Using Text Messaging to Improve Diabetes Care in Diverse Populations

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Conflicts of Interest

- Shantanu previously co-founded and was part-owner of mHealth Solutions, a mobile health software company, but since October 2011 has no financial relationship or position in the company

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Existing Solutions for Extending Primary Care

Programs

- Self-management classes

- Care management programs

- Peer-to-peer support

- Lay health workers

- Health coaches

- Telemonitoring

Barriers

- Lack of tailoring

- Low touch

- Lack of integration

- Staffing/training

- Quality control

- Reimbursement

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Perspective

Automated Hovering in Health Care — Watching Over the 5000 Hours

David A. Asch, M.D., M.B.A., Ralph W. Muller, M.A., and Kevin G. Volpp, M.D., Ph.D.

The dominant form of health care financing in the United States supports a reactive, visit-based model in which patients are seen when they become ill, typically during hospitalizations and at outpatient visits. That care model falls short not just because it is expensive and often fails to pro-tivities that can profoundly affect their health.

The increasing attention being part of longitudinal clinical care. Transitional care models are being touted as a way of coordinating care beyond hospitalization. And hospitals and health plans are developing "hot-spotter" approaches, deploying tailored and intensive attention to managing the care of their most challeng-

Asch DA, Muller RW, Volpp KG. Automated hovering in health care--watching over the 5000 hours. N Engl J Med. 2012 Jul 5;367(1):1-3.

Pilot Study (2009)

• Research Question: Is text messaging a feasible tool to reduce health disparities?

• Eligibility: African-American adults with type 2 diabetes, no recent hospitalizations, health better than 'poor', on treatment, cell phone

• Intervention: Enrolled in SMS-DMCare for 4 weeks, weekly calls by CDE to troubleshoot and modify message program

  - a daily medication reminder (e.g., "Time to take your diabetes medications")

  - a daily or semi-weekly question about medication adherence (e.g., "Did you take your medications today?")

  - a weekly question about foot care (e.g. "How many times did you check your feet this week?") messages

Demographics

	N=18	%
Age, years (mean, range)		55 [38 - 72]
18 - 39	1	6
40 - 54	8	44
55-64	6	33
65-74	3	17
Gender		
Female	12	67
Marital status		
Single	7	39
Married/Living as married	8	44
Separated/Divorced/ Widowed	3	17

	N=18	%
Education		
Some high school or less	4	22
High school graduate	3	17
Some college	8	44
College graduate or higher	3	17
Insurance		
Uninsured	0	0
Medicaid	6	33
Medicare	0	0
Medicare + Medicaid	0	0
Private Insurance	7	39
Medicare + Private	5	28

Mobile Phone Usage

	N=18	%
Years owning cell phone		
0 - 5	6	33
6 -10	8	44
> 10	4	22
Comfort level with phone calls		
Comfortable	17	94
Not comfortable	0	0
Uncomfortable	1	6
Total calls made/ received per day		
< 5	8	44
6 - 10	3	17
11 - 20	2	11
> 20	6	33

	N=18	%
Comfort level with texting		
Very or somewhat comfortable	10	56
Not comfortable	0	0
Very or somewhat uncomfortable	8	44
Total texts sent/ received per day		
0	6	33
1 - 5	5	28
6 - 10	2	11
> 10	5	28

Results: Text Messaging Activity

Text messages sent/received total (#)	220.9
Text messages received by participant (#)	126.4
Text messages sent by participant (#)	94.5
Text messages requiring a response (#)	78.7
Participant messages sent without prompt (#)	31.4
Percent of messages responded to correctly (%)	80.2
Median participant response time (minutes)	6.1
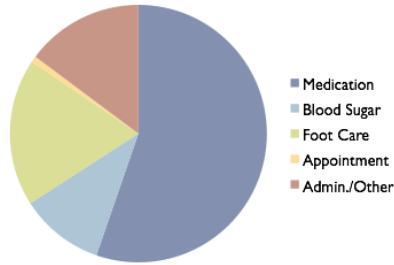
Legend:
- Medication
- Blood Sugar
- Foot Care
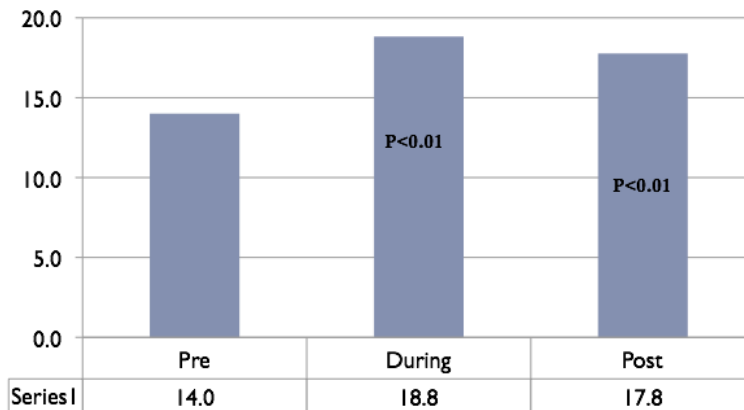- Appointment
- Admin./Other

Dick JJ, Nundy S, Solomon MC, Bishop KN, Chin MH, Peek ME. Feasibility and usability of a text message-based program for diabetes self-management in an urban African-American population. J Diabetes Sci Technol. 2011 Sep 1;5(5):1246-54.

Results: User Experience

	Strongly Agree	Moderately or Slightly Agree	Slightly, Moderately or Strongly Disagree
It was easy to receive and read the text messages from the research team.	94	6	0
It was easy to send text messages to the research team.	72	28	0
I found the text message reminders to be helpful at decreasing the number of pills I missed.	89	11	0
I found the text message reminders to be helpful at increasing the number of times I checked my feet.	89	11	0
I found the text message reminders to be helpful at decreasing the number of doctor visits that I missed.	87	13	0
I would be willing to use a cell phone reminder system in the future to help me manage my diabetes.	78	22	0
I would recommend a cell phone reminder system to my friends/family that have diabetes.	94	6	0

Results: Self-Efficacy

Series I	Pre	During	Post
	14.0	18.8	17.8

*Skaff M, Mullan J, Fisher L, Chesla C. A contextual model of control beliefs, behavior, and health: Latino and European Americans with type 2 diabetes. Psychol Health. 2003; 18:295–312.

Dick JJ, Nundy S, Solomon MC, Bishop KN, Chin MH, Peek ME. Feasibility and usability of a text message-based program for diabetes self-management in an urban African-American population. J Diabetes Sci Technol. 2011 Sep 1;5(5):1246-54.
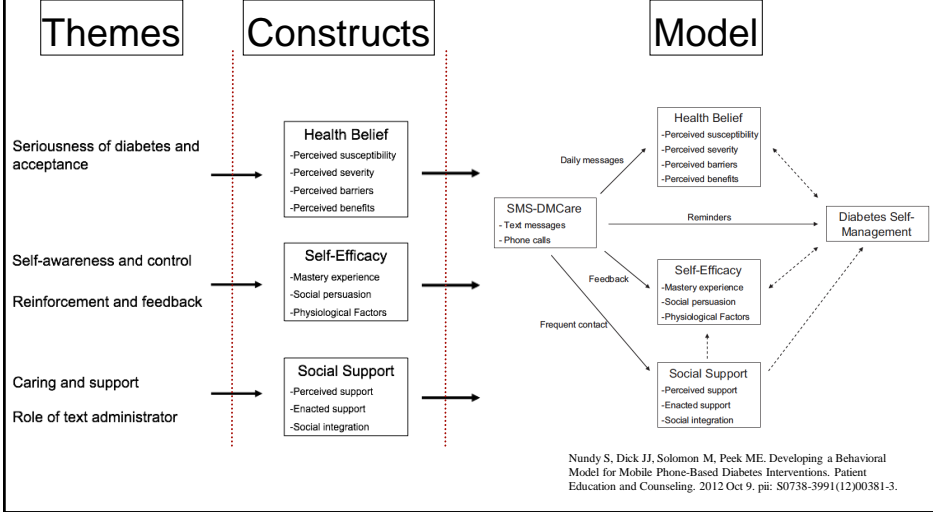
Results: Open-ended interviews

"At first when I started off, oh my God, they're just blowing me up with these texts... but then, I'm like, I'm taking my, I looked at what I was doing, and what I was accomplishing, and my sugar actually's gotten better. When I started taking my sugar, checking my glucose you call it, and uh it was much better. So it helps me a lot. I welcome the texts."

"But somebody is involved in being concerned about what's going on with you besides the visits with the doctor or maybe the nurse checking up on you. This is some kind of constant something."

"I wasn't aware of the importance of [checking my feet] before the study...Well, I always knew people with high level of diabetes are prone to amputations… And that's something very serious and I wouldn't want that to happen to me. And I just never realized that it was so closely related."

Nundy S, Dick JJ, Solomon M, Peek ME. Developing a Behavioral Model for Mobile Phone-Based Diabetes Interventions. Patient Education and Counseling. 2012 Oct 9. pii: S0738-3991(12)00381-3.

Results: Theme Mapping

Themes | Constructs | Model

Seriousness of diabetes and acceptance

Self-awareness and control

Reinforcement and feedback

Caring and support

Role of text administrator

Health Belief
-Perceived susceptibility
-Perceived severity
-Perceived barriers
-Perceived benefits

Self-Efficacy
-Mastery experience
-Social persuasion
-Physiological Factors

Social Support
-Perceived support
-Enacted support
-Social integration

Daily messages

Health Belief
-Perceived susceptibility
-Perceived severity
-Perceived barriers
-Perceived benefits

SMS-DMCare
- Text messages
- Phone calls

Reminders

Diabetes Self-Management

Feedback

Self-Efficacy
-Mastery experience
-Social persuasion
-Physiological Factors

Frequent contact

Social Support
-Perceived support
-Enacted support
-Social integration

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Results: Hypothesized Behavioral Model

Health Belief
-Perceived susceptibility
-Perceived severity
-Perceived barriers
-Perceived benefits

Daily messages

SMS-DMCare
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- Phone calls

Reminders

Diabetes Self-Management

Feedback

Self-Efficacy
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## Developing a Text Message-Based Chronic Care Model

- Research Question: How to translate the text messaging pilot into an institutional initiative?

- Research Gap: Mobile phone-based interventions have shown promise in research settings, but implementing them in real-world health systems is largely unexplored.

- Methods: Iterative program design that built upon the pilot study and engaged multiple institutional stakeholders

- Study setting: Academic medical center in an underserved urban setting; traditional clinic and specialty practice without formal diabetes self-management education programs or care management; fee-for-service payment

Results: Stakeholder Analysis

Patients	A 'human face' to the program rather than fully automated
	Control of timing, frequency and content
Providers	No time to enroll and monitor patients
	How to respond to clinically relevant text messages
Clinic Leaders	Difficult to engage providers especially if the system required change in workflow
Health Plan	Two RN-trained administrators who had capacity and interest
	HIPAA and med-legal concerns

Nundy S, Dick JJ, Goddu A, Hogan P, Lu E, Solomon MC, Bussie A, Chin MH, Peek ME. Using Mobile Health to Support the Chronic Care Model: Developing an Institutional Initiative. International Journal of Telemedicine and Applications (In press).

Results: Care SMartS Model
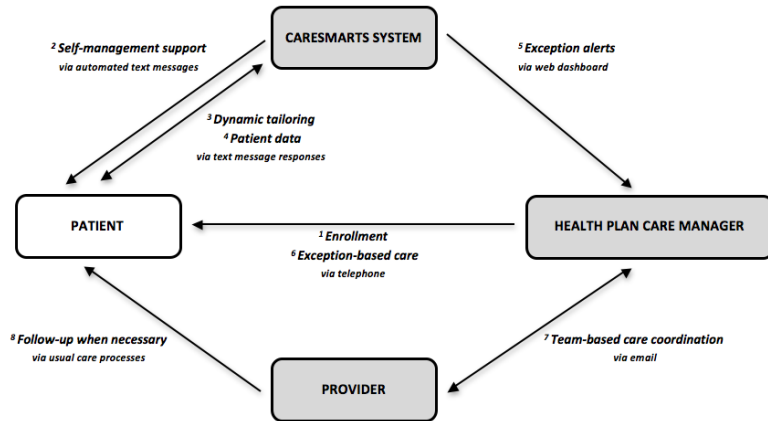
Nundy S, Dick JJ, Goddu A, Hogan P, Lu E, Solomon MC, Bussie A, Chin MH, Peek ME. Using Mobile Health to Support the Chronic Care Model: Developing an Institutional Initiative. International Journal of Telemedicine and Applications. Vol 2012 (2012).

Sample Text Messages

Topic	Message Type	Example Text Message
Medication	Education	To get the most out of your medicines, you need to take them as prescribed and on time, every day. Even if you're not feeling sick.
	Prompt	Reminder: Time for your medicine!
	Assessment	In the last 7 days how many days did you take all of your diabetes medications?
Glucose Monitoring	Encouragement	Monitoring blood sugars is not just so your doctor knows how you are doing. Glucose monitoring is a tool for YOU to know how you are doing.
Nutrition	Tip	If it's not in your kitchen, you probably won't eat it. Avoid temptation by not keeping desserts or unhealthy snacks in the house.
Foot Care	Education	Increased blood sugars can cause nerve damage to the foot and decrease circulation. Over time this can lead to pain, infection, and other foot problems.
Exercise	Education	Did you know that experts recommend moderate physical activity for at least 30 MINUTES 4 times per week? (yes/no)
Living with a Chronic Illness	Education	Tip: Your clinic has a way to see urgent patients the same day or within 48 hours. When you are not feeling well, the emergency room is not your only option.

Video Link

- http://chicago.cbslocal.com/2012/10/18/text-messaging-system-helps-diabetics-keep-in-touch-with-doctors/

End of Prepared Slides

Demonstration Project

- University of Chicago Health Plan (UCHP) members with type 1 or type 2 diabetes who have access to a mobile phone enrolled for 6 months

- Evaluation:
  - Clinical outcomes: HbA1C, blood pressure, weight, quality of life
  - Behavioral measures: self-care, health beliefs, self-efficacy, social support
  - Health care utilization: ER visits, hospitalizations, medication possession ratio
  - Operational measures: FTEs, provider workflow, patient satisfaction
  - Business case: health plan perspective

- Hypothesis #1: Pre-post improvement in glycemic control in individuals with uncontrolled diabetes (HbA1c>7.5%)

- Hypothesis #2: Pre-post improvement in self-management, health beliefs, self-efficacy, and social support

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Demographics (N=74 out of 380)

		%
Age, years (mean, range)		54 [22-69]
18-39	4	5
40-49	14	19
50-59	32	43
60-70	24	32
Gender		
Female	41	55
Race		
African-American	39	53
Caucasian	24	32
Ethnicity		
Hispanic	8	11

		%
Job Status		
Not working/retired	11	15
Employed	61	82
Homemaker	0	0
Education		
Less than high school	0	0
High school graduate	9	13
Associate's degree	32	44
Bachelor's degree	21	29
Grad or professional	10	14

Primary Outcome

- **Glycemic Control (HbA1c)**

- ▪ <u>All Patients</u>: Baseline 7.8%, 6 months 7.3% (p=0.034)

- ▪ <u>HbA1c >8%</u>: Baseline 9.9%, 6 months 8.4% (p=0.009)

Self-Care Activities and Quality of Life

Measure	Baseline	6 Month	p-value
Morisky Medication Adherence Scale (0-4)	2.9	3.4	0.02*
Healthy Diet (last 7 days)	4.5	5.1	0.10
Healthy Diet (over 7 days)	4.4	5.2	0.02*
5+ Servings of Fruits/Vegetables (last 7 days)	4.1	4.4	0.59
1+ Servings of High Fat Foods (last 7 days)[1]	2.2	2.7	0.21
Exercise (last 7 days)	2.8	2.8	0.78
Physical Activity (last 7 days)	2.8	3.4	0.05*
Medication Adherence (last 7 days)	5.9	6.3	0.42
Blood Sugar Check (last 7 days)	4.5	5.3	0.01**
Blood Sugar Adherence (last 7 days)	4.0	4.6	0.19
Foot Check (last 7 days)	4.9	5.5	0.15
Shoe Check (last 7 days)	2.2	3.1	0.02*
Feeling overwhelmed with demands of diabetes[1]	2.4	2.1	0.05*
Feeling of failure for diabetes routine[1]	2.8	2.0	0.00**
Feeling unmotivated to perform self-care[1]	2.4	1.9	0.01**
Feeling depressed about life with diabetes[1]	2.2	1.8	0.00**

Self-Care Baseline to 3 Months (N=64)

Domain	Scale	Measure	Baseline	3 Months	p value
Self-care	Morisky	Medication adherence (0-4)	2.92	3.34	0.00**
	SDSCA	Diabetes medication (0-7)	5.96	6.05	0.51
	SDSCA	Healthful eating plan	4.59	5.28	0.10
	SDSCA	Personal eating plan	4.51	5.16	0.12
	SDSCA	Servings of fruits and veges	4.06	4.44	0.41
	SDSCA	High fat foods	2.22	2.56	0.24
	SDSCA	Do exercise session	2.74	3.02	0.39
	SDSCA	>30 minutes of exercise	2.73	3.41	0.04*
	SDSCA	Test blood sugar at least once	4.62	5.03	0.06
	SDSCA	Test BS as recommended	4.06	4.33	0.40
	SDSCA	Foot inspection	4.97	6.03	0.01**
	SDSCA	Shoe inspection	2.19	2.17	0.91

Behaviors Baseline to 3 Months (N=64)

Domain	Scale	Measure	Baseline	3 Months	p value
Self-efficacy	Skaff	Self-efficacy (8-32)	27.38	28.45	0.01**
Health beliefs	DRHP	Long-term risks others (4-20)	15.01	15.19	0.92
	DRHP	Long-term risks self (4-20)	10.54	11.20	0.28
	RPS-DM	Risk knowledge (0-5)	4.54	4.42	0.55
	RPS-DM	Perceived personal control (4-16)	13.53	14.11	0.05*
Social support	Tang	Amount of social support received (1-5)	3.85	4.22	0.02*
	Tang	Satisfaction with social support (1-5)	4.15	4.42	0.14

* significant at p<0.05; ** significant at p<0.01 Morisky = Morisky 4-Item Self-Report Measure of Medication; SDSCA = Summary of Diabetes Self-Care Activities; Skaff = Skaff Self-Efficacy Scale; DRHP = Diabetes Related Health Problems; RPS-DM = Risk Perception Survey-Diabetes Mellitus; Tang = Tang et al. The Diabetes Educator 2008 34: 266.