mg/dL (05/08/07)	❓	> 50mg/dL	No	
Triglycerides	150 mg/dL (08/05/07)	❓	< 150 mg/dL	No	
Urine Microalbumin-to-Creatinine Ratio	350 mg/dL (01/05/08)	❗ ☐	< 30 mg/dL	Yes!	
Urine Microalbumin	350 mg/dL (01/05/08)	❗	< 30 mg/dL	Yes!	
Serum Creatinine	1.4 mg/dL (11/15/08)	☑	< 1.5 mg/dL	?	
Eye Exam	Last exam: (12/15/08)	☐	annually	No	
Foot Exam		☑	annually	n/a	
Dental Exam		❓	every 6 months	n/a	
Flu Shot	Last exam: (02/25/07)	☑	annually, during the fall	?	
Pneumonia		❓	every 5 years, if over 65	?	
Aspirin Use	Yes (05/12/07)	☑	daily aspirin use	n/a	
Exercise	120 min/week (01/05/08)	❗	150 min/week	n/a	Though you still are not meeting the goal of 150 minutes per week, you have increased your activity from 100 minutes per week to 120 minutes per week. Start by trying to increase the duration or frequency of your weekly exercise.
Being Smoke Free		❓	no smoking	?	
Weight	175 lbs (01/15/08)	☑	reduce by 5-10% if BMI not 18.5-24.9	Yes!	
BMI	24.9 lbs (01/15/08)	☑	18.5-24.9	Yes!	

Democratization of Health Care

- Mobile technology offers a scaleable, accessible, cost-effective **platform** to drive clinical outcomes for **chronic disease management**

- Mobile solutions introduce **real-time engagement** for the first time in the history of managing chronic conditions

- Mobile solutions extend the components of **patient-centered, self care** through **contextually-delivered, real-time intervention** that's tailored to behavioral preferences and disease needs

- Mobile health solutions (mHealth) **improve quality of care** by connecting measurement, monitoring and management of diseases on a daily and longitudinal basis, to create actionable outcomes for patients and providers

- *Democratization of healthcare* = Improve access, quality, care coordination, outcomes and affordability

Thanks!

Malinda Peeples, RN,MS,CDE
WellDoc
mpeeples@welldocinc.com
www.welldocinc.com