

Gender Differences in Diabetes Self-Management: A Mixed-Methods Analysis of a Mobile Health Intervention for Inner-City Latino Patients

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Abstract

Background:

The benefit of mobile health (mHealth) on diabetes management among low-income, inner-city patients is largely unknown, particularly for Latino patients. TEXT-MED (Trial to Examine Text Message for Emergency Department Patients with Diabetes) is a text message-based program designed to improve disease knowledge, self-efficacy, and glycemic control among low-income, inner-city Latinos. In phase I, 23 patients participated in an acceptability and feasibility study. Contrary to our model, there was no increase in knowledge despite increases in self-efficacy and healthy behaviors. In phase II, we performed a mixed-methods analysis to understand how TEXT-MED achieved these seemingly contradictory findings.

Method:

We performed a qualitative analysis of focus groups with patients from phase I. We explored patients' receipt of health information from TEXT-MED and other information sources. We used these qualitative findings to perform a mixed-methods analysis of the outcomes from phase I, reanalyzing the quantitative measures of self-efficacy, diabetes knowledge, and healthy behaviors.

Results:

We conducted two focus groups, one in English and one in Spanish. Through qualitative analysis, we found gender differences in information sources, dietary self-efficacy, and desired educational content. Applying this knowledge, we re-stratified phase I outcomes by gender and found differential changes in diabetes knowledge, self-efficacy, and behaviors. Men had increased self-efficacy while women showed increased knowledge.

Conclusions:

The efficacy of mHealth on diabetes management was affected by gender. Specifically, men and women differ in their dietary self-efficacy, information sources, and desired topics in future mHealth interventions. To achieve maximal impact, future mHealth interventions should be mindful of this gender difference.

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Abbreviations: (mHealth) mobile health, (TEXT-MED) Trial to Examine Text Message for Emergency Department Patients with Diabetes

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Introduction

The rate of diabetes has increased consistently over the last 30 years, making it a growing public health crisis.¹ The Latino community has been affected at disproportionately higher rates.^{1,2} Latino children have a 70% higher projected risk of developing diabetes than their non-Hispanic white peers.³ Many obstacles contribute to this disparity, including socioeconomic status, access to care, and language barriers.⁴⁻⁹ To reach Latinos and other underserved groups, innovative interventions must be designed; mobile health may be just that solution.

Mobile health (mHealth) is an emerging field that uses devices that many patients already own and use to improve health. mHealth has the potential to reach a large number of patients in a cost-effective way.¹⁰ Through text messaging, social networking sites, and non-voice applications, technology can be used to reach patients even when they are away from healthcare settings.¹¹⁻¹⁴ mHealth has been shown to increase knowledge, encourage healthy behaviors, and improve chronic and acute disease management.¹⁵⁻¹⁷ The optimal methods of using mHealth to improve management of chronic diseases, including diabetes, are under active investigation.¹⁸⁻²³ However, the efficacy of mHealth programs tailored specifically to low-income, inner-city patients is largely unknown. To explore this, we designed TEXT-MED (Trial to Examine Text Message for Emergency Department Patients with Diabetes), a text message-based program designed for low-income, inner-city Latinos to increase their knowledge, self-efficacy, and subsequent disease management and glycemic control. We conducted TEXT-MED in three phases. Phase I (completed) was designed to test feasibility and acceptability among the target population.²⁴ Phase II (this study) is a qualitative analysis of the program. Phase III, a randomized and controlled trial, is ongoing.

In May 2011, we conducted phase I of TEXT-MED among adult patients with diabetes who were recruited from the emergency department at Los Angeles County Hospital at the University of Southern California, which is the largest public safety-net hospital in Los Angeles County serving a predominantly Latino population. Phase I was a 1-month bilingual diabetes curriculum of text messages developed in collaboration with a diabetes educator, an endocrinologist, clinical specialists, and native Spanish speakers. The curriculum was based on the National Diabetes Education Program.²⁵ Patients received three text messages a day in their preference of English or Spanish. The messages consisted of (1) educational and motivational messages (67%), (2) trivia questions (12%), (3) healthy-behavior challenge (14%), and (4) medication reminders (5%). We collected demographic, clinical, and biometric data at an index visit and a follow-up visit. We also measured patients' health behaviors, knowledge, and beliefs, using the Diabetes Knowledge Test,²⁶ the Diabetes Empowerment Scale – Short Form,²⁷ and the eight-item Morisky Medication Adherence Scale.^{28,29} Using a Likert-style scale, we also measured patients' reports of healthy behaviors and satisfaction. Our reports are published²⁴ and are summarized in **Table 1**.

We designed TEXT-MED to increase patients' knowledge, which we hypothesized would result in increased self-efficacy and subsequent disease management. Self-efficacy is a patient's belief that he has the ability to manage his disease.^{30,31} Increasing one's self-efficacy has been shown to improve diabetes management.³¹ Unfortunately, for those who design interventions for the medically underserved, self-efficacy can be difficult to measure with standardized scales in marginalized populations.^{25,32} Analysis of phase I showed that patients improved healthy behaviors and reported increased self-efficacy but did not show a concurrent increase in knowledge. This went against our hypothesized model of TEXT-MED's action. In trying to understand this contradiction to our model, we employed a mixed-method approach using focus groups in phase II to examine how TEXT-MED impacted diabetes self-management.

Methods

Qualitative Data Collection and Analysis

We convened two focus groups of 90-min duration—one in English and one in Spanish. We recruited participants from the pool of phase I participants through three rounds of telephone calls. Participants consented to audio recording prior to participating and were assured that their confidentiality would be protected. Participants received \$50 reimbursement for their time and transportation costs. Elena Taylor, an experienced, bilingual moderator, led the

Table 1.
Phase I TExT-MED Outcomes (Scales and Reported Healthy Behaviors) Stratified by Gender

Action by participant	All, average (95% confidence interval)	Men, average (95% confidence interval)	Women, average (95% confidence interval)
Diabetes Knowledge Questionnaire			
Pre-trial	8.4 (7.4 – 9.5)	8.4 (6.9 – 9.8)	8.5 (6.7 – 10.4)
Post-trial	8.4 (5.1 – 8.7)	6.8 (3.2 – 7.5)	10.5 (6.3 – 12.3)
Morisky Medication Adherence			
Pre-trial	3.6 (2.6 – 4.7)	3.1 (1.6 – 4.6)	4.8 (2.8 – 6.1)
Post-trial	4.5 (3.5 – 5.4)	4.0 (2.6 – 5.4)	5.1 (3.9 – 6.4)
Diabetes Empowerment Scale			
Pre-trial	31.6 (29.4 – 33.8)	30.0 (27.5 – 32.5)	34.2 (30.1 – 38.3)
Post-trial	33.7 (31.5 – 35.8)	33.4 (30.6 – 36.3)	34.0 (29.9 – 38.1)
Blood sugar checks in last week			
Pre-trial	3.3 (2.0 – 4.6)	3.4 (1.6 – 5.1)	3.1 (0.7 – 5.5)
Post-trial	4.5 (3.2 – 5.7)	3.3 (1.5 – 4.9)	6.3 (5.3 – 7.2)
No. of times exercised in last week			
Pre-trial	2.0 (0.8 – 3.3)	1.9 (0.3 – 3.5)	2.2 (-0.01 – 4.6)
Post-trial	3.7 (2.4 – 5.1)	4.0 (1.9 – 5.4)	3.9 (0.9 – 6.9)
No. of times checked feet in last week			
Pre-trial	4.2 (2.9 – 5.6)	4.5 (2.7 – 6.3)	3.8 (1.3 – 6.3)
Post-trial	4.6 (3.3 – 5.9)	3.8 (1.9 – 5.7)	5.8 (4.3 – 7.2)
% who ate a fruit or vegetable each day			
Pre-trial	61% (35% – 78%)	43% (13% – 73%)	78% (44% – 112%)
Post-trial	79% (51% – 95%)	82% (55% – 109%)	75% (19% – 105%)
% who checked a food label in last week			
Pre-trial	65% (39% – 82%)	50% (20% – 80%)	78% (44% – 112%)
Post-trial	63% (36% – 86%)	50% (12% – 88%)	75% (36% – 114%)

groups using a structured guide to deliver consistent probes between groups. The structured guide explored patients' receipt of health information, specifically (1) how they sought health information, (2) how trustworthy and valid they found the information from TExT-MED, (3) whether they sought further information after receiving a text message, and (4) with whom they shared the TExT-MED information. A bilingual notetaker assisted by collecting additional data, including visual information and body language. The discussion was allowed to follow the natural direction of the participants' conversations if they were engaged and sharing. If dialogue stalled, the moderator probed by using the structured guide. All discussions were recorded, translated as needed, and transcribed verbatim for analysis. Respondents were coded as male or female in the transcripts. Two members of the research group (Elizabeth Burner and Elena Taylor) completed the qualitative analysis, identifying the important themes as defined by both the moderator's guide and index discussion points. While establishing the framework of principal themes in an iterative process, investigators mapped relevant discussion quotes.

Mixed-Methods Analysis

We used the themes that arose from the qualitative analysis to identify important demographic variables in diabetes management. We took the most important variable and used it to sort patients into subgroups. We then reanalyzed the quantitative phase I outcomes to look for a differential impact of TExT-MED. Values were averaged for each subgroup, excluding those patients with missing data from the follow-up analysis.

Results

In phase I, we recruited 23 patients (14 men and 9 women) who were 69% Latino. Twenty patients (12 men and 8 women) were available for follow-up data collection at trial completion. For phase II, 8 patients were able to return for focus groups, of which 75% identified as Latino. Participants attended focus groups in their preferred language, with one group of English speakers ($n = 5$; 3 women, 2 men) and one group of Spanish speakers ($n = 3$; 2 men, 1 woman).

Qualitative Analysis

From analysis of focus-group transcripts, gender differences emerged in multiple diabetes management areas. Gender impacted the patients' perceptions of the program, the challenges they faced, and their individual management strategies. The most important subthemes that differed by gender were (1) dietary self-efficacy, (2) health information sources, and (3) desired content of further educational materials (Table 2).

Table 2. Gender Differences Identified via Qualitative Analysis		
Subtheme	Men	Women
Dietary Self Efficacy	Lack of cooking and food acquisition skills hamper disease management	Men need more help with diet; women already have dietary knowledge
Health information sources	Internet, physicians, wives, television	Friends, family, physicians
Desired content of educational materials	Erectile dysfunction, mental health	Yeast infections, menopause, mental health

Dietary Self-Efficacy Differed by Gender

Men perceived their lack of gender-specific skills, such as cooking, as a challenge to diabetes management. Single men noted that not having a spouse to assist them in food preparation was especially problematic. Men also felt that they lacked healthy diet knowledge. They felt that these issues limited their ability to manage their diabetes. Comments were made, such as (translated directly from Spanish):

“My wife helped me quite a bit. She went around looking for healthier food. Food that has less fat.”

“Since I’m not married and I don’t have anyone to cook for me, sometimes . . . sometimes I don’t know what to eat.”

Women did not identify lack of cooking skills or food knowledge as a challenge. One woman stated, when asked if the educational messages were helpful, “Not really, because I was already informed; I already knew quite a bit of this stuff.”

Women thought that men were limited by a lack of food knowledge and thought that the men could use extra help from a program such as TExT-MED: “I think especially for someone like [male name redacted] here, being single here, maybe some recipes, simple recipes that people can look at and save it.”

Health Information Sources Differed by Gender

Men and women had different sources of health information. Outside of TExT-MED, men accessed health information through their doctors, television shows such as Dr. Oz, and their wives. The most reliable sources were considered to be physicians and TExT-MED. In response to the probe “Where do you get your health information you rely on?” male participants stated the following:

“I like to read; I don’t really talk to anyone about that.”

“I see something in the news and if I see something that says diabetes on it, it catches my attention . . . but as far as texting, the texting was the biggest, the biggest part of my education.”

“From the doctor I learned and this [TExT-MED] helped me a lot, these messages. Now I take my medicines.”

Women reported more reliance on information from social sources and identified fewer broadcast sources of information. Women reported that their friends with diabetes or their health care experience were their most reliable sources of information. Women also gained information from reading and from their doctors, but these sources were not regarded as equally important. Typical responses from female participants to the same probe were:

"Lot of friends; I gravitate to elderly people so I have all these surrogate mothers that are diabetics."

"Trusted friends and family. I have a really good friend; she is actually a nurse, so she's the one that gives me a lot of advice. She has diabetes, too."

Desired Content of Educational Materials Differed by Gender

Men in the groups noted a special need for information on erectile dysfunction. They believed that most men would not spontaneously discuss this topic. When asked, "Is there a topic we're not addressing [in the text messages]?" the male participants responded:

"A topic, I can't speak for ladies, but for males, um, health symptoms as far as performance."

"I just didn't want to say anything either, but now that he spoke up. I'm serious, diabetics, we have issues."

Women, in contrast, thought specific information for women, including prevention of yeast infections and how to deal with menopause, would be helpful for future programs. In response to the same probe:

"Women go through a lot of things like hormone changes, like menopause, but it all affects the same thing and that general information . . . that would be helpful."

"My experience of being diabetic, like if your sugars are not in control, like I would experience a lot of yeast infections."

Both language groups and genders felt mental health and resources for mental health should be addressed in future versions of the program. In response to the probe, "Is there more information that would be helpful?":

[Male respondent]: "It'd be helpful if you put an address or two in there, in need of mental health."

[Female respondent]: "Mental health ... these things can come up as being part of being a diabetic."

Phase I Quantitative Data Stratified by Gender

Because gender difference in diabetes management was a major finding to emerge from the qualitative analysis, phase I was reanalyzed and stratified by gender. As a result, we found gender differences in the TEXT-MED outcomes between men and women. Men's average scores on the Diabetes Knowledge Questionnaire decreased slightly (8.4 to 6.8), while women's knowledge increased (8.5 to 10.5). Self-efficacy measured by the Diabetes Empowerment Scale improved for men, with a minimal change for women (30 to 33.4 for men and 34.2 to 34.0 for women). Checking food labels did not change for men or women, while percent of patients who ate a fruit or vegetable each day improved for men (from 43% to 82%) but did not change for women. Medication adherence and exercise behaviors improved for both gender groups. Women increased the number of times they checked their blood sugar and feet, while men exhibited no change in blood sugar checks and decreased the number of times they checked their feet. The exact changes are shown in **Table 1**.

Discussion

The Health Belief Model posits that knowledge and education act as cues to action to change a patient's perceived threat of disease.^{33,34} With increasing threat, patients are more likely to make healthy behavior changes. TEXT-MED was designed to increase knowledge, but in the group as a whole, it did not. However, these predominantly Latino patients showed improved self-efficacy and healthy behaviors. To understand this contradictory finding, we conducted a subgroup analysis of the phase I outcomes using a mixed-methods design. We conducted focus groups and, using qualitative analysis, determined that gender had an impact on diabetes management and response to TEXT-MED. Using this finding, we reanalyzed the initial outcomes and found that men and women responded to the program differently. By using this mixed-methods design, we were able to conduct our subanalysis purposively rather than randomly. Conducting *post-hoc* analyses of all possible subgroups is prone to observing spurious associations.³⁵

Gender differences were repeatedly identified through analysis and were explicitly and spontaneously addressed by participants during the focus groups. Men and women differed in their dietary self-efficacy, their sources of information, and the content that they desired in future program iterations. Guided by these findings, we reexamined the outcomes of the phase I TEXT-MED stratifying by gender. We found a possible differential impact of the program on the two gender groups. We did not expect this difference because the program was created to be gender neutral. Further, a review of the literature had shown inconsistent differences between men and women's management of their diabetes.³⁶

Self-efficacy has been shown to be more important in diabetes management than social support and other factors.³⁹ In this gender-specific reanalysis, men had an increase in self-efficacy without an increase in knowledge, while women had an increase in knowledge with little increase in self-efficacy. The level of male self-efficacy increased to nearly that of the women, who started with higher self-efficacy but did not show an increase with the program. In particular, men had lower dietary self-efficacy and relied on female relatives, particularly wives, for guidance. This left single men with little support and married men at the mercy of their spouses' diabetes knowledge. Men also had an increase in fruit and vegetable intake, surpassing the women who had higher baseline levels. Because one study has suggested that there are no gender differences in attitudes toward diet,⁴⁰ finding this difference is important because it shows that we may need gender-tailored programs to maximize effectiveness.

While men had an increase in self-efficacy, women exhibited an increase in knowledge. Prior to TEXT-MED, women primarily relied on health information from friends while men relied on their wives, physicians, and broadcast sources. Research has shown that women in Mexico are more likely to share diabetes information with peers than with men.⁴¹ This gender difference in knowledge gains may reflect the unreliability of the sources on which these women relied prior to TEXT-MED. Additionally, women and men identified gender-specific areas needing support from diabetes interventions. Particularly with regard to sexual health, men and women had different challenges to overcome. Both genders thought that mental health was a critical barrier to managing their disease and should be addressed in future interventions.

One limitation of this study is that some of the phase I participants were not available for phase II. The fact that some patients participated in phase II and others did not may reflect higher patient motivation, which could introduce selection bias. Initially, we planned to differentiate groups by gender, ethnicity, and then primary language. However, the small number of participants limited the structure of the focus groups, forcing us to stratify by language alone. Because the groups consisted of mixed genders, patients may not have been comfortable with bringing up gender-specific topics. Still, gender differences arose as the predominant theme even though the group structure should have biased against finding gender differences. Extensive coding to reach saturation of concepts was not feasible given the limited nature of this trial and small number of participants. If there had been more data, additional and equally important themes also could have emerged. Phase III is under way within a larger group to determine if TEXT-MED achieves statistically significant attitude, behavior, and physiologic change, and will also try to confirm these preliminary qualitative findings.

Conclusions

In this mixed-methods study of an mHealth intervention, gender differences affected multiple diabetes management areas for our predominantly Latino patients. To maximize the impact of mHealth on diabetes management, future researchers should validate these findings in their own work, and mHealth developers should keep gender in mind when designing new interventions.

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Disclosures:

The content herein is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Diabetes and Digestive and Kidney Diseases or the National Institutes of Health.

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