

## Curriculum Vitae

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- Duarte, A. C.**, Thomas, S. A. (2014, April). The use of electronic interventions to improve medication and appointment adherence in the Hispanic population: A systematic review. Poster session presented at Public Health Research@Maryland, College Park, MD.
- Burda, C., Haack, M.R., **Duarte, A.C.**, Alemi, F. Cell phones for homeless: U.S. psychiatric nurse practitioners and medication management. 52<sup>nd</sup> International ICAA Conference on Dependencies, Estoril, Portugal, October 11-16, 2009.

## **Publications**

- Duarte, A. C.**, Thomas, S. A. (2016). The use of phone technology in outpatient populations: A systematic review. *The Open Nursing Journal*, 10(Suppl. 1:M3):45-48. doi:10.2174/1874434601610010045
- Burda, C., Haack, M., **Duarte, A.**, & Alemi, F. (2012). Medication adherence among homeless patients: A pilot study of cell phone effectiveness. *Journal of the American Academy of Nurse Practitioners*, 24(11):675-81. doi:10.1111/j.1745-7599.2012.00756.x

## **Abstract**

**Title of Dissertation:** The Use of Text Messaging to Improve Adherence and Functioning in Psychiatric Patients.

Ana Cecilia Duarte, Doctor of Philosophy, 2018

Dissertation Directed by: Carla L. Storr, ScD, MPH  
Professor, Family and Community Health  
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**Background:** Failure to attend psychiatric appointments can lead to poor medication adherence, relapse into crisis and/or re-hospitalization, or dropping out of treatment altogether. Changes are called for in the way clinicians and their practices can use technology to level the playing field in terms of health disparities, remove barriers to communication, decrease stigma, and assist in building self-efficacy and confidence in the treatment system.

**Purpose:** To explore whether text messaging can improve adherence and function in the adult psychiatric outpatient population.

**Methods and Results:** A literature review demonstrated that psychiatry, as a discipline, has not fully embraced all that technology has to offer despite a limited number of studies showing phone interventions improved health outcomes. A pilot randomized texting intervention of 89 adult psychiatric patients was conducted at a non-profit outpatient mental health clinic in a large urban Mid-Atlantic metropolitan area. The intent to treat group (n=47) received text message appointment reminders in addition to regular reminder calls from the clinic's Front Desk, while the treatment as usual group (n=42) received the reminder phone calls only.

**Implications:** Though the main outcomes of appointment and medication adherence in response to the text reminder intervention of this study did not achieve significance, the results were still generally in line with the literature, which demonstrates support for the use of text messaging technology in this way. This would suggest there is value in using text appointment reminders in practice for psychiatry/mental health. Because appointment adherence is a problem that plagues every type of healthcare practice, those that avail themselves of technology that provides text reminder capability will likely benefit in terms of improved appointment adherence. Regular attendance at appointments improves the patient-provider relationship which plays an important role in patients' medication adherence and overall stability and good health. This cannot help but cascade into improved well-being.

**Committee Chair:** Carla L. Storr, ScD, MPH, Professor, School of Nursing

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The Use of Text Messaging to Improve Adherence and Functioning  
in Psychiatric Patients.

by  
Ana Cecilia Duarte

Dissertation submitted to the Faculty of the Graduate School of the  
University of Maryland, Baltimore in partial fulfillment  
of the requirements for the degree of  
Doctor of Philosophy  
2018

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## **Dedication**

To my husband, Manuel Vazquez. You are my life's greatest gift.

## Acknowledgements

*Rejoice in hope, be patient in tribulation, be constant in prayer. Romans 12:12*

I was once told that getting a PhD is not a team sport. Having played softball all my life, I equated this idea to being in the batter's box; in that space, you are, indeed, on your own. However, numerous people assist in getting any player up to bat and I would like to express my appreciation to everyone on my PhD team who helped get me to this point.

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# CHAPTER 1 INTRODUCTION

## Overview and Significance

Adherence can be defined as the concept of patient and provider collaborating toward patient care goals.<sup>1,2</sup> Poor adherence to treatment of chronic health issues is a global problem. The rate of general long-term adherence is near 50% in developed countries and even lower in less developed countries, resulting in poor treatment outcomes for patients, as well as increased cost burden on the healthcare system.<sup>1</sup>

Adherence is a complex and multi-dimensional issue that has long been of great significance to health care providers and organizations. Improvement of adherence and subsequent patient outcomes is dependent on adequately addressing and conducting proper surveillance of factors in each of these interrelated areas. There are numerous predictors of poor adherence such as stress, poor insight, substance abuse, comorbidities, level of cognitive function, anxiety or other emotions surrounding treatment, cultural or other beliefs regarding medication efficacy, fear or anxiety about potential addiction, side effects, complex regimens, literacy level, housing or employment status, barriers to care, length of treatment, and financial hardship.<sup>2</sup> Changes are called for in the way clinicians and their practices view adherence, including incorporating useful tools for proper assessment and encouragement of good practices.<sup>1</sup> Improvements in the patient/provider interaction, one component of the health care team/system-related dimension of adherence, is where the provider and practice can exert the most direct influence.<sup>3</sup>

Access to mental health and a focus on prevention are important goals which place increased demands on both mental and physical healthcare resources.<sup>4</sup> Despite this

increased demand and attempts to address it, patients continue to have trouble adhering to both appointments and to their medication regimen, familiar scenarios in practice.<sup>5-10</sup>

Patient follow-up to post-discharge appointments is associated with decreased readmissions and symptom stabilization and maintenance over time.<sup>6</sup> Adherence to appointments is associated with medication adherence and can also strengthen the relationship between provider and patient, otherwise known as the therapeutic alliance. Medication adherence is linked to improved functioning and quality of life, and patients who take their medications as prescribed feel generally healthier.<sup>7,10</sup>

As of January 2018 95% of American adults own a mobile phone,<sup>11</sup> increased from 91% just five years prior.<sup>12</sup> These high rates of ownership trend across gender, age, race, and cultural/ethnic demographics<sup>12</sup> and suggest that the use of text messages could be a bridge to adherence. Patients are open to electronic interventions that can assist them with adherence.<sup>7</sup> Text messaging, specifically, offers an inexpensive and easily implemented strategy to aid in adherence, and has been shown to be a viable method of reaching underserved populations or those who have historically been difficult to access for follow-up.<sup>13-16</sup> While a number of studies have been directed toward the use of text messaging to address adherence, few have specifically addressed the specialty area of psychiatry.

## **Summary of the literature**

### **Appointment Adherence**

Missed appointments, or “no-shows,” are familiar occurrences in the health care field. While little information is available for national rates in the U.S., appointment adherence rates range between 8% and 94%, averaging 58% in the U.S., Canada, and the

U.K., in a variety of practices. This translates to an average no-show rate of 42%.<sup>17</sup> The rate of missed appointments in primary care settings in the U.S. is between 5% and 55% of all appointments.<sup>18</sup>

In psychiatry the no-show rates are even higher; rates of missed psychiatric appointments in the U.K. were revealed in one review to be almost double that of missed appointments in other disciplines.<sup>5</sup> In another study, no-shows for intake, or first appointments, in an outpatient psychiatry clinic represented 36% of all scheduled appointments.<sup>19</sup> Failure to attend psychiatric appointments can lead to poor medication adherence, relapse into crisis and/or re-hospitalization, or dropping out of treatment altogether,<sup>5,6</sup> all poor and even dangerous patient outcomes.

### **Medication Adherence**

Medication adherence is also an issue of interest and of serious consequence in health care. As of 2014, 60% of Americans had at least one chronic health condition,<sup>20</sup> up from nearly 50% only four years earlier, many of which require medications and with expected increases in future years.<sup>21</sup> A national survey of adults indicates that 64% of Americans prescribed medications for chronic conditions do not take them correctly. The rate of adherence problems increases with the number of prescribed medications—in cases where patients take only one or two medications, the rate of improper adherence is 56%, as opposed to 70% in those who take three or more medications.<sup>7</sup>

The advent of electronic prescribing (e-prescribing) systems allows very direct measurement of adherence in the context of prescription fill rates. Two separate studies reported new prescription non-fill rates of 24% and 28% over the course of one year for general medications.<sup>22,23</sup> In cases of serious mental illness, high rates of medication

adherence are even more difficult to achieve.<sup>8,9</sup> Patients with bipolar or schizophrenia diagnoses only take 51% to 70% of their prescribed medications,<sup>24</sup> and a sample of Medicare patients with schizophrenia demonstrated only 41% adherence with their prescribed antipsychotics.<sup>25</sup> Poor medication adherence is associated with relapse, hospitalization, poorer functioning and course of illness, and suicide.<sup>8,9,26</sup> Patients who report poor adherence also report generally poorer subjective health status.<sup>7</sup>

### **Reasons for non-adherence**

Reasons generally given by patients for missing psychiatric appointments include forgetfulness or confusion about appointment details, clinic communication problems, emotions regarding the appointment, poorly understood consequences of missing an appointment, oversleeping, and hospitalization.<sup>5,18,27,28</sup> The degree or chronicity of illness, diagnosed disorder, including dual diagnosis, and the patient's level of function also influence appointment adherence in psychiatry.<sup>5</sup>

Similarly, patients may attribute psychiatric medication non-adherence to forgetfulness or confusion about the medication regimen.<sup>7</sup> Factors may also include type, chronicity, and complexity of diagnoses; working against medication adherence are also forces such as stigma, fear of addiction, and concern about side effects.<sup>10,24,28</sup> For serious and persistent mental illness, unawareness of illness, or "anosognosia,"<sup>26(p101)</sup> is a major predictor of non-adherence.

### **Technology to improve adherence**

In the literature specifically targeting technology use in psychiatry, relatively few used a text messaging intervention.<sup>29,30,39,31-38</sup> Conversely, texting interventions were used in over twice as many studies in other domains: diabetes,<sup>40-45</sup> weight loss and

obesity,<sup>46,47</sup> asthma control,<sup>48</sup> women's health,<sup>49-52</sup> smoking cessation,<sup>53-55</sup> cardiac rehabilitation,<sup>56</sup> orthopedics and arthritis,<sup>57,58</sup> and general primary care appointments.<sup>59-62</sup>

Studies that use cell and smart phone interventions in the field of psychiatry focus on the areas of counseling and care management,<sup>63,64,73,74,65-72</sup> and medication reminders and monitoring.<sup>75,76</sup> The current literature demonstrates a need for further research on cell or smart phone interventions, specifically in the use of text messaging technology.

### **Purpose of the Study**

The purpose of the study was to determine if the use of text messaging improves adherence to follow-up appointments and medications, as well as enhances functioning in the adult psychiatric outpatient population. This project began with a systematic literature review on the use of technology to improve adherence. The goals of the review were to 1) evaluate the quality of evidence-based studies on cell or smart phone interventions for adherence, 2) examine their use in Hispanic and psychiatric populations, and 3) summarize the kind of outcomes resulting from these studies. Then a small pilot interventional study of patients from various racial and ethnic groups and with diverse psychiatric diagnoses was conducted. This pilot study builds upon the work already begun using text messages for clinical purposes, setting the stage for larger studies with more diverse populations within the discipline of psychiatry.

### **Theoretical Framework**

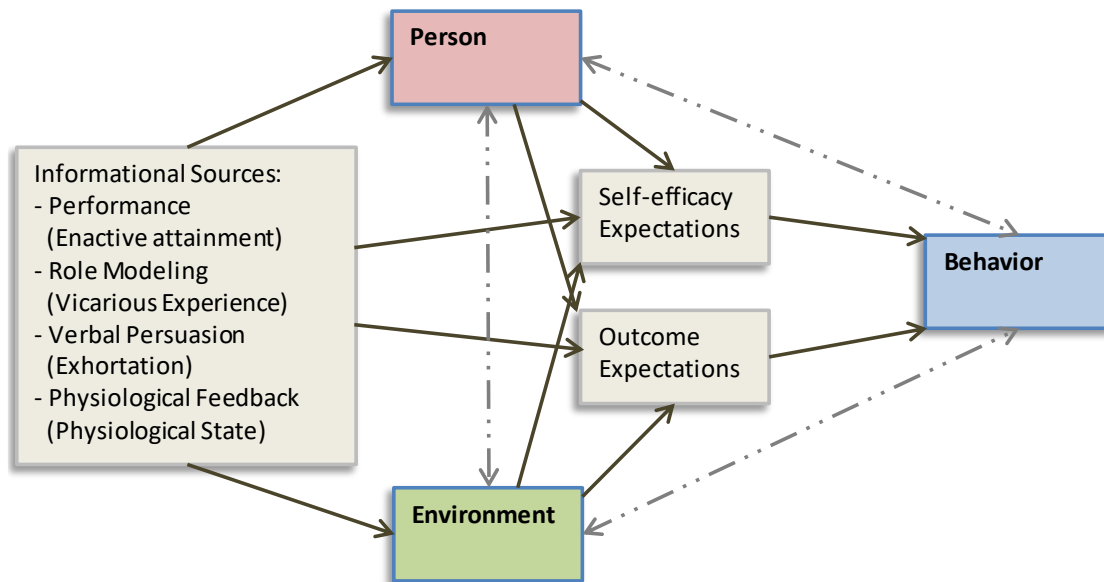
#### **Bandura's theory of Self-Efficacy**

Bandura's theory of Self-Efficacy,<sup>77</sup> illustrated in Figure 1.1, is the theory of choice for this research because its iterative nature lends itself well to this interventional study, which capitalizes on mobile phone technology to influence adherence behaviors.

Self-Efficacy theory describes relationships between concepts and domains that are reflective of the way humans make decisions to act in a particular way. Antecedent factors can influence individual actions via technology, in this case text messaging, which in turn may encourage positive actions leading to improvements in general functioning. Antecedents to verbal or social persuasion, such as suggestion and exhortation, are techniques used by other studies that have attempted to reinforce self-efficacious behaviors to achieve successful outcomes.<sup>29,40,48,49,75,78,79</sup>

The consequences of successful achievement can fall into any of four process domains: cognitive, motivational, affective, and selection. Cognitive processes are rooted in organization and objectivity; motivational processes are actions guided by cognition; affective processes are beliefs in coping skills colored by mood or anxiety; and selection processes are actions with long-range impact across a lifetime. Seen through this lens, a consequence of using text messages to aid in adherence in the target population may be the making of a conscious decision to follow the treatment regimen. Possible ramifications of this decision, in addition to reduced psychiatric symptoms, include generally improved/stabilized functioning, maintaining employment, avoiding hospitalization, and better relationships with friends and loved ones.<sup>75</sup>

**Figure 1.1. Bandura’s theory of Self-Efficacy, adapted from Resnick, 2008. Dotted lines represent theoretical roots in Social Cognitive Theory.**



### **Adapted Bandura’s theory of Self-Efficacy**

A review of the theoretical underpinnings of mobile health (mHealth) studies<sup>80</sup> determined that existing theories might not adequately guide development of studies in this technological area. Other studies have adapted and combined traditional theories, or developed new ones, to better address technological interventions for mHealth.<sup>49,81–83</sup>

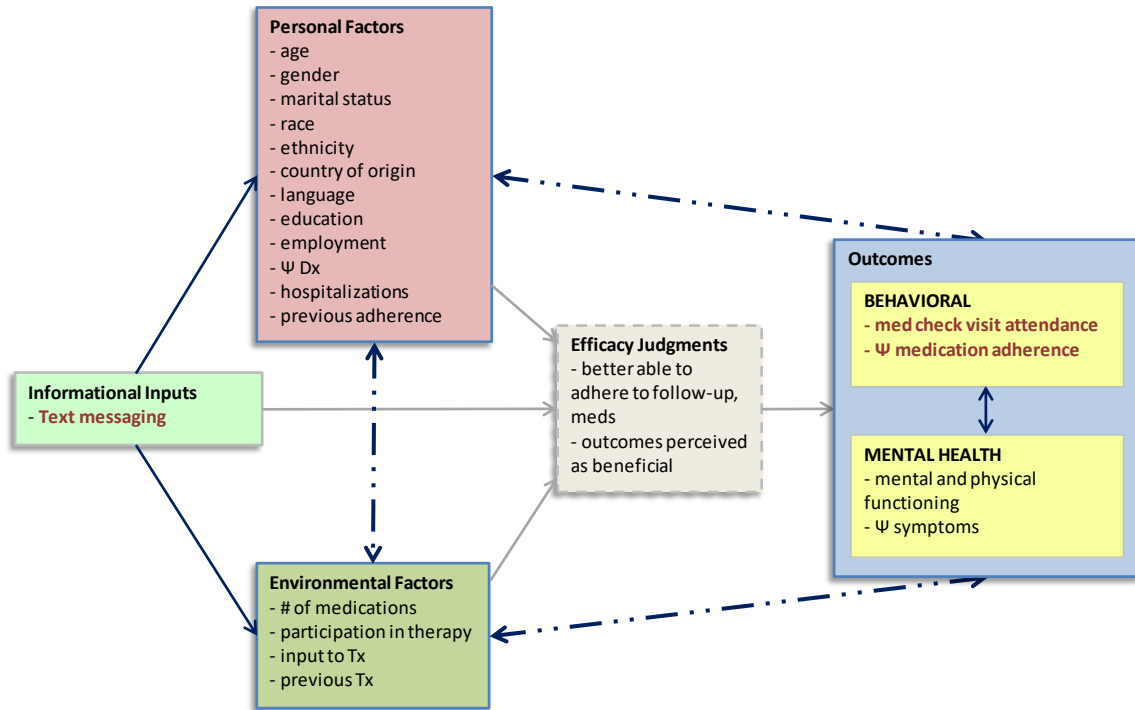
In a similar vein, for this study Bandura’s original theoretical framework is adapted to address more adequately the outcome variables. Adherence is linked in a variety of ways to functioning and physical, as well as mental, health. One of the principal outcomes for this study is level of functioning. Good mental functioning is well known to play a positive role in a variety of aspects of physical health and general functioning. It can be conceptualized as mental well-being, but this concept can be difficult to define, as it encompasses multiple aspects of an individual’s genetics, experiences, knowledge, and beliefs. It is also not static; rather, it is seen as a point along

a continuum, evolving throughout a person's life in step with maturity and life experiences.<sup>84</sup>

Mental well-being is one of three components, along with physical and social well-being, of the overall definition of health. In addition to mental health treatment, mental illness prevention and promotion strategies also target mental well-being.<sup>85</sup> In the context of this broader definition of mental well-being as a descriptor for mental functioning, attention must be given to the interrelationships of mind and body in the study outcomes.

Figure 1.2 shows an enhanced model of the theory of Self-Efficacy, depicting variables of interest for the pilot study. The text messaging intervention is the main input variable and main outcome variables are visit adherence and psychiatric medication adherence. Additional outcome variables are mental and physical functioning and psychiatric symptoms. Self-efficacy and outcome expectations have been collapsed into one category called Efficacy Judgments, and these directly contribute to Behavioral and Mental Health Outcomes. Outcomes are expected to result in repeated adherence and symptom relief, which influence the person and environment. The reciprocal determinism connections between Behavior, Person, and Environment seen in the original theoretical framework are echoed in the adapted framework.

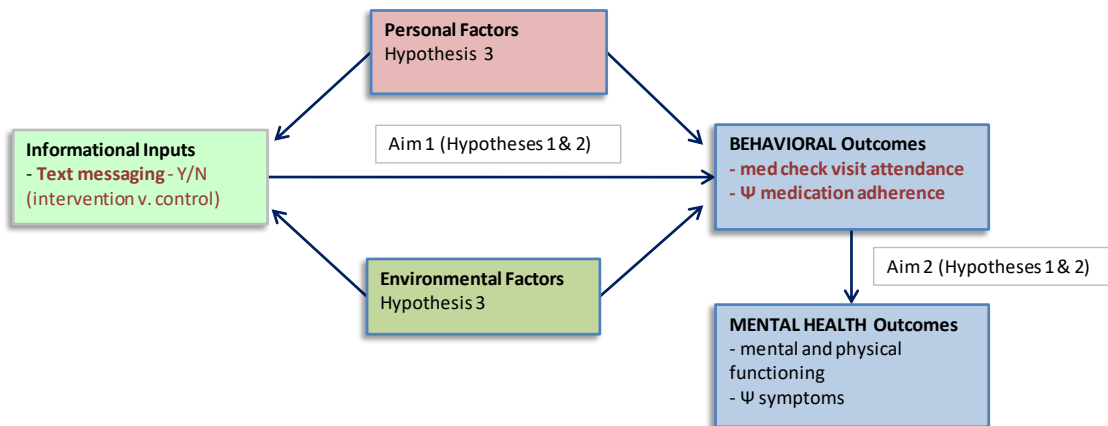
**Figure 1.2. Bandura’s theory of Self-Efficacy, adapted to include variables of interest for the pilot study.**



### Specific Aims and Hypotheses

The above adapted theoretical framework guided the operationalized model for the pilot study as seen in figure 1.3.

**Figure 1.3. Operationalized version of Bandura’s theory of Self-Efficacy for the pilot study.**



### **Specific Aim 1**

The first aim of this study is to determine whether, if exposed to the text messaging intervention, patients show improvements in follow-up appointment adherence, psychiatric medication adherence, and whether these improvements are seen after controlling for confounders.

Hypotheses:

- H<sub>1</sub>: Patients who receive a text messaging intervention will have greater follow-up appointment adherence than those who do not receive the intervention.
- H<sub>2</sub>: Patients who receive a text messaging intervention will have greater psychiatric medication adherence than those who do not receive the intervention.
- H<sub>3</sub>: The association between text messaging and any improvement will still be present once potential personal and environmental confounding factors are held constant.

### **Specific Aim 2**

The second aim of this study is to determine in what way(s) overall adherence resulting from the intervention has changed level of functioning (see variables in Table 1).

Hypotheses:

- H<sub>1</sub>: Patients who have overall adherence will show improvements in functioning.
- H<sub>2</sub>: Patients who have overall adherence will show decreased psychiatric symptoms.

## **Methods**

Detailed design and methods for this study are elaborated in each of the following chapters containing the manuscripts that are part of this dissertation. The following is a brief overview of the methods used in the literature review and the pilot intervention.

## Literature Review

The Qualitative Assessment Tool for Quantitative Studies (QATQS) to assess studies found in the literature. QATQS grading criteria is shown in Table 1.1. Multiple databases were searched using combinations of the terms psychiatry, adherence, technology, and Hispanic. Record screening occurred as a combination of title and abstract review within multiple databases. Final screening was based on full text of the articles. Consensus was achieved at each screening step by two independent reviewers.

**Table 1.1. QATQS assessment and grading criteria**

Quality Component	Assessment Criteria
Selection Bias	Degree to which participants are representative of target population Percentage of study candidates who agreed to participate
Design	Study design Description of randomization process Appropriate randomization sequence
Confounders	Controlling of confounders via design Baseline balance as to confounders
Blinding	Outcome assessors Participants
Data Collection	Reliability and validity of assessment tools/methods
Withdrawals and Drop-Outs	Reporting of withdrawal numbers and reasons Percentage of participants completing the study
Intervention Integrity	Percentage of participants receiving intended intervention Measurement of consistency of intervention administration Contamination/unintended intervention
Analysis Appropriate to Question	Level of allocation and analyses Appropriateness of statistical methods to study design Analyses for intention-to-treat
<b>Global Quality Rating</b>	Strong = 4 strong ratings and 0 weak ratings Moderate = less than 4 strong ratings and 1 weak rating Weak = 2+ weak ratings

## Pilot Study

This was an interventional pilot study of a randomized experimental design with pre-test and post-test. The study was conducted at a busy primary psychiatric outpatient clinic serving, on average, 250 patients for medication management appointments per month. The clinic is part of a non-profit community behavioral health system in a large Mid-Atlantic urban metropolitan area.

Timeframes for adherence studies in mental health range from three months to one year.<sup>13,86–89</sup> In most clinical cases, it takes between eight to twelve weeks to see full results of prescribed medications, without taking into consideration medication increases and possible changes, though in some cases results are discernible in less time. Because of this clinical response pattern, the study was conducted over a four-month period for each participant.

Participants were recruited in person at the site and, upon signing consent, were randomized to either intent to treat (ITT) or treatment as usual (TAU) groups. Those in the ITT group received the text messaging intervention in addition to the usual phone call reminders offered by the clinic, while those in the TAU group only received the phone call. At baseline, and again at two and four months, participants completed four scales: World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), DSM-5 Self-Rated Level Cross-Cutting Symptom Measure—Adult (DSM-5), Cohen Perceived Stress Scale-10 (PSS-10), and Degner Control Preferences Scale (CPS). These scales and their psychometric properties are discussed in more detail in the appendix. Demographic and clinical information were obtained from clinic records.

### **Human Subjects**

The research protocol was approved by the Institutional Review Board (IRB) at the University of Maryland, Baltimore protocol number HP-00060928.

### **Power and Sample Size**

Sample size calculation was based on Cohen's guidelines.<sup>90</sup> For a study of medium Effect Size (Cramer's V/Phi of 0.30, 1df), power of 0.80, and  $\alpha$  of 0.05, a sample size of 87 participants in each group were estimated to be required for a total of 174

participants. Rounding up to allow for dropouts yielded an estimated sample size of 200 participants for a full study. Since this was a pilot study a target of 100 participants was set based on similar studies in the literature ranging from 76 to 123 participants<sup>33,49,91</sup>

### **Overview of Manuscripts**

The following three chapters present the various manuscripts that include one published article and two manuscripts in preparation for submission. These articles were developed in accordance with the requirements of the dissertation manuscript option and encompass the aims of the study.

The article titled “The Use of Phone Technology in Outpatient Populations: a Systematic Review” is presented in Chapter 2 and was published in *The Open Nursing Journal* in June 2016. This was a systematic review of the literature on phone technology being used in adult outpatient populations, with special focus on psychiatric populations and Hispanic patients. Chapter 3, titled “Do Text Reminders Improve Follow-Up Appointment and Medication Adherence in Psychiatric Outpatient Populations?” is in preparation for submission to the *Journal of the American Medical Informatics Association*. This manuscript addresses Aim 1, which focuses on whether patients receiving text message reminders show improvements in follow-up appointment and medication adherence. Lastly, Chapter 4, titled “The Effects of Adherence on Psychiatric Symptoms and Mental and Physical Well-Being” is in preparation for submission to *Internal Medicine Review*. The focus of this manuscript is Aim 2, which examines whether patients who have overall adherence, to both follow-up appointments and their medication regimens, demonstrate improvement in various facets of well-being.

## CHAPTER 2 THE USE OF PHONE TECHNOLOGY IN OUTPATIENT POPULATIONS: A SYSTEMATIC REVIEW<sup>1</sup>

### Abstract

**Objective:** A systematic review was conducted to identify the types of phone technology used in the adult outpatient population with a focus on Hispanic patients and psychiatric populations.

**Methods:** A search for articles was conducted on the EMBASE, PubMed and PsycINFO databases. Articles reviewed were peer-reviewed, full- text, English language and published through mid-November 2014.

**Results:** Twenty-one articles were included in this review and grouped according to combinations of phone technology, medical specialty area and population. For all articles, phone technology was defined as telephone, cell, or smart phone. Technology was used in psychiatry with Hispanic population in four articles, in psychiatry with non-Hispanic population in seven articles and in other specialties with Hispanic population in ten articles. Articles were evaluated for quality. Six articles were assessed as strong, eight were moderate and seven were weak in global quality. Interventions included direct communication, text messaging, interactive voice response, camera and smart phone app. Studies with Hispanic populations used more text messaging, while studies in psychiatry favored direct communication. The majority of articles in all groups yielded improvements in health outcomes.

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<sup>1</sup> Duarte AC, Thomas SA. The Use of Phone Technology in Outpatient Populations: A Systematic Review. *Open Nurs J.* 2016;10(Suppl 1: M3):45-58.  
doi:10.2174/1874434601610010045

**Conclusion:** Few studies have been conducted using phone technology in Hispanic and psychiatric populations. Various phone technologies can be helpful to patients in diverse populations and have demonstrated success in improving a variety of specific and overall healthcare outcomes. Phone technologies are easily adapted to numerous settings and populations and are valuable tools in efforts to increase access to care.

### **Introduction**

Alexander Graham Bell's invention, the telephone, fundamentally transformed person-to-person communications, allowing efficient and immediate voice contact between two remote parties.<sup>92</sup> In the almost 140 years since its introduction, this communications technology has experienced an explosive evolution. Mobile phones and personal digital assistants (PDAs) have been widely available to the public for almost three decades.<sup>93</sup> Wireless technology continued to advance rapidly and the mobile phone's most recent incarnation, the smart phone, has propelled growth in this technology and similar devices to the present day.<sup>94</sup> Like the introduction of computers into households across the globe, the evolution of mobile technology has changed the way people communicate and access information.

The term Digital Divide refers to inequalities in access to internet. While this situation may have been the case in the past, this gap has been shrinking at a very rapid pace. Year-end estimates for 2014 worldwide cell phone subscriptions in developed countries were expected to near 1.5 billion, which translates to approximately 121 subscriptions per 100 inhabitants.<sup>95</sup> Today, cell phone ownership among Americans is at 91%, minority groups are more likely to use a smart phone for internet access, and Blacks, whites, and Hispanics are equally likely to own mobile phones.<sup>12,96</sup> Additionally,

80% of smart phone owners surveyed worldwide by the analytics software company FICO were interested in using their phones for healthcare communications, specifically seeking reminders of upcoming appointments (76%) as well as reminders to make appointments or take medications (69%).<sup>97</sup> A 2013 PEW survey found that 56% of American adults own a smart phone as opposed to more basic cell phone models, up from 46% the year before and 35% two years prior.<sup>98</sup> This growth trends across gender, age, race, and cultural/ethnic demographics. The high rates of ownership and usage of the instruments to access health information on the internet, as well as strong user preferences for healthcare communications *via* smart phone, suggest that this widespread personal technology can be useful in reducing health disparities and improving access to healthcare *via* increased communication.<sup>97,99,100</sup>

Mental health issues are of serious concern and place a great burden on all levels of society. Individuals, families, and entire communities are affected, and access to care is a barrier worldwide. The gaps between mental healthcare demand and supply are estimated at 76%-85% in low and middle-income countries and between 35% and 50% in high- income countries by the World Health Organization (WHO).<sup>101</sup> U.S. Healthy People 2020 guidelines identify increasing access to mental health and a focus on prevention as important goals, placing increased demands on both mental and physical healthcare resources.<sup>4</sup> Improved adherence to treatment regimens yields improved patient outcomes. Despite increased demand and attempts to address it, patients continue to have trouble adhering to both appointments and medication regimens resulting in sub-optimal outcomes.<sup>5-10</sup>

Several reviews have examined the use of cell and voice technology in enhancing self-care and disease management, behavioral changes, preventive care, and appointment attendance in a variety of healthcare settings, age groups, and health conditions with particular progress in the realm of text messaging interventions.<sup>102–105</sup> The majority of studies identified in these reviews were conducted in countries other than the U.S. While two Cochrane reviews<sup>104,105</sup> examined trials in low, middle, and high-income countries, none of the reviewed studies specifically examined racial, ethnic, or socioeconomic minority groups. Likewise, none of the reviews yielded studies targeting phone interventions in the psychiatric specialty area.

The goal of this review is to identify and evaluate the types of phone technology used in the adult outpatient population, focusing on Hispanic patients and psychiatric populations, two areas not reviewed in depth to the authors' knowledge. The results of this review will identify quality of existing studies and gaps in the literature, both of which will bring to light areas for further research. Innovative technological interventions specifically directed toward these populations, which are vulnerable due to health disparities or the stigma of illness, may lead to improved appointment and medication adherence and yield improved health management and outcomes.

## **Methods**

### **Design**

A systematic review was conducted using the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.<sup>106,107</sup> Relevant articles were identified and selected for ultimate review, synthesis, and grading of the evidence. Because studies were expected to be of diverse types, settings,

comparators and outcomes, this systematic review did not lend itself to the additional step of conducting a meta-analysis.<sup>108</sup>

### **Literature Search**

The PRISMA Statement<sup>106,107</sup> also guided the literature search. *A priori* criteria for inclusion yielded studies that were peer-reviewed, full-text, English language, conducted in any country and involved human subjects over the age of 18. Inclusion criteria used phone technology intervention with either a psychiatric and/or Hispanic population. Specifically excluded were review articles, meta-analyses, case studies, as well as dissertations and poster presentations. Systematic searches were conducted on three electronic databases, EMBASE, PubMed, and PsycINFO (EBSCO). An initial search was performed in early March 2013 for all articles to date; because technology use in healthcare is relatively new, no lower date parameter was used to exclude older studies initially, though during full-text screening, articles published before 2003 were eliminated. A second search was conducted in early November 2014 to include new articles since the first search. Google Scholar and hand searches of full-article reference lists were also performed with each series of electronic database searches.

Searches were conducted using various combinations of terms in the following broad categories: psychiatry, adherence, technology, and Hispanic. Specific search terms have been summarized in Table 2.1.

**Table 2.1. Summary of systematic search terms by general category**

General Category	Search Terms
Psychiatry	mental disorders, mental health, mental health services, psychiatric
Adherence	adherence, appointment adherence, appointment compliance, compliance, follow up, medication adherence, medication compliance, medication follow up, medication management, patient adherence, patient compliance, self care, self management, treatment adherence, treatment compliance
Technology	applications, apps, interactive, internet, mhealth, mms, mobile health, multimedia, multi media, multimedia messag*, short messag*, sms, social media, tablet*, texted, texting, cell phone, cellular phone, computer assisted, internet based, mobile phone, online, smartphone, smart phone, telecommunications, telemedicine, telephone, text messag*, wireless phone, wireless telephone
Hispanic	Central American, Cuban, Hispanic American, Latin American, Mexican, Puerto Rican, Salvadoran, Hispanic*, Latino*, Spanish speaking

Two reviewers independently followed a three-step screening process to narrow down the list of studies for final evaluation in this systematic review: (i) screening by title; (ii) screening by abstract; and (iii) screening of full-text articles. Prior to moving forward, consensus was achieved at each step.

### **Data Extraction**

Data extraction was performed by one reviewer who created three detailed evidence tables with the following information from each article: author, year, location, study design, sample size, population, setting, technology and intervention, comparators and main outcomes. Both reviewers confirmed accuracy of table data by re-checking against the original articles. Any data discrepancies were discussed and appropriate changes or corrections made. An additional column was added to each evidence table reflecting global quality rating.

### **Quality Assessment**

Quality of the studies was evaluated using the Qualitative Assessment Tool for Quantitative Studies (QATQS).<sup>109,110</sup> Validity and reliability, in randomized as well as non-randomized studies, have been demonstrated for the QATQS.<sup>110,111</sup> Eight

components of quality are examined by the QATQS: (i) selection bias, (ii) design, (iii) confounders, (iv) blinding, (v) data collection, (vi) withdrawals and drop-outs, (vii) intervention integrity, and (viii) analysis appropriate to question. Ratings of strong, moderate or weak are assigned to each of the first six components, in accordance with the tool’s guide and dictionary. These individual ratings are combined to produce a global quality rating (Table 2.2). Each reviewer performed an independent evaluation, then both came together to discuss discrepancies and arrive at 100% agreement on final study quality ratings.

**Article Evaluation**

Each article was analyzed in the context of technology used, population and medical specialty area. Three detailed evidence tables were created, grouping articles by phone technology, population, and specialty and including summarized information from each article, as well as quality rating per the QATQS.<sup>109</sup>

**Table 2.2. QATQS assessment and grading criteria**

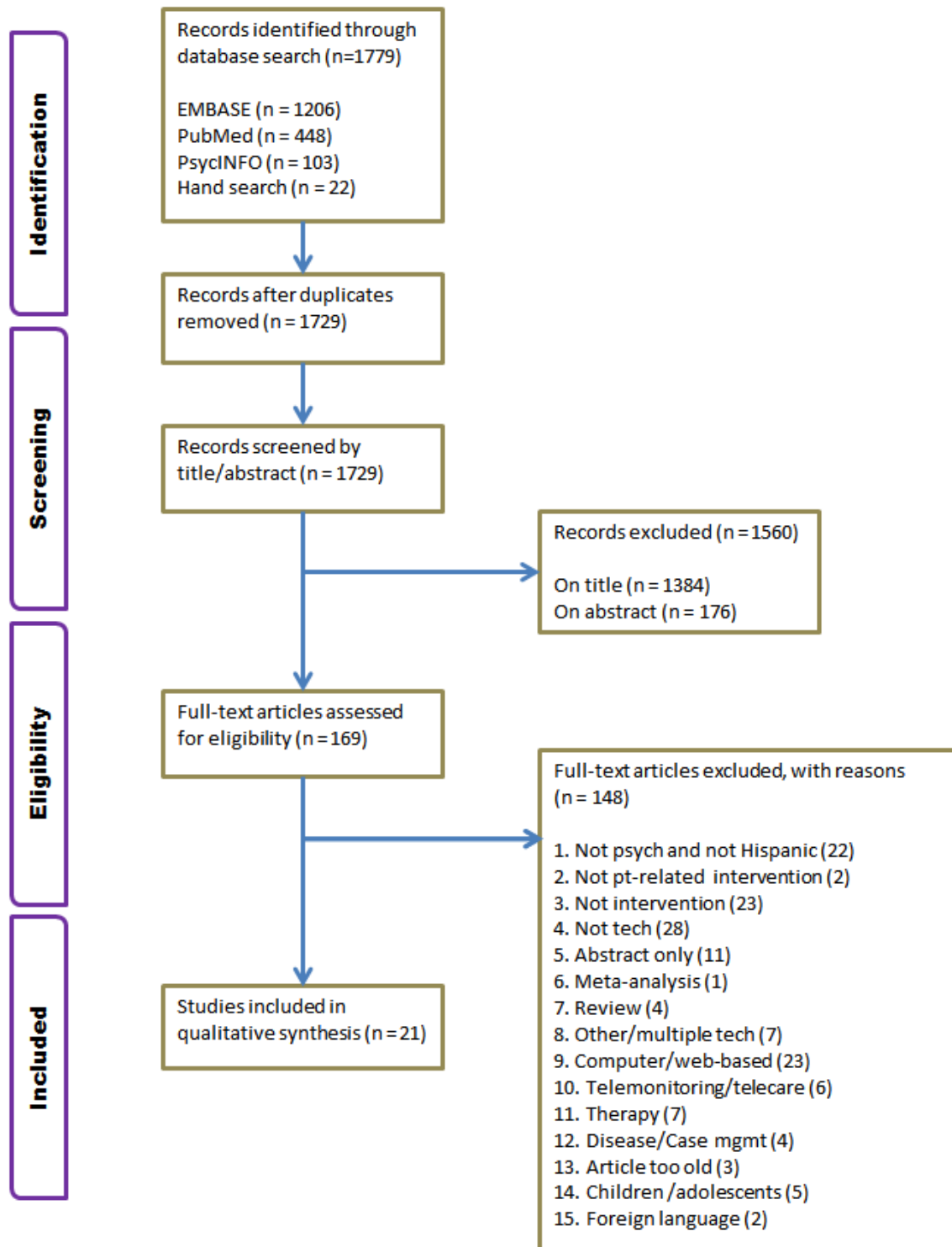
<b>Quality Component</b>	<b>Assessment Criteria</b>
Selection Bias	Degree to which participants are representative of target population Percentage of study candidates who agreed to participate
Design	Study design Description of randomization process Appropriate randomization sequence
Confounders	Controlling of confounders via design Baseline balance as to confounders
Blinding	Outcome assessors Participants
Data Collection	Reliability and validity of assessment tools/methods
Withdrawals and Drop-Outs	Reporting of withdrawal numbers and reasons Percentage of participants completing the study
Intervention Integrity	Percentage of participants receiving intended intervention Measurement of consistency of intervention administration Contamination/unintended intervention
Analysis Appropriate to Question	Level of allocation and analyses Appropriateness of statistical methods to study design Analyses for intention-to-treat
<b>Global Quality Rating</b>	Strong = 4 strong ratings and 0 weak ratings Moderate = less than 4 strong ratings and 1 weak rating Weak = 2+ weak ratings

## Results

Initial literature searches yielded 1,757 articles from the databases and hand searches yielded an additional 22 articles (Figure 2.1). Fifty articles were duplicates, leaving 1,729 articles to be screen by title and abstract. Of these, 1,384 were excluded on title and 176 were excluded on abstract. After full-text assessment of 169 articles, 21 were retained in the final list for qualitative synthesis.<sup>29,40,78,81,91,112–118,41,119,49,63–66,75,76</sup>

The articles were grouped as follows for analysis: (i) four articles using phone technology in psychiatry with Hispanic populations,<sup>66,114,115,119</sup> (ii) seven articles using phone technology in psychiatry with non-Hispanic populations,<sup>29,63–65,75,76,117</sup> and (iii) ten articles using phone technology in other specialties with Hispanic populations.<sup>40,41,49,78,81,91,112,113,116,118</sup> For all articles, phone technology was defined as telephone, cell, or smart phone. The term psychiatry encompassed articles specific to the field, as well as articles in other disciplines that targeted psychiatry-specific outcomes. Of the 21 studies, ten were randomized controlled studies (RCTs),<sup>29,49,66,78,81,112–114,117,118</sup> nine were cohort studies,<sup>40,41,63,64,75,91,115,116,119</sup> and two were controlled clinical trials (CCTs).<sup>65,76</sup> With one exception,<sup>29</sup> all articles reported on studies conducted in the United States.

Figure 2.1. Flow diagram for literature search



## **Technology Use in Psychiatry with Hispanic Populations**

Four articles (two RCTs and two cohort studies)<sup>66,114,115,119</sup> described interventions using phone technology in Hispanic populations with outcomes specifically in the realm of psychiatry. Details regarding these studies can be found in Table 2.3. A total of 2,205 participants were included in the studies, the majority in safety net populations<sup>66,119</sup> and the remainder in the general population.<sup>114,115</sup> Two articles<sup>66,114</sup> were of strong quality while one each were found to be of moderate<sup>115</sup> and weak<sup>119</sup> quality.<sup>109</sup>

All four articles used phone technology interventions for mental health outcomes, though none specified the type of phone used in the intervention. Two articles described studies in breast cancer survivors; one used telephone psycho- education to address depression in this population<sup>114</sup> and the other used therapy and cancer education to help with more general mental health support.<sup>115</sup> The other two articles addressed studies using phone technology for depression in individuals with diabetes; the first provided collaborative care using the telephone<sup>66</sup> and the second used a telephone interactive voice response (IVR) system.<sup>119</sup> Two articles<sup>66,114</sup> reported improvement in depressive symptoms. Additionally, one of these articles<sup>66</sup> noted ongoing depression treatment and overall improvement in quality of life, but did not report significant differences in clinical outcomes for diabetes as a result of the intervention. A third article reported significant improvements in psychological, physical, social, and spiritual QOL.<sup>115</sup> The remaining article<sup>119</sup> did not report any outcomes as it described a study currently underway.

**Table 2.3. Articles that included technology use in psychiatry with Hispanic populations**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
Ashing, 2014 <sup>114</sup> USA, CA RCT	n=252/Randomized n=221 (I: n=110, 99 completed, C: n=111, 100 completed); 18+ y.o., English or Spanish speaking Latina BCA survivors via CA Cancer Registry; general population	<u>Telephone.</u> Eight bi- weekly psycho- educational interventions, 40-50 minutes plus survivorship booklet.	Survivorship booklet only.	<u>Level of depressive symptoms.</u> Over time, within language group, significantly decreased. Follow-up also showed significant decrease in symptoms. By language preference, both English and Spanish language- preferred showed significant decrease from baseline to follow-up.	Strong
Badger, 2013 <sup>115</sup> USA, AZ Cohort	n=80 dyads (160 total) (I: n=40, C: n=40), Latina BCA survivors and their supportive partners; general population	<u>Telephone.</u> (TIP-C intervention) Weekly interpersonal psychotherapy + CA education for BCA survivors, every other week for supportive partners. English or Spanish.	(THE intervention) Standardized educational materials sent prior to intervention, reviewed over the phone. Weekly sessions for BCA survivors, every other week for supportive partners. English or Spanish.	<u>Psychological, physical, social, and spiritual QOL.</u> Significant improvements (in all EXCEPT spiritual) for BCA survivors in both groups over time. Significant improvements (in ALL QOL areas) for supportive partners in both groups over time. No	Moderate

Table 2.3. Articles that included technology use in psychiatry with Hispanic populations (cont'd.)

First Author, Year Location Study Design	Sample Sizes/ Population/ Setting	Technology/ Intervention	Comparators	Main Outcomes Intervention v. Comparators	Global Quality Rating
				clear support demonstrating one intervention better than the other.	
Ell, 2011 <sup>66</sup> USA, CA RCT	n=387 (I: n=193, 138 @ 24 mos; C: n=194, 126@ 24 mos) low-income adults with diabetes & depression - part of Multifaceted Diabetes and Depression Program (MDDP); English or Spanish speaking, in primary safety net care	<u>Telephone.</u> Educational pamphlets and resource lists plus socioculturally adapted collaborative care for depression in primary care (psychotherapy, antidepressants, or both; telephone symptom monitoring & relapse prevention)	Enhanced Usual Care includes same pamphlets and resource lists as intervention group. PCPs also could Rx antidepressants and provide counseling or refer for community mental health.	<u>Depression care.</u> More going Tx at 24 months; <u>Depression symptoms.</u> Improved at 24 month; <u>QOL.</u> Overall improvement, narrowing over time, not significant at 24 mos; <u>DM clinical outcomes.</u> No significant differences.	Strong
Wu, 2014 <sup>119</sup> USA, CA Cohort	n=1406 (I: n=442, C1: n=484, C2: n=480) low-income, predominantly Hispanic/Latino adults with diabetes, English or Spanish speaking, county safety net clinics	<u>Telephone IVR.</u> Technology-facilitated depression care (TC). Educational/resource materials + calls from automated telephonic assessment (ATA) call system. Monthly ATA calls for depressed at baseline, Q 3 mos. for not depressed at baseline. TC group also gets telephone appt reminders.	In addition to educational and resource materials: 1) Usual care (UC), traditional clinic depression and diabetes care; 2) Collaborative care team supported care (SC) includes RN, NP, SW to assist with MH issues for 6 mos, then return to usual care.	<u>Depression outcomes.</u> <u>Treatment adherence.</u> <u>Social and economic stress reduction.</u> <u>DM self-care mgmt.</u> <u>Health care utilization.</u> <u>Care mgmt. model cost.</u> <u>Cost-effectiveness.</u> <u>Comparisons.</u> No results; project in progress. Goal: reduce health disparities via	Weak

**Table 2.3. Articles that included technology use in psychiatry with Hispanic populations (cont'd.)**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
				improved outcomes and reduced costs.	

Abbreviations: RCT=randomized controlled trial, I=intervention, C=comparator, y.o.=years old, BCA=breast cancer, CA=cancer, TIP-C=telephone interpersonal counseling, THE=telephone health education, QOL=quality of life, mos=months, PCPs=primary care providers, Rx=prescribe, Tx=treatment, DM=diabetes mellitus, IVR=interactive voice response, appt=appointment, RN=registered nurse, NP=nurse practitioner, SW=social worker, MH=mental health.

### **Technology Use in Psychiatry with Non-Hispanic Populations**

Phone technology interventions in non-Hispanic populations targeting outcomes in the area of psychiatry are described in seven articles (two RCTs, two CCTs, and three cohort studies).<sup>29,63-65,75,76,117</sup> Study details are described in Table 2.4. These studies included a total of 45,767 participants. Four studies included subjects from the general population,<sup>63-65,76</sup> two studies involved people who had completed inpatient programs<sup>29,117</sup> and one study recruited from a federally qualified health center (FQHC).<sup>75</sup> Two articles were rated strong in quality,<sup>29,117</sup> two were rated moderate,<sup>65,75</sup> and the remaining three were rated weak.<sup>63,64,76</sup>

Three articles described the use of cell or mobile phone interventions<sup>29,75,76</sup> while the remaining four did not specify the type of phone used in the intervention.<sup>63-65,117</sup> The three articles using mobile phone interventions all did so in participants with substance abuse problems. One pilot study conducted in Ireland used a text messaging intervention in a group of patients diagnosed with depression and alcohol abuse.<sup>29</sup> Another pilot used IVR in the dually-diagnosed homeless population.<sup>75</sup> The last of these articles used cell phone cameras to take pictures of morning medications of methamphetamine-dependent individuals.<sup>76</sup> Of the remaining four articles, three involved counseling or support call

interventions for patients with depression,<sup>63</sup> serious and persistent mental illness (SPMI)<sup>65</sup> and posttraumatic stress disorder (PTSD) in veterans,<sup>117</sup> while one used IVR technology in depression.<sup>64</sup> Of five articles addressing medication adherence, four reported improvements or high levels of adherence<sup>63,65,75,76</sup> and one reported no significant impact to adherence, though age was identified as a confounder.<sup>64</sup> In addition, one study reported greater likelihood of therapy continuation, improvements in refill timeliness, symptom burden and severity, and mental quality of life (QOL) with no improvements in physical QOL.<sup>63</sup> Other studies reported high ability to reach participants using technology and subjective improvements in communications,<sup>75</sup> as well as decreased emergency department (ED) utilization<sup>65</sup> and usefulness of the technology in measuring adherence.<sup>76</sup> The article focusing on depression and alcoholism reported improved depression, abstinence, and functioning, while noting no significant difference in compulsion to drink.<sup>29</sup> Lastly, the study addressing PTSD reported no significant differences in PTSD or depression, aggressive behaviors, alcohol or drug problems, QOL, time to rehospitalization, or engagement in care.<sup>117</sup>

**Table 2.4. Articles that included technology use in psychiatry with non-Hispanic populations**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
Agyapong, 2012 <sup>29</sup> Ireland RCT (Pilot)	n=54 (I: n=26, C: n=28) adult pts w/depression and ETOH; completers of inpatient program	<u>Mobile phone.</u> BID supportive text messages.	Thank-you text messages every 2 weeks.	<u>Depression and abstinence.</u> Improved. <u>Functioning.</u> Improved. <u>Compulsion to drink.</u> No significant difference.	Strong

**Table 2.4. Articles that included technology use in psychiatry with non-Hispanic populations (cont'd.)**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
Aubert, 2003 <sup>63</sup> USA Cohort	n=5624 (I: n=505, C1: n=1375, C2: n=3744) adult insurance pharma plan members with depression with new prescription (none in last 180 days) for an antidepressant medication; general population	<u>Telephone.</u> Four telephone counseling calls. Five educational mailings. Toll-free number set up for participant questions.	1) Minimal intervention: completed first call but did not consent to continuing interventions. 2) No interventions.	<u>Medication adherence.</u> Improved. <u>Therapy continuation.</u> More likely. <u>Refill timeliness.</u> Improved. <u>Symptom burden.</u> Improved. <u>QOL-mental.</u> Improved. <u>QOL-physical.</u> No significant difference. <u>Symptom severity.</u> Improved.	Weak
Burda, 2012 <sup>75</sup> USA, MD Cohort (Pilot)	n=10 adult homeless dual-Dx'd pts, mostly black, mostly men; FQHC	<u>Cell phone IVR.</u> Daily phone calls, two attempts.	None	<u>Medication adherence.</u> High levels reported. <u>Ability to reach participants.</u> High. <u>Subjective report of communications.</u> Improved.	Moderate
Castle, 2012 <sup>64</sup> USA, PA Cohort	n=39,020 (I1: n=293, I2: n=11,280, I3: n=27,447) adult insurance pharma plan members newly Rx'd antidepressant medication; general population	<u>Telephone IVR.</u> Calls to participants with option to listen then transfer to depression mgmt program. If not reached, msg left with callback number.	3 a posteriori intervention groups: 1) reached, transferred, 2) reached, not transferred, 3) not reached.	<u>Medication adherence.</u> Not significantly impacted by intervention. Age was confounder, as increase in adherence seen with increasing age.	Weak
Cook, 2008 <sup>65</sup> USA, CO CCT	n=202 (I: n=51, C: n=151) adult Medicaid members SPMI, received 2nd gen antipsychotic in last 30 days;	<u>Telephone.</u> Adherence counseling via CBT/MI. F/U written materials upon completion.	Not contacted after multiple attempts.	<u>ED Utilization.</u> Decreased. <u>Medication adherence.</u> Improved.	Moderate

**Table 2.4. Articles that included technology use in psychiatry with non-Hispanic populations (cont'd.)**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
	mostly women; general population				
Galloway, 2011 <sup>76</sup> USA, CA CCT	n=20 methamphetamine-dependent adults, men and women; general population	<u>Cell phone.</u> For 8 weeks, subjects took pictures of daily morning medication at time of administration. Time-stamped photos e'mailed to data collection account.	Medication Event Monitoring System (MEMS) caps on bottles, weekly pill counts.	<u>Medication adherence.</u> High levels reported. Photos of medication useful in measuring adherence.	Weak
Rosen, 2013 <sup>117</sup> USA, CA RCT	n=837 (I: n=412, C: n=425) veterans entering residential PTSD treatment; men and women, multi-site, post-discharge	<u>Telephone.</u> Standard outpatient care plus bi-weekly phone monitoring and support for 3 months post-discharge.	Standard outpatient aftercare: referral to outpatient counselors, psychiatrists, or both.	<u>PTSD symptoms, aggressive behaviors, ETOH and drug problems, depression, QOL., time to rehospitalization, engagement in care.</u> No significant differences.	Strong

Abbreviations: RCT=Randomized Controlled Trial, I=intervention, C=comparator, ETOH=alcohol, BID=twice daily, pharma=pharmacy, QOL=quality of life, Dx'd=diagnosed, FQHC=Federally qualified health center, IVR=interactive voice response, Rx'd=prescribed, mgmt=management, msg=message, CCT=controlled clinical trial, SPMI=serious and persistent mental illness, 2<sup>nd</sup> gen=second generation, CBT/MI=cognitive behavioral therapy/motivational interviewing, F/U=follow up, ED=emergency department, PTSD=post-traumatic stress disorder.

### **Technology Use in Other Specialties with Hispanic Populations**

Ten articles fell into the category of phone technology use with Hispanics in other medical specialty areas (six RCTs and four cohort studies).<sup>40,41,49,78,81,91,112,113,116</sup> Details of these studies are listed in Table 2.5. A total of 1,615 participants were included in these studies. Subjects were recruited from general populations for three studies,<sup>81,91,116</sup> safety net populations for three studies,<sup>40,112,113</sup> FQHC for two studies,<sup>41,118</sup> and one each from county health department<sup>49</sup> and community settings.<sup>78</sup> Using QATQS rating

criteria,<sup>109</sup> two articles were determined to be of strong quality,<sup>112,118</sup> five of moderate quality,<sup>40,49,78,81,113</sup> and three were considered of weak quality.<sup>41,91,116</sup>

Eight articles described the use of cell or smart phone technology as the study intervention,<sup>40,41,49,91,112,113,116,118</sup> while two did not specifically describe the type of instrument used.<sup>78,81</sup> The eight cell phone studies represented a variety of populations. Three articles described studies using text messaging in subjects with diabetes<sup>40,41,113</sup>; two of these were pilot studies.<sup>40,41</sup> Three more pilot studies of text messaging were conducted with participants who were pregnant,<sup>49</sup> overweight or obese,<sup>116</sup> and in patients with hypertension.<sup>118</sup> One text messaging intervention was used in post-emergency department (ED) follow-up patients<sup>112</sup> and one pilot intervention study used IVR in healthy construction workers.<sup>91</sup> The two interventions that did not specify the type of phone included one study that made calls to women about mammography<sup>81</sup> and another using telephone IVR in individuals with diabetes.<sup>78</sup>

Four studies focused on diabetes management. One article described improvements in healthy behaviors, self- efficacy, and medication adherence, but no improvement in disease knowledge.<sup>40</sup> A second article also reported improvements in these same areas, in addition to improved clinical outcomes, disease knowledge, and QOL, most notably in the Spanish-speaking subgroup, but all lacking statistical significance.<sup>113</sup> A third article reported a high response rate to prompting for glucose monitoring but no improvement in appointment attendance rates.<sup>41</sup> The last article in the diabetes management group described two studies, the first of which did not use phone technology but provided participants for the second study that did use technology. The latter study yielded significant improvement in glucose monitoring.<sup>78</sup> The remaining

articles discussed studies that targeted a wide range of health outcomes. In one article, increased screening mammograms were reported. Though the increase itself was not statistically significant; some predictors with significance include age, study group, prior mammograms, knowledge of when to begin getting mammograms.<sup>81</sup> Significant improvements were demonstrated in post-ED follow-up visits,<sup>112</sup> health beliefs regarding preparation for motherhood,<sup>49</sup> and weight management behaviors and clinical indicators.<sup>116</sup> One study showed improvements in resting and ambulatory blood pressure (BP), with significance in the former outcome measure, as well high levels of program acceptability and adherence.<sup>118</sup> One final article discussed demonstrated adherence to health diary keeping.<sup>91</sup>

**Table 2.5. Articles that included technology use in other specialties with Hispanic populations**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
Allen, 2005 <sup>81</sup> USA, CA RCT	n=430 (I: n=219, C: n=211) Black and Hispanic women; general population near ambulatory care center	<u>Telephone.</u> Tailored telephone counseling calls to provide mammogram recommendation information.	Phone calls to inquire if participant had screening mammogram since enrollment.	<u>Screening mammogram between baseline and 6-month follow-up.</u> Self-report; more screening mammograms, but not significant. Predictors with significance: age, study group, prior mammograms, knowledge of age when women should begin regular mammograms.	Moderate

**Table 2.5. Articles that included technology use in other specialties with Hispanic populations (cont'd.)**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
Arora, 2012 <sup>40</sup> USA, CA Cohort (Pilot)	n=23 resource-poor pts with diabetes, men and women, Spanish or English speaking; safety net population	<u>Cell phone.</u> Daily text messages, unidirectional, English or Spanish. Educational/motivational, medication reminders, healthy living challenges, trivia messages, phone link message to allow participants to call in for free tool for DM management.	None	<u>Healthy behaviors, DM self-efficacy, medication adherence.</u> All showed improvement. <u>Diabetes knowledge.</u> No change. <u>Satisfaction scores.</u> Favorable.	Moderate
Arora, 2014a <sup>112</sup> USA, CA RCT	n=328 (I: n=146, C: n=182) low-income English- and Spanish-speaking pts needing follow-up after ED visit	<u>Cell phone.</u> Text message appointment reminders, unidirectional, English or Spanish.	Usual care: written follow-up appointment reminders.	<u>Post ED follow-up visits.</u> Significantly improved.	Strong
Arora, 2014c <sup>113</sup> USA, CA RCT	n=128 (I: n=64, C: n=64) adult patients with poorly controlled diabetes; men and women, Spanish or English speaking, urban, public ED safety net population	<u>Cell phone.</u> Daily text messages, unidirectional, English or Spanish. In addition to usual care. Educational/motivational, medication reminders, healthy living challenges, trivia messages.	Usual care: not defined.	<u>HbA1C, medication adherence.</u> Improvement, but not statistically significant. <u>ED use in follow-up period.</u> Decreased. <u>Self-efficacy, self-care, diabetes knowledge, QOL.</u> Also improved, not significant. <u>ALL improvements.</u> Greater in Spanish-speaking subgroup. <u>Satisfaction scores.</u> Intervention	Moderate

**Table 2.5. Articles that included technology use in other specialties with Hispanic populations (cont'd.)**

<b>First Author, Year Location Study Design</b>	<b>Sample Sizes/ Population/ Setting</b>	<b>Technology/ Intervention</b>	<b>Comparators</b>	<b>Main Outcomes Intervention v. Comparators</b>	<b>Global Quality Rating</b>
				very highly rated.	
Evans, 2012 <sup>49</sup> USA, VA RCT (Pilot)	n=123 (breakdowns between I and C groups unavailable) low-income pregnant women, mostly Hispanic; county health department	<u>Cell phone.</u> Text messages providing prenatal education/tips + usual care.	Usual care: prenatal counseling and care.	<u>Agreement with belief in preparation for motherhood.</u> Significantly improved.	Moderate
Fischer, 2012 <sup>41</sup> USA, CO Cohort (Pilot)	n=47 low-income adult pts with diabetes; English and Spanish speaking; FQHC	<u>Cell phone.</u> Text messages, two-way: prompts for blood sugar measurement and appointment reminders; pts respond to both and also receive acknowledgement text. English or Spanish.	None	<u>Response to text message prompts, including glucose data.</u> High rate of response. <u>Appointment attendance rates.</u> No difference from pre-intervention rates.	Weak
Grzywacz, 2013 <sup>91</sup> USA, NC Cohort (Pilot)	n=119 Latino construction workers; non-probability sample; age 19+; general population	<u>Cell phone IVR.</u> VoiceXML application for participant entry of daily health diary information via keypad.	None	<u>Adherence to diary keeping.</u> Over one-third adhered; feasibility supported.	Weak
Kolodziejczyk, 2013 <sup>116</sup> USA, CA Cohort (Pilot)	n=20 adult, overweight or obese, English- or Spanish-speaking; general population	<u>Cell phone.</u> Tailored daily text messages (3-5) for 8 weeks + binder w/weekly weight management literature + weekly (10-15 min) counseling calls for encouragement/reinforcement. English or Spanish.	None	<u>Weight, BMI.</u> Significant decrease. <u>Weight management behaviors.</u> Significant increase. <u>Feasibility and acceptability.</u> Favorable.	Weak
Lorig, 2008 <sup>78</sup>	n=567 (Study (A) I: n=219, C: n=198)	<u>STUDY (A) No phone.</u> SDSMP	(A) Usual care: ranging	(A) 6-month: <u>HbA1C, health</u>	Moderate

**Table 2.5. Articles that included technology use in other specialties with Hispanic populations (cont'd.)**

First Author, Year Location Study Design	Sample Sizes/ Population/ Setting	Technology/ Intervention	Comparators	Main Outcomes Intervention v. Comparators	Global Quality Rating
USA, CA RCT	(to reinforcement study only: n=34; randomized to reinforcement study: n=116); Study (B) I: n=184, C: n=203 (all previously received SDSMP)) Spanish-speaking adults with type 2 diabetes; re-randomized from first study to second study; community settings	Community-based, peer-led, 6-week program. <u>STUDY (B) Telephone IVR</u> . Monthly reinforcement call: 1) greeting/participant rating of ability to manage DM in next month, 2) choice to listen or not listen to two 90-second vignettes, 3) opportunity to leave message. Staff member response to message, if needed.	from community clinics to specialist care; (B) No reinforcement call.	<u>distress, hypo-/hyper-glycemia, self-efficacy</u> . All significantly improved. (A) 18-month: same as 6-month plus <u>self-reported global health, communication w/physician</u> . All significantly improved. <u>ALSO: physician and ED visits</u> . Decreasing trend. (B) 18 month: <u>Glucose monitoring</u> . Significantly improved. Otherwise, no other significant differences.	
Sieverdes, 2013 <sup>118</sup> USA, SC RCT (Pilot)	n=10 (I: n=5, C: n=5) adult Hispanic pts with HTN, men and women 50/50; FQHC	<u>Smart phone</u> . SMASH app auto-collect home BP (BID every 3 days) + electronic med tray data (daily). Phone reminder for BP, med tray (or phone if needed) reminder for med. Abnormal data prompted contact from study coordinator or nurse. Written & oral adherence info provided to pts. Text, e'mail, or periodic voice motivational/reinforcement messages.	Usual care: not defined.	<u>Provider and pt acceptability</u> . High. <u>Program adherence</u> . Good to excellent. <u>Resting BP</u> . Significant improvement. <u>Ambulatory BP</u> . Improvement but not significant.	Strong

Abbreviations: RCT=randomized controlled trial, I=intervention, C=comparator, DM=diabetes mellitus, ED=emergency department, HbA1C=hemoglobin A1C, QOL=quality of life, FQHC=Federally qualified health center, IVR=interactive voice response, VoiceXML=voice extensible markup language, BMI=body mass index, SDSMP=Spanish Diabetes Self-Management Program, HTN=hypertension, SMASH= Smartphone Medication Adherence Stops Hypertension, BID=twice daily, med=medication, BP=blood pressure, pts=patients.

## **Discussion**

This systematic review identified and evaluated studies using phone technology interventions in outpatient populations published between 2003 and 2014. Specific focus was placed on Hispanic patients and psychiatric populations. Using QATQS criteria,<sup>109</sup> six articles were assessed as strong,<sup>29,66,112,114,117,118</sup> eight were moderate,<sup>40,49,65,75,78,81,113,115</sup> and seven were weak in global quality.<sup>41,63,64,76,91,116,119</sup>

Studies included in this review demonstrate the variety of settings, patient populations, and health outcomes for which phone technology was used successfully. Eighteen studies yielded improvements in their outcome measures. Only two articles reported no improvements or equivocal results<sup>41,64</sup> and one article reported no results at all, as it is an active study.<sup>119</sup> The types of phone technologies most frequently used in the articles were direct communication, in seven studies,<sup>63,65,66,81,114,115,117</sup> text messaging, in seven studies,<sup>29,40,41,49,112,113,116</sup> and IVR, in five studies.<sup>64,75,78,91,119</sup> Two other studies each used camera<sup>76</sup> and a smart phone application (app).<sup>118</sup> Most articles specifying the use of cell phones were unclear as to type of phone, and only one study specifically mentioned the use of a smart phone intervention. Given the trend toward increasing smart phone ownership over basic cell phones,<sup>98</sup> future studies would do well to capitalize on the myriad specialized functions of these communication devices.

### **Phone Technology**

In studies with Hispanic participants, text messaging was the phone technology used most often, cited in six articles,<sup>40,41,49,112,113,116</sup> followed by direct communication,

described in four articles,<sup>66,81,114,115</sup> IVR, in three articles,<sup>78,91,119</sup> and smart phone app, in one.<sup>118</sup> These findings are in line with reported rates of cell phone ownership and use.<sup>12,96</sup> In contrast, studies in psychiatry favored direct communication, usually in the form of some sort of phone-based counseling or education, and cited in six studies<sup>63,65,66,114,115</sup>; IVR was used in three articles,<sup>64,75,119</sup> while text intervention was discussed in only one article,<sup>29</sup> as was cell phone camera.<sup>76</sup> The preference for direct communication is not surprising in a field where face-to-face meetings are the treatment norm. Though text messaging was only used in one article for psychiatry, the success of this type of intervention in Hispanics suggests that this form of technology could be helpful in other populations as well.

### **Patient Populations**

All reviewed articles described studies conducted in outpatient populations in the U.S. except one, which took place in Ireland. Two-thirds focused on Hispanics<sup>40,41,115,116,118,119,49,66,78,81,91,112–114</sup> and over half were in psychiatric settings or targeting psychiatric outcomes.<sup>29,63,119,64–66,75,76,114,115,117</sup> In contrast to previous reviews, this represents an increase in and, possibly, a trend toward technology research in populations where health disparities and stigma have previously been barriers to care.

### **Health Outcomes**

The main outcomes reported by the studies in this review were quite varied, yet common threads were found among articles. The four articles that focused on psychiatric issues in Hispanics<sup>66,114,115,119</sup> discussed depressive symptoms, QOL, and depression care, though one article did not publish results as the study was still ongoing.<sup>119</sup> In each of the three articles presenting results, health outcomes showed improvement with the

intervention, although one article reported positive results in both the intervention and comparator groups.<sup>115</sup>

In the seven articles discussing interventions for psychiatry in non-Hispanics,<sup>29,63–65,75,76,117</sup> outcomes measured included depression and PTSD symptoms, substance use issues, medication adherence, treatment continuation, QOL, ED use, time to rehospitalization, and engagement in care. Four of these articles<sup>29,63,65,76</sup> reported improvements in health outcomes due to the intervention. In one study medication adherence was not significantly impacted but age was determined to be a confounder,<sup>64</sup> and in another no significant differences were noted in any of the PTSD outcomes reported.<sup>117</sup> Two pilot studies were included in this group and yielded good results with interventions in substance-use populations.<sup>29,75</sup>

The grouping of ten articles where interventions were studied for other healthcare specialties in Hispanic populations<sup>40,41,49,78,91,112,113,116,118</sup> described the most diverse set of outcomes, with positive results attributed to the interventions in six of the studies. Significant outcomes were reported in healthy behaviors, self-efficacy, and medication adherence,<sup>40</sup> appointment adherence,<sup>112</sup> health beliefs,<sup>49</sup> weight management,<sup>116</sup> glucose monitoring,<sup>78</sup> and resting blood pressure.<sup>118</sup> One study reporting improvements in numerous outcome areas noted that all improvements were greater in the subgroup of Spanish-speakers, though none were of statistical significance.<sup>113</sup> This grouping of articles also contained six pilot studies<sup>40,41,49,91,116,118</sup> that, in addition to reporting positive results, demonstrate acceptability and feasibility.

## Summary

Results from the studies conducted in Hispanic populations demonstrate that the use of mobile phone technology was successful and feasible across a variety of disciplines, providing evidence of positive, if not significant improvements in health outcomes. In particular, studies using text messaging interventions yielded promising results, showing that Hispanics can be targeted using this form of technology to achieve improvements in health behaviors and overall personal healthcare. A smart phone app was also shown to be a promising intervention in the Hispanic population. Overall, the literature indicates that Hispanics, as a group, are receptive and responsive to the more advanced technological features of mobile phones, and more interventions using these technologies should be undertaken.

The articles in this review also demonstrate that psychiatry, as a discipline, has not fully embraced all that technology has to offer. This is evident in the prevalence of more basic telephone and mobile modalities, such as voice and IVR, in the studies. The successful intervention among the psychiatry-focused studies using text messaging provides support for the use of more advanced mobile technology in psychiatry. Despite efforts toward reduction, a great deal of stigma surrounding mental illness remains that can, and often does, directly influence care access and continuity. The evidence shown in the literature suggests that the use of advanced mobile and smart phone technologies could provide a bridge to pharmacological and non-pharmacological treatment and appointment adherence, as well symptom reduction and improved mental well-being. Benefits realized in other disciplines, such as improvements in health attitudes, beliefs,

and behaviors, including better symptom monitoring, could also be achieved in psychiatry if mobile technologies were exploited to their full capabilities.

### **Limitations**

This review contained several limitations. The review included only English language articles and all studies but one were conducted in the U.S., which may introduce bias. Since phone technology is evolving at such a rapid pace, this review may not have captured very recent studies that may quickly be changing the state of the science. A meta-analysis was not done in this review due to the clinical diversity of the articles.

### **Conclusion**

While studies have been conducted on the use of cell and smart phone interventions, few of them have focused on Hispanic patients and psychiatric populations. The articles in this review show that various types of phone technology can be helpful to patients in diverse populations. Text messaging, IVR, direct communication and smart phone app interventions have all demonstrated success in improving a variety of healthcare outcomes in these populations. These technologies can positively influence medication adherence, appointment attendance, QOL and engagement in care. Because of the high levels of ownership and generally low costs of interventions such as text messaging and smart phone apps, phone technologies can be easily adapted to numerous settings and populations and are valuable tools in efforts to increase access to care.

### **Conflict of Interest**

The authors confirm that this article content has no conflict of interest.

### **Acknowledgements**

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**CHAPTER 3**  
**DO TEXT REMINDERS IMPROVE FOLLOW-UP**  
**APPOINTMENT AND MEDICATION ADHERENCE IN**  
**PSYCHIATRIC OUTPATIENT POPULATIONS?<sup>1</sup>**

**Background and Significance**

In healthcare, adherence is defined as the extent to which individuals embrace health behaviors in accordance with medical advice. Poor adherence is a global problem and is associated with sub-optimal patient health outcomes, as well as increased cost burden on the healthcare system.<sup>1</sup> The issue of adherence is complex and multi-faceted. Often a lack of improvement in health and functioning are a result of not keeping appointments and following medication routines. By incorporating technological tools that increase interaction between patients and their healthcare team, providers and practices can assist and encourage adherence.<sup>1,3</sup>

Missed appointments, or “no-shows,” are all too familiar in most healthcare clinics and practices. In primary care settings in the U.S., no-show rates range anywhere from 5% to 55% of all appointments.<sup>18</sup> Average no-show rates of 42% have been identified in various types of practices in the U.S., Canada, and the U.K.<sup>17</sup> No-show rates in psychiatry are even higher; a U.K. review revealed that missed psychiatric appointments outnumbered no-shows in other disciplines by a ratio of almost two to one.<sup>5</sup> One U.S. study showed that 36% of patients failed to attend their initial intake appointments.<sup>19</sup> Potentially dangerous outcomes such as failure to properly take

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<sup>1</sup> Ana C. Duarte, Carla L. Storr, Sue A. Thomas, University of Maryland School of Nursing; Marisa L. Wilson, The University of Alabama at Birmingham School of Nursing. In preparation for submission to *Journal of the American Medical Informatics Association*.

psychiatric medications, dropping out of treatment, and relapse into crisis are all associated with failure to attend psychiatric appointments.<sup>5,6</sup>

Poor medication adherence is also an issue of great importance and concern. Sixty percent of Americans were reported to have chronic health conditions in 2014,<sup>20</sup> yet 64% of adults taking medications for these conditions do not take them properly.<sup>7</sup> Lower rates of medication adherence are seen in psychiatry, particularly in individuals with severe mental illness.<sup>8,9</sup> Medication adherence rates for patients with diagnoses of bipolar or schizophrenia range from 30% to almost 50%.<sup>24,25</sup> Higher rates of relapse, hospitalization, poorer functioning and course of illness, and suicide are all associated with nonadherence to psychiatric medications.<sup>8,9,26</sup>

The two most-cited reasons for appointment no-shows are forgetting and misunderstanding of appointment date and time.<sup>5,18,27,28</sup> Similarly, forgetfulness and confusion about medications influenced medication adherence.<sup>7</sup> In psychiatry, chronicity and degree of illness, poor functioning and level of illness awareness, stigma, and fear of addiction or medication side effects also influence non-adherence for both appointments and medications.<sup>10,24,26,28</sup> Increased access to mental health, as well as a focus on prevention, are important goals identified by the Healthy People 2020 guidelines,<sup>120</sup> which have placed greater demand on both mental and physical healthcare resources. Despite attempts to respond to this increased demand, adherence problems persist, leading to sub-optimal patient outcomes.<sup>5-10</sup>

Technology offers simple and helpful tools to assist with tracking appointments and other scheduled activities in a safe and anonymous fashion. In the not-so-distant past, technology was not within everyone's grasp, but the Digital Divide, a term used to refer

to internet and technology access inequalities, has been shrinking at a very rapid pace. As of year-end 2015 cellphone subscriptions globally exceeded 7 billion, roughly 97 subscriptions for every 100 persons worldwide.<sup>121</sup> Present-day cell phone ownership in the U.S. is at 95%, with equal likelihood of ownership among Blacks, Whites, and Hispanics, and greater likelihood for minority groups to use the instruments for internet access.<sup>11,96</sup> In a worldwide FICO survey of smart phone owners, 80% expressed an interest in using their mobile units for communications regarding healthcare. Specifically, of those surveyed, 76% sought reminders for upcoming appointments and 69% desired reminders to make appointments or to take medications.<sup>97</sup>

A PEW survey noted that smart phone ownership among American adults was at 56% in 2013, as opposed to more basic types of mobile phones. In the previous year and two years prior, smart phone ownership percentages were 46% and 35%, respectively.<sup>98</sup> Growth has trended across numerous demographics, including age, gender, race, and ethnicity. The ubiquity of mobile phone technology, its usage in the internet acquisition of health information, and user desire for communications regarding their health suggest a great utility in the reduction of barriers to care.<sup>13-16,97,99,100</sup> Text messaging, available on basic as well as smart phones, can be a powerful and inexpensive tool that is easily implemented to assist with adherence,<sup>13</sup> as well as to improve patient engagement, an important component of the Medicare Access and CHIP Reauthorization Act (MACRA) under the Improvement Activities category.<sup>122</sup>

Several reviews of the use of cell phone technology, specifically text messaging, have been conducted. Most studies identified in the reviews were conducted outside of the U.S., in diverse countries on every continent except Antarctica. The outcomes

examined included healthcare appointment attendance, subjective aspects and outcomes of pregnancy, smoking cessation, medication and supplement adherence, child and adult health behaviors, chronic disease management (diabetes, asthma, hypertension), stress management, social functioning, and weight loss.<sup>102–105</sup> None of the reviews included studies focused on the use of text messaging specifically in psychiatry.<sup>123</sup> Twice as many individual studies used text interventions in other areas of healthcare<sup>40,41,50–59,42,60–62,43–49</sup> than in psychiatry.<sup>29,30,39,31–38</sup>

This study addresses the distinct system-patient relationship aspect of the complex issue of adherence. By piloting a text messaging intervention designed specifically to improve appointment adherence for psychiatric outpatients, it hopes to improve medication adherence in this population as well.

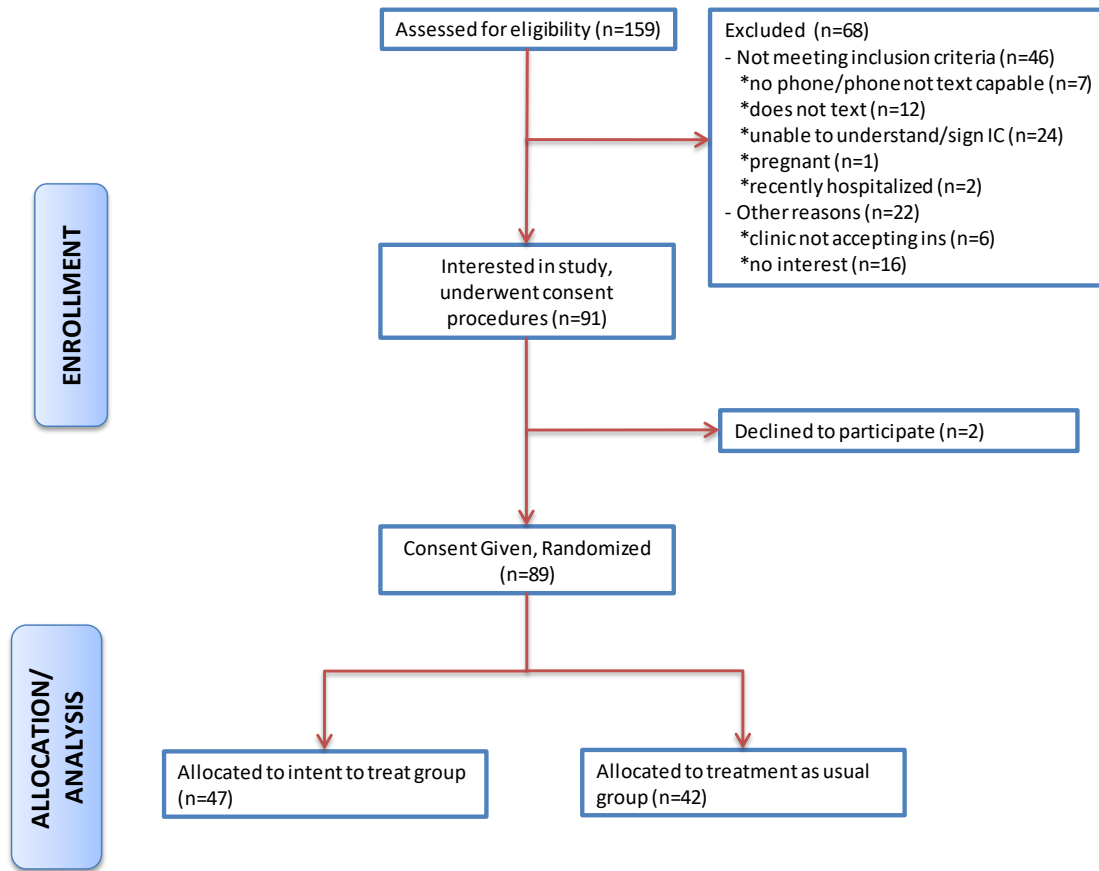
### **Materials and Methods**

The study was an interventional pilot study conducted at a primary psychiatric outpatient clinic within a non-profit behavioral health system in a large Mid-Atlantic urban metropolitan area. Approval for conducting this study with human subjects was obtained from the University of Maryland Institutional Review Board (IRB). Study participants were recruited from patients already in the clinic system. To be included in the study, a participant had to meet the following criteria: already established as a medication management patient at the clinic for at least three months with an appointment scheduled in the next 60 days; any race or ethnicity, foreign or U.S. born; at least 18 years of age but not more than 65 years of age; had a cell phone or smart phone capable of receiving text messages; possessed manual dexterity and understanding of text messaging, required to receive and read messages using cell/smart phone; and able to

understand and sign informed consent. Patients were ineligible if they were: pregnant or planning pregnancy; actively suicidal or homicidal; or had been hospitalized for severe or acute mental or physical issues in the last three months. By definition, these criteria excluded any patients who had active symptoms of psychosis and/or memory/orientation problems, commonly seen in patients with Alzheimer's and other dementias, as well as with serious and persistent mental illnesses such as severe schizophrenia.

A total of 89 patients met the eligibility requirements and consented to participate and allow access to their medical records. After consent and a baseline interview, 47 participants were randomized to the intent to treat (ITT) group and 42 to the treatment as usual (TAU) group by rolling a die. An "even" roll (2, 4, or 6) randomized to ITT and an "odd" roll (1, 3, or 5) randomized to TAU. The CONSORT Diagram of the study design can be seen in Figure 3.1.

**Figure 3.1. CONSORT Diagram of Study Design. Adapted from The CONSORT Flow Diagram: <http://www.consort-statement.org/consort-statement/flow-diagram>**



A commercial, web-based system was used to create and send text messages to the ITT group. At the end of each recruitment day, participant information was transcribed into an electronic spreadsheet and saved to comma-separated values (.csv) format. These data included: appointment date and time; amount of time, in hours or days, prior to appointment to send text; first name; first initial of last name plus ID number; country code; mobile number; clinic name; description; and message template. The .csv file, in turn, was uploaded to the texting system. Text scheduling could be confirmed by directly visualizing on a system calendar, and there was also capability to insert individual text information, as well as editing or cancellation of individual

uploaded scheduled text events. The message sent to the participants was generic and did not include any identifying participant information, reading: “This is a reminder of your appointment on [date] at [location]. Call [clinic phone number] to change. Txt STOP to OptOut.”

The ITT group received the HIPAA-compliant text message appointment reminder 24 hours prior to their next appointment, in addition to the usual phone call reminder 24-72 hours prior to the appointment, while the TAU group received only the usual phone call reminder. Both text and phone call reminders were provided for all appointments during the participants’ involvement time in the study; at least every two months, as per clinic policy, or some other interval as guided by treatment progress. The study period was June 2015 through May 2016, during which time rolling recruitment was conducted. Baseline interviews were performed on the day of recruitment and consent, with two follow-up interviews at approximately two and four months after initiation of the study. Each participant was involved in the study for up to four months. On average, participants were in the study for 118 days; the shortest time of involvement was 46 days and the longest was 185 days.

### **Data Collection**

Demographic data were obtained via participant report and the clinic’s secure electronic patient chart archives. Clinical and treatment-related data were obtained from the clinic’s electronic health record/prescribing system (EHR). Text message delivery was done using web-based commercial messaging software, clinic Front Desk staff assisted with follow-up appointment tracking, and medication adherence was tracked by participant report as well as the EHR.

## **Main Outcome Measures**

Appointment adherence was considered met if the patient came in for a scheduled appointment or otherwise contacted the clinic more than 24 hours in advance, as per clinic policy, to cancel or reschedule. Timely communication with the clinic was considered a “positive” adherence outcome, as opposed to a “no-call, no-show” or late cancellation of a scheduled appointment, which defined non-adherence.

Psychiatric medication adherence was obtained when possible, by asking participants directly if they had taken medications as prescribed over the previous 30 days. A “yes” answer was considered a “positive” adherence outcome while a “no” was considered non-adherence. In cases where face-to-face meeting with participants did not occur, documentation in the EHR progress notes was reviewed; commentary specifically describing medication non-adherence was recorded as a “negative” adherence outcome, otherwise a “positive” adherence outcome was recorded.

## **Participant Demographic Characteristics and Clinical Variables**

Patient demographic characteristics including gender, marital status, race, ethnicity, country of origin, primary language, educational level, employment status, and age at recruitment were obtained from the electronic patient charts. The EHR also provided the primary diagnosis and number of psychiatric medications prescribed. Medication management appointments, no-shows, appointment cancellations, and hospitalizations in the 12 months preceding the study were also reviewed. These variables were also obtained from the EHR or, in some cases where unavailable, from the clinic’s separate electronic chart repository.

## **Statistical Analysis**

Data analysis was performed using IBM SPSS Statistics for Windows, Version 21.0. Chi-square analysis was conducted for nominal variables and t-tests for scale variables. Where scale variables were not normally distributed, Mann-Whitney U test was used in the analysis. Variables for the intervention and both the outcome measures are all dichotomous, and the intervention variable is two levels with a between groups design. Chi-square and Mann-Whitney U were used to explore differences, with *p*-values less than or equal to 0.05 considered significant. Odds ratios were calculated to determine the magnitude of association between text messaging and appointment adherence, as well as between text messaging and medication adherence. In these cases, 95% confidence intervals that did not include 1.0 indicated statistical significance of the association. Since several appointment reminders were provided for each participant over the study period, up to the first three appointment reminders are the focus of analysis.

## **Results**

### **Baseline Characteristics of Participants**

The majority of the sample were female (71.9%), not married or partnered (83.1%), White (56.1%), and non-Hispanic (82.0%) (Table 3.1). Mean age at recruitment was 41.19 years, most were U.S.-born (84.3%), and reported English as their primary language (91.0%). While 68.5% of the sample had some level of education beyond high school, 56.2% reported being unemployed. Sample characteristics did not differ between the two intervention groups.

**Table 3.1. Summary of sample characteristics**

Variable	Total ( <i>n</i> = 89)	Intent to Treat (ITT) ( <i>n</i> = 47)	Treatment As Usual (TAU) ( <i>n</i> = 42)	Statistic	<i>P</i> - Value
	N (%)	N (%)	N (%)	$\chi^2$	
Gender				0.65	0.421 <sup>a</sup>
Male	25 (28.1)	11 (23.4)	14 (33.3)		
Female	64 (71.9)	36 (76.6)	28 (66.7)		
Marital Status				0.80	0.371 <sup>a</sup>
Married/Partnered	15 (16.9)	10 (21.3)	5 (11.9)		
Not Married/Partnered	74 (83.1)	37 (78.7)	37 (88.1)		
Race				1.71	0.425
Black	24 (27.0)	10 (21.3)	14 (33.3)		
White	50 (56.1)	28 (59.6)	22 (52.4)		
Other	15 (16.9)	9 (19.1)	6 (14.3)		
Ethnicity				1.16	0.281 <sup>a</sup>
Hispanic	16 (18.0)	6 (12.8)	10 (23.8)		
Non-Hispanic	73 (82.0)	41 (87.2)	32 (76.2)		
Country of Origin				<0.001	0.950 <sup>a</sup>
U.S.	75 (84.3)	39 (83.0)	36 (85.7)		
Outside of U.S.	14 (15.7)	8 (17.0)	6 (14.3)		
Primary Language				0.29	0.468 <sup>a,b</sup>
Spanish	8 (9.0)	3 (6.4)	5 (11.9)		
English	81 (91.0)	44 (93.6)	37 (88.1)		
Educational Level				0.02	0.896 <sup>a</sup>
Up to High School grad/GED	28 (31.5)	14 (29.8)	14 (33.3)		
Beyond High School/ GED	61 (68.5)	33 (70.2)	28 (66.7)		
Employment Status				<0.001	1.000 <sup>a</sup>
Employed	39 (43.8)	21 (44.7)	18 (42.9)		
Not Employed	50 (56.2)	26 (55.3)	24 (57.1)		
		Mean (SD)	Mean (SD)	<i>t</i> -test	
Age at Recruitment	41.19 (13.02)	40.89 (13.51)	41.52 (12.60)	-0.23	0.821 <sup>c</sup>

<sup>a</sup> Continuity Correction – computed for a 2x2 table.

<sup>b</sup> Fisher's Exact for cells with expected count < 5.

<sup>c</sup> Levene's Test not significant, equal variances assumed.

Clinical factors and patient involvement in treatment are reflected in Table 3.2.

The majority of the patients were equally spread across four major types of primary diagnoses. Number of no-shows in the last 12 months ranged from 0 to 5 and number of no-shows was almost evenly split in each of the groups. Hospitalizations and cancellations in the last 12 months ranged from 0 to 1 and 0 to 2, respectively. The majority of participants in both ITT and TAU had no cancellations at all, while less than 10% in each group reported being hospitalized in the 12 months prior to their start date in the study. The average number of medication management appointments attended in the

prior 12 months was around 6% for both groups, with total number of appointments per patient ranging from a minimum of 1 to a maximum of 12 during the specified timeframe. The number of medications at start of the study ranged from a low of 1 to a high of 10 (median = 3.00 for ITT and 3.50 for TAU). Clinical factors and previous treatment involvement were comparable across the two intervention groups.

**Table 3.2. Summary of sample clinical factors and involvement in treatment**

Variable	Total (n = 89)	ITT (n = 47)	TAU (n = 42)	Statistic	p-Value
	N (%)	N (%)	N (%)	X <sup>2</sup>	
Primary Diagnosis				1.13	0.889 <sup>a</sup>
Schizophrenia & Psychotic/Bipolar	25 (28.1)	13 (27.6)	12 (28.5)		
Depressive	25 (28.1)	12 (25.5)	13 (31.0)		
Anxiety & OCD/Trauma & Stressors	20 (22.4)	10 (21.3)	10 (23.8)		
Neurodevelopmental	16 (18.0)	10 (21.3)	6 (14.3)		
Other	3 (3.4)	2 (4.3)	1 (2.4)		
No-Shows Preceding 12 Months				<0.001	1.000 <sup>b</sup>
Rare (0-1)	41 (46.1)	22 (46.8)	19 (45.2)		
Often (2 or more)	48 (53.9)	25 (53.2)	23 (54.8)		
Cancelled Appointments Preceding 12 Months				0.08	0.778 <sup>b</sup>
None	72 (80.9)	37 (78.7)	35 (83.3)		
At least one	17 (19.1)	10 (21.3)	7 (16.7)		
Inpatient Hospitalizations Preceding 12 Months				0.02	0.897 <sup>a,b</sup>
No	84 (94.4)	45 (95.7)	39 (92.9)		
Yes	5 (5.6)	2 (4.3)	3 (7.1)		
	Mean (SD)	Mean (SD)	Mean (SD)	t-test	
Medication Management Appointments Preceding 12 Months	6.04 (1.97)	6.13 (1.88)	5.95 (2.07)	0.42	0.677 <sup>c</sup>
	Median	Median	Median	Mann-Whitney Z-statistic	
Number of Prescribed Psychiatric Medications at Start	3.00	3.00	3.50	-0.33	0.973

<sup>a</sup> Cells with expected count < 5.

<sup>b</sup> Continuity Correction – computed for a 2x2 table.

<sup>c</sup> Levene's Test not significant, equal variances assumed.

### Follow-Up Appointment Adherence

In the aggregate, the ITT group demonstrated a slightly higher percentage appointment adherence than the TAU group (Table 3.3), however the difference was not

significant (OR = 1.36, 95% CI = 0.63, 2.93). For the first reminder interval, results were very similar for the two groups (OR = 0.94, 95% CI = 0.33, 2.72). For the second reminder interval, while ITT participants showed a higher adherence percentage than those in the TAU group, between group differences still did not show significance (OR = 6.79, 95% CI = 0.79, 58.29). The third reminder interval, like the first two, did not find differences in adherence between the groups (OR = 0.75, 95% CI = 0.14, 4.13), with ITT group members showing a slightly lower adherence percentage than those in the TAU group.

**Table 3.3. Results of text reminder interventions on appointment adherence**

		Across First Three Intervals								
Group	N	Show/Cancel/Reschedule (%)					No Show (%)			
ITT	91	78 (85.7)					13 (14.3)			
TAU	103	84 (81.6)					19 (18.4)			
		Reminder Interval 1			Reminder Interval 2			Reminder Interval 3		
Group	N	Show/ Cancel/ Reschedule (%)	No Show (%)	N	Show/ Cancel/ Reschedule (%)	No Show (%)	N	Show/ Cancel/ Reschedule (%)	No Show (%)	
ITT	45	36 (80.0)	9 (20.0)	34	33 (97.1)	1 (2.9)	12	9 (75.0)	3 (25.0)	
TAU	42	34 (81.0)	8 (19.0)	41	34 (82.9)	7 (17.1)	20	16 (80.0)	4 (20.0)	

### Follow-up Medication Adherence

The results of text reminders on medication adherence, again in aggregate and by reminder interval, are displayed in Table 3.4. No significant differences were detected in medication adherence across the aggregate of the three intervals between the groups (OR = 1.24, 95% CI = 0.51, 3.02). Nor were there differences in medication adherence at any of the specific intervals (first: OR = 0.96, 95% CI = 0.18, 5.21; second: OR = 1.02, 95% CI = 0.27, 3.78; third: OR = 1.94, 95% CI = 0.29, 13.19).

**Table 3.4. Results of text reminder interventions on medication adherence**

		Across First Three Intervals								
Group	N	Medication Adherence (%)				Medication Non-adherence (%)				
ITT	65	55 (84.6)				10 (15.4)				
TAU	76	62 (81.6)				14 (18.4)				
		Reminder Interval 1			Reminder Interval 2			Reminder Interval 3		
Group	N	Adherence		N	Adherence		N	Adherence		
		Yes	No		Yes	No		Yes	No	
ITT	29	26 (89.7)	3 (10.3)	27	22 (81.5)	5 (18.5)	9	7 (77.8)	2 (22.2)	
TAU	30	27 (90.0)	3 (10.0)	32	26 (81.2)	6 (18.8)	14	9 (64.3)	5 (35.7)	

## Discussion

This study was conducted at a large metropolitan area behavioral health clinic to examine whether a text messaging appointment reminder intervention could improve both office appointment and medication adherence. While similar studies have been conducted in other disciplines, few have specifically explored this intervention in the psychiatric outpatient population.<sup>123</sup>

While not significant, overall, the ITT group demonstrated slightly better appointment adherence with the intervention than the TAU group. Three reminder intervals were examined during the study. In a population of low-income patients involved in group psychotherapy at an outpatient behavioral health center, adjunctive text message reminders produced longer involvement in therapy and attendance at more sessions during the study timeframe.<sup>34</sup> These results may be influenced by the sequential nature of psychotherapy, where weekly sessions are typically conducted as part of treatment, each one building upon prior sessions. In another, larger study of patients recently discharged from psychiatric hospitalization and prescribed antipsychotics, text messages that included appointment reminders were not found to reduce re-hospitalization which, as primary outcome, was viewed as an indicator of adherence.<sup>39</sup> It is possible that severity of illness contributed to the results and also appointment

adherence was not explicitly examined as an outcome. Another study in a large and diverse metropolitan safety net population found that text messages improved post-ED follow-up appointments, but these findings were not limited to a particular specialty<sup>112</sup>; there may be different motivating factors for post-emergency appointment follow-ups than for specialty ongoing outpatient follow-up appointments.

In general, and for the latter two of the three reminder intervals examined, the ITT group had slightly better medication adherence rate than the TAU group. Nonetheless, significance was not achieved for the differences between the two groups during any of the reminder intervals, though results were trending toward improvement. Three other studies in psychiatry demonstrated similar results. Patients prescribed Naltrexone for alcohol use disorders (AUDs) did not show significant improvement in adequate adherence, defined as taking 80% of prescribed medication.<sup>33</sup> Typically, medication adherence for individuals with AUDs is difficult to achieve. In a population of patients with HIV and comorbid bipolar disorder, text reminders to take medications, both antiretroviral and psychiatric, resulted in high levels of adherence, but not significantly different from controls.<sup>36</sup> In a study involving patients with schizophrenia, a texting intervention including medication reminders resulted in higher medication adherence in study participants who lived independently, possibly because they lacked supportive assistance with medications.<sup>30</sup> Severity of illness may be a common factor in results of lower significance in psychiatric studies. In a study of adults with poorly controlled HbA1c levels, daily text messages yielded an increase, though not significant, in medication adherence.<sup>124</sup> Another study involved patients with diabetes in a working-class, urban community. The intervention provided numerous text messages, including

medication reminders, yielding significant improvements in medication adherence when measured at three and six months, but not on weekly measures.<sup>43</sup> A text-based cardiac rehabilitation intervention did not specifically provide medication reminders, yet medication adherence, a secondary outcome, showed significant improvement for those in the intervention group.<sup>56</sup>

Results for medication adherence in the literature are varied. The lack of significant differences in the current study may very likely be due to the already-high levels of medication adherence among all participants at the start of the study, potentially creating a ceiling effect. Another possible reason for a lack of significance in differences between the groups is that medication adherence was self-reported by the participants—either to the researcher directly, or to the provider during the appointment. Lastly, patients who agreed to be in the study may already be predisposed to adherence.

Clinical factors randomized well. Psychiatric diagnoses in this study were diverse and relatively equally distributed. The number of medication management appointments in the previous 12-month period were similar between the ITT and TAU groups. On average, patients were seen every two months, reflective of typical intervals in psychiatry. Likewise, no-shows, cancellations, hospitalizations, all for the previous 12 months, and number of medications prescribed at the start of the study were all similar between the groups. Few of these clinical factors are found in the literature. Having an appointment in the last six months, psychiatric treatment periods, and number of medications are each mentioned in different studies as clinical characteristics of the study populations, but none are further elaborated by the authors.<sup>36,39,112</sup>

Several limitations were noted in this study. The study was conducted at only one site and with patients from one prescriber, which could introduce bias and constrain generalizability. The study was relatively small and possibly underpowered. Logistical issues with the texting system as well as a diminishing recruitment pool made it difficult to extend the project to obtain a larger sample. Also, during the study the clinic changed its policies regarding insurance, causing the loss of a small number of participants which, in an already small sample, may have further reduced power.

Neither the researcher nor the participants were blinded to the randomization. This could also introduce bias, especially a Hawthorne effect among the participants. Since the intervention may have lost its novelty as it progressed, this may have helped counter the Hawthorne effect. Contamination may also have occurred due to participants discussing with others in the waiting room or overhearing conversations with the Front Desk. Because the commercial texting system was not electronically linked to the clinic's appointment system, there was potential for loss of information for the TAU group or for any rescheduled appointments.

Clinical factors provide additional variables that could potentially affect appointment adherence. In this study, because no significant findings were revealed between the ITT and TAU groups, evaluation of these additional factors would have added little to the study results. Additionally, any self-reported data may have resulted in a ceiling effect, where minimal improvements, if any, could be realized. Finally, the intervals between appointments differed for participants. This is standard practice in psychiatric medication management, as follow-up appointments depend on progress and response at each appointment. The relatively short per-participant study cycle of four

months may have limited the opportunity to provide appointment reminders for either group. The intervention may work better for those who must wait longer for their next appointments, as appointments may be more easily forgotten if they are separated by months rather than weeks.

Despite these limitations, the study did have various strengths. Mainly, it was well-randomized, as shown by a lack of significant differences between the baseline data for the ITT and TAU groups. The population was also very diverse and included more clinical factors of interest, including a broad range of diagnoses, as compared with other, similar studies. Lastly, the texting program was easy to use and the system design allowed for each participant to receive a number of appointment reminders. It is noteworthy that a phone call reminder could occur up to 72 hours before the appointment, whereas text reminders were always scheduled exactly 24 hours prior, allowing for consistency in reminder delivery.

### **Conclusion**

Appointment and medication adherence are multi-faceted and complicated problems facing healthcare providers today. While this study's text messaging intervention yielded improvements in appointment and medication adherence, they were not significant. This may be due to an already high adherence level, which speaks well to the ability of the clinic and the provider to engage patients in treatment.

Studies have shown text messaging to be an effective means of patient communication in other medical specialties, many of which have already implemented the use of these reminders. Fewer of these types of studies have been conducted in psychiatry. By demonstrating that the psychiatric outpatient population is willing to

receive, and responds relatively well to text messaging appointment reminders, this study sets the stage for more studies in the field, which has been slow to adopt the technology. Future studies could explore the relationship of adherence to health outcomes, and a larger study could make it possible to explore sub-population analyses as well.

Implementation of a HIPAA-compliant text reminder system provides psychiatric clinics and practices a simple and cost-effective way to assist their patients with adherence and helps reduce barriers to care. Additionally, adoption of a text reminder system can help healthcare organizations meet Improvement Activity goals of increasing patient engagement under MACRA.

## **CHAPTER 4**

### **THE EFFECTS OF ADHERENCE ON PSYCHIATRIC SYMPTOMS AND MENTAL AND PHYSICAL WELL-BEING<sup>1</sup>**

#### **Background and Significance**

Adherence, as defined in healthcare, is the extent to which individuals exhibit behaviors according to the medical advice which they have been given including taking medications and making healthy lifestyle decisions.<sup>1,3</sup> Poor adherence is a worldwide issue associated with poor patient health outcomes and an increased financial burden on healthcare systems.<sup>1</sup> Clinically, adherence can be described as two main types: appointment and medication adherence.

Missed appointments, also known as “no-shows,” are frequent occurrences in healthcare settings and reflect a lack of appointment adherence. In the U.S. no-show rates in primary care range from 5% to 55% of all appointments.<sup>18</sup> Psychiatry no-show rates are almost twice the rate of those in other disciplines,<sup>5</sup> and in one study at a U.S. outpatient clinic, no shows for initial appointments made up 36% of all scheduled appointments.<sup>19</sup>

Medication adherence is also an issue of concern. Chronic health conditions affect almost 50% of Americans,<sup>21</sup> and of adults taking medications for these conditions, 64% do not take them correctly.<sup>7</sup> Again, in psychiatry, rates of adherence are poorer, especially for patients with severe mental illness.<sup>8,9,25</sup> In patients with a bipolar or schizophrenia diagnosis, 30% to 49% are non-adherent to their prescribed medications.<sup>24</sup>

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<sup>1</sup> Ana C. Duarte, Carla L. Storr, Sue A. Thomas, University of Maryland School of Nursing. In preparation for submission to *Internal Medicine Review*.

Poor adherence, for both appointments and medications, is associated with potentially dangerous outcomes. Failure to come to appointments can lead to improper medication adherence, treatment drop-out, and relapse or crisis.<sup>5</sup> Similarly, non-adherence to psychiatric medications can lead to lower levels of functioning, poorer course of illness and subjective health status, and higher rates of relapse, hospitalization, or suicide.<sup>7-10,26</sup>

Functional outcomes in physical and mental health are linked in various ways to adherence. A number of studies have been conducted which demonstrate the positive correlations between adherence and physical health outcomes, such as glycemic control and event-free survival after myocardial infarction.<sup>125,126</sup> Studies in psychiatry have shown that appointment non-adherence has demonstrated a negative impact on psychiatric illness and social functioning, while symptoms in patients with Obsessive-Compulsive Disorder decrease with treatment adherence.<sup>28,127</sup>

Bandura's theory of Self-Efficacy provides the theoretical platform for this study.<sup>77</sup> Because of its iterative nature, positive, repeated experiences influence outcomes. When the theoretical model is extended, adherence, a behavioral outcome influenced by environmental and personal factors, becomes a predictor of the outcomes of interest. The goals of this study are to determine whether patients at an outpatient mental health clinic who adhere to both their follow-up visits and medication regimens show improvement in mental and physical functioning, psychiatric symptoms and stress levels, and trend toward more active or collaborative input to treatment, over time. Variables of interest in this study are level of functioning, conceptualized as the physical and mental well-being components of the WHO's overall definition of health<sup>84</sup>;

psychiatric symptoms comprised of two variables: mental health domains across psychiatric diagnoses and levels of stress perceived by the patient; and the patient's input to treatment, defined as the degree of control the patient wishes to have in the treatment decision-making process.

### **Materials and Methods**

The study was an interventional pilot study conducted in a non-profit primary psychiatric outpatient setting in a large urban metropolitan area.<sup>128</sup> The human subject study approval was obtained from the University of Maryland Institutional Review Board (IRB). Patients were recruited from individuals already in the clinic system. Inclusion criteria were: patient with an established medication management plan for at least three months and an appointment scheduled in the upcoming 60 days; all races or ethnicities, foreign or U.S. born; between 18 and 65 years of age; had a cell phone or smart phone with text messaging capability; knowledge and ability to send and receive text messages; and able to give informed consent. Ineligibility criteria were: pregnancy; active homicidal or suicidal thoughts; or hospitalized for severe or acute mental or physical reasons in the preceding three months. These criteria excluded any patients with active psychoses and/or memory/orientation issues, or with mental issues which cause severe functional impairments.

The project involved 89 patients who met requirements and consented to participate. Patients were randomized to intent to treat (ITT) and treatment as usual (TAU) groups to determine whether those who received text message reminders (ITT group) would demonstrate better adherence to follow-up visits and in taking their medications than those who did not receive text (TAU group). Because no significant

differences were detected between the ITT and TAU groups, study results were then examined for differences between overall adherent and overall non-adherent patients.

### **Data Collection**

Patient-specific data were retrieved from two separate electronic systems at the practice, as well as during face-to-face meetings. Demographic data were acquired from the clinic's secure electronic patient charting system and direct report from participants. Data related to clinical factors and engagement in treatment were collected from the electronic health record/prescribing system (EHR).

The study started in June 2015 and recruitment and follow-up continued through May 2016. On the day of recruitment and consent, baseline interviews were conducted. Two follow-up interviews were conducted at approximately two (T2) and four (T3) months after recruitment. The assessments were performed by the researcher in face-to-face interviews in a private office at the clinic to ensure confidentiality. All study participants were involved for up to four months. Average days participants were in the study was 118, with a range of 46 to 185 days. The goal of the assessments was to capture four outcomes: disability level, psychiatric symptoms, perceived stress level, and patient input to treatment.

### **Measures**

The independent variable, overall adherence, is dichotomous with a between groups design. In the context of this study, adherence is viewed in the aggregate; overall adherence is defined as attendance at all follow-up visits and taking medications as prescribed, while the absence of either of these elements is considered non-adherence.

Disability level was measured by the World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), 36-item interviewer-administered version.<sup>129</sup> Cronbach's  $\alpha$  was 0.88 and 0.87 at T2 and T3, respectively. Scores ranged from 0 to 96.74, with lower scores indicative of lower levels of disability and thus better functioning. The WHODAS 2.0 also provided information on functional disability, total disability, and reduced ability in the last 30 days.

The DSM5 Cross-Cutting Symptom Measure (DSM5) was used to assess symptoms being experienced by the participants.<sup>26,130</sup> Scores ranged from 0 to 44, with lower scores reflecting fewer symptoms. Cronbach's  $\alpha$  at both T2 and T3 was 0.85.

Level of perceived stress was measured using the Perceived Stress Scale-10 (PSS-10).<sup>131</sup> In this study, Cronbach's  $\alpha$  was 0.89 for both T2 and T3. Range of scores was 0 to 40 and lower scores were associated with less stress.

The Control Preferences Scale (CPS) was used to measure the participant's preferred role in medical decision-making.<sup>132</sup> Participants indicated preferences between 1 and 5. Lower scores suggested that a greater amount of participation in treatment was desired.

### **Participant Demographic Characteristics and Clinical Variables**

Characteristics of study participants were explored for similarities between those who were adherent and those who were non-adherent, as well as to detect any potential confounding variables, as indicated by any significant differences. The characteristics explored were gender, marital status, race, ethnicity, country of origin, primary language, educational level, employment status, and age at recruitment.

Clinical factors and engagement in treatment were also examined at baseline for between-group similarities and to detect confounders. These included primary diagnosis and participation in psychotherapy, medication management visits, no-shows, cancelled appointments, hospitalizations, and number of prescribed psychiatric medications. Baseline data for disability level (including number of days out of the last 30 where functional difficulty, total disability, and reduced ability were experienced), psychiatric symptoms, perceived stress, and patient's desired input to treatment were obtained via administration of the corresponding measurement instruments.

### **Statistical Analysis**

The IBM SPSS Statistics for Windows software, Version 21.0, was used for data analysis. Chi-square tests were used for analysis of nominal variables and t-tests were used for scale variables. Mann-Whitney U tests were conducted for analysis of scale variables with non-normal distribution. For these non-normally distributed variables, effect sizes were computed using the formula  $r = z / \text{square root of } N$  ( $N$  = total number of cases). For all variables,  $p$ -values less than or equal to 0.05 were considered significant.

Differences were explored using *t-test*, Chi-Square, and Mann-Whitney U. Regression was performed using Linear Mixed Models, controlling for baseline functioning and to account for missing data. Various models were run for each outcome variable. Models were initially selected using lowest AIC/BIC and then further analysis was conducted to determine predictor variables of significance. Once initial predictor variables were identified, models were re-run using the Maximum Likelihood estimation and the most parsimonious were selected as best fit for the final models.

## Results

### Baseline Characteristics of Participants

The main characteristics of the participants in the study can be seen in Table 4.1. Most were female (71.9%), did not have a spouse or partner (83.1%), and were White (56.1%) of non-Hispanic ethnicity (82.0%). The majority were born in the U.S. (84.3%) and primarily English-speaking (91.0%). Education beyond high school was reported by 68.5% of the sample. Despite relatively high levels of education, the majority were currently unemployed (56.2%). The mean age of participants at recruitment was 41.19 years.

Intervention groups were very similar on almost every characteristic assessed. A significant association was found between age and adherence ( $t$ -test = -3.06,  $p$  = 0.003). Those in the adherent group tended to be approximately 8 years older than those in the non-adherent group. Accordingly, age was viewed as a potentially confounding variable. For all other personal variables, no significant differences were noted.

**Table 4.1. Summary of sample characteristics**

Variable	Total ( <i>n</i> = 89)	Adherent ( <i>n</i> = 35)	Non-Adherent ( <i>n</i> = 54)	Statistic	<i>p</i> - Value
		Mean (SD)	Mean (SD)	<i>t</i> -test	
Age at Recruitment	41.19 (13.02)	46.20 (12.29)	37.94 (12.54)	-3.06	0.003 <sup>a</sup>
	N (%)	N (%)	N (%)	$\chi^2$	
Gender				0.10	0.747 <sup>b</sup>
Male	25 (28.1)	11 (31.4)	14 (25.9)		
Female	64 (71.9)	24 (68.6)	40 (74.1)		
Marital Status				0.86	0.353 <sup>b</sup>
Married/Partnered	15 (16.9)	8 (22.9)	7 (13.0)		
Not Married/Partnered	74 (83.1)	27 (77.1)	47 (87.0)		
Race				0.29	0.865
Black	24 (27.0)	10 (28.6)	14 (25.9)		
White	50 (56.1)	20 (57.1)	30 (55.6)		
Other	15 (16.9)	5 (14.3)	10 (18.5)		
Ethnicity				1.03	0.311 <sup>b</sup>
Hispanic	16 (18.0)	4 (11.4)	12 (22.2)		
Non-Hispanic	73 (82.0)	31 (88.6)	42 (77.8)		
Country of Origin				<0.001	0.997 <sup>b</sup>
U.S.	75 (84.3)	30 (85.7)	45 (83.3)		
Outside of U.S.	14 (15.7)	5 (14.3)	9 (16.7)		
Primary Language				<0.001	1.000 <sup>b,c</sup>
Spanish	8 (9.0)	3 (8.6)	5 (9.3)		
English	81 (91.0)	32 (91.4)	49 (90.7)		
Educational Level				0.06	0.811 <sup>b</sup>
Up to High School grad/GED	28 (31.5)	10 (28.6)	18 (33.3)		
Beyond High School grad/GED	61 (68.5)	25 (71.4)	36 (66.7)		
Employment Status				1.91	0.167 <sup>b</sup>
Employed	39 (43.8)	19 (54.3)	20 (37.0)		
Not Employed	50 (56.2)	16 (45.7)	34 (63.0)		

<sup>a</sup> Levene's Test not significant, equal variances assumed.

<sup>b</sup> Continuity Correction – computed for a 2x2 table.

<sup>c</sup> Fisher's Exact for cells with expected count < 5.

## Clinical Characteristics of Participants

Clinical factors and patient engagement in treatment are shown in Table 4.2. Four major diagnostic categories seen in clinical practice account for 78.6% of primary diagnoses among study participants and more were engaged in psychotherapy than not (61.8% v. 38.2%, respectively). Participants' Degner scale choices reflected more than a 3-times greater preference for an active or collaborative role in treatment decision-making than a passive one (76.4% v. 23.6%). Mean number of medication management visits attended in the 12 months prior to the study was 6.04, ranging from 1-12. Mean

score for disability level was 34.48 (range 0.94-96.74), for psychiatric symptoms, 20.22 (range 0-42), and for perceived stress level, 21.06 (range minimum score was 0, maximum was 40). For all these instruments, lower scores are indicative of better mental and/or physical health.

Both groups had similar indicators of last 30-day functional difficulty, total disability, and reduced ability, with those in the non-adherent group reflecting a slightly higher median number of days of functional disability (18 v. 11) and total disability (3 v. 2). Reduced ability days were slightly higher in the adherent group ( $Md = 5.00, n = 35$ ) than the non-adherent group ( $Md = 4.50, n = 54$ ). Range for all these variables was 0-30 and no significance was detected.

No-shows in the last 12 months ranged from 0 to 5 and in both groups number of participants with two or more no-shows was slightly higher than those who rarely no-showed. In each group less than 6% reported having inpatient hospitalization in the previous 12 months (range 0-1). A higher percentage of participants in the adherent group than in the non-adherent group had at least one cancellation in the prior 12 months (25.7% v. 14.8%). In both groups, the average number of medication management visits attended in the prior 12 months was approximately 6% (range 1-12). Median number of medications at the start of the study for each group was 3.00. Clinical factors and previous treatment involvement were comparable across the two intervention groups. Lastly, no significant differences were found in the baseline scores of the WHODAS 2.0, DSM5, and Degner at baseline. Additionally, individual domains within psychiatric symptoms and disability level were examined, also yielding no differences between adherent and non-adherent participants.

**Table 4.2. Summary of sample clinical factors and engagement in treatment at baseline**

Variable	Total (n = 89)	Adherent (n = 35)	Non-Adherent (n = 54)	Statistic	p-Value
	N (%)	N (%)	N (%)	X <sup>2</sup>	
Primary Diagnosis				1.43	0.839 <sup>a</sup>
Schizophrenia & Psychotic/Bipolar-related	25 (28.1)	10 (28.6)	15 (27.7)		
Depressive	25 (28.1)	12 (34.2)	13 (24.1)		
Anxiety & OCD/Trauma & Stressors	20 (22.4)	7 (20.0)	13 (24.1)		
Neurodevelopmental	16 (18.0)	5 (14.3)	11 (20.4)		
Other	3 (3.4)	1 (2.9)	2 (3.7)		
Participation in Psychotherapy				0.25	0.614 <sup>b</sup>
Engaged in Therapy	55 (61.8)	20 (57.1)	35 (64.8)		
Not Engaged in Therapy	34 (38.2)	15 (42.9)	19 (35.2)		
Patient Input to Treatment – Degner Scale				0.43	0.806
Active Role – Patient leads decision-making	36 (40.4)	13 (37.1)	23 (42.6)		
Collaborative Role – Shared decision-making	32 (36.0)	14 (40.0)	18 (33.3)		
Passive Role – Provider leads decision-making	21 (23.6)	8 (22.9)	13 (24.1)		
No-Shows Preceding 12 Months				<0.001	1.000 <sup>b</sup>
Rare (0-1)	41 (46.1)	16 (45.7)	25 (46.3)		
Often (2 or more)	48 (53.9)	19 (54.3)	29 (53.7)		
Cancelled Appointments Preceding 12 Months				1.00	0.316 <sup>b</sup>
None	72 (80.9)	26 (74.3)	46 (85.2)		
At least one	17 (19.1)	9 (25.7)	8 (14.8)		
Inpatient Hospitalizations Preceding 12 Months				<0.001	1.000 <sup>a,b</sup>
No	84 (94.4)	33 (94.3)	51 (94.4)		
Yes	5 (5.6)	2 (5.7)	3 (5.6)		
	Mean (SD)	Mean (SD)	Mean (SD)	t-test	
Medication Management Visits Preceding 12 Months	6.04 (1.97)	6.13 (1.88)	5.95 (2.07)	0.42	0.677 <sup>c</sup>
Disability Level – WHODAS 2.0 (0 to 100)	34.48 (19.27)	32.78 (19.57)	35.59 (19.18)	0.67	0.506 <sup>c</sup>
Psychiatric Symptoms – DSM5 Cross-Cutting Symptoms (0 to 52)	20.22 (10.04)	19.57 (10.35)	20.65 (9.90)	0.49	0.624 <sup>c</sup>
Perceived Stress Level – PSS-10 Score (0 to 40)	21.06 (7.67)	20.06 (7.30)	21.7 (7.90)	0.99	0.325 <sup>c</sup>
	Median	Median	Median	Mann-Whitney Z-statistic	
Functional Difficulty Last 30 (Days) – WHODAS 2.0	15.00	11.00 <sup>d</sup>	18.00	-1.15	0.250
Total Disability Last 30 (Days) – WHODAS 2.0	3.00	2.00 <sup>d</sup>	3.00	-0.72	0.471
Reduced Ability Last 30 (Days) – WHODAS 2.0	5.00	5.00 <sup>d</sup>	4.50	-0.39	0.700
Number of Prescribed Psychiatric Medications at Start	3.00	3.00	3.00	-0.31	0.758

<sup>a</sup> Cells with expected count < 5.

<sup>b</sup> Continuity Correction – computed for a 2x2 table.

<sup>c</sup> Levene's Test not significant, equal variances assumed.

<sup>d</sup>  $n = 34$ —one participant chose not to answer

## Regression Results and Models

A summary of significant interactions that led to model selection for predictors for each outcome variable can be seen in Table 4.3. Predictors of significance were detected for Perceived Stress Level, Psychiatric Symptoms, and Patient Input to Treatment, while none were found for Disability Level.

The interaction between Follow-up visit and Adherence group was a significant predictor of Perceived Stress ( $F(1,126.0) = 4.10, p = 0.045$ ), though neither Follow-up visit nor Adherence group, alone, were. Psychiatric symptoms were predicted significantly by Gender ( $F(1,177.8) = 4.28, p = 0.040$ ) and the interaction between Gender and Follow-up visit ( $F(1,120.8) = 4.80, p = 0.030$ ), and Follow-up visit by itself was not a significant predictor. For Patient Input to Treatment, the three-way interactions between Age at recruitment and Gender with Follow-up visit and Adherence group emerged as significant predictors ( $F(1,120.5) = 3.95, p = 0.049$  and  $F(1,119.7) = 4.08, p = 0.046$ , respectively). Meanwhile, individual variables and two-way interactions that were components of the three-way interaction were not found to be significant predictors for this outcome variable.

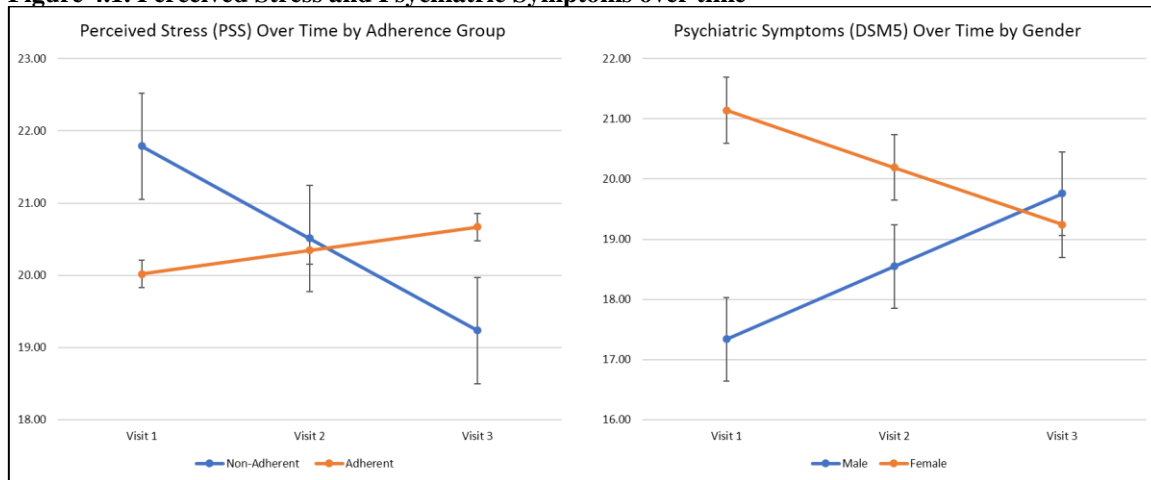
**Table 4.3. Summary of significant interactions for each outcome variable controlling for baseline**

	Perceived Stress Level	Psychiatric Symptoms	Disability Level	Patient Input to Treatment
Follow-up visit x Adherence group	X	n	n	n
Age at recruitment x Follow-up visit x Adherence group	n	n	n	X
Gender	n	X	n	n
Gender x Follow-up visit	n	X	n	n
Gender x Follow-up visit x Adherence group	n	n	n	X

X = interaction ( $p < 0.05$ )  
n = no interaction

Figure 4.1 shows graphs of Perceived Stress and Psychiatric Symptoms over time. The graph on the left shows that Perceived Stress scores decreased significantly in the non-adherent group and increased significantly in the adherent group over approximately four months. The graph on the right shows that, for males, reports of psychiatric symptoms increased significantly over the four months while females reported significantly decreased symptoms over the same period.

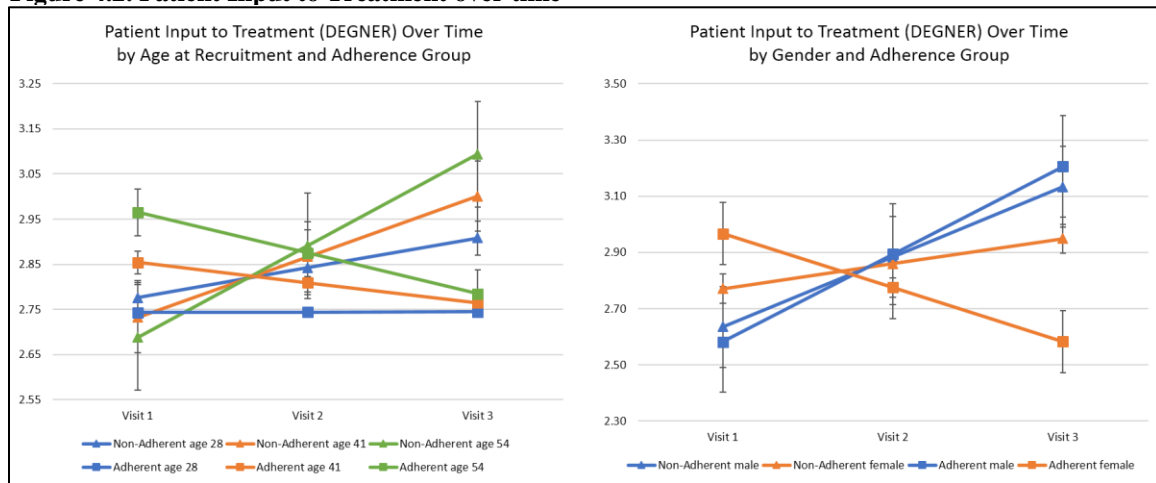
**Figure 4.1. Perceived Stress and Psychiatric Symptoms over time**



The graphs in Figure 4.2 illustrate Patient Input to Treatment over the four-month timeframe. The left-side graph shows that, for individuals in the non-adherent group, the older the patient the greater the increase in Degner score; for those in the adherent group, the older the patient the greater the decrease in Degner score. The graph on the right

shows that, over time, Degner scores for males increased regardless of adherence status. For females, Degner scores for those who were non-adherent increased significantly over time while scores for adherent females decreased over the same time period. Higher Degner scores demonstrate a preference for greater provider involvement and lower scores demonstrate a preference for greater individual treatment decision-making.

**Figure 4.2. Patient Input to Treatment over time**



## Discussion

This study explored whether text message appointment reminders could improve overall adherence, to include both office visit and medication adherence, at a large metropolitan area behavioral health clinic. These adherence outcomes were then examined for impacts to well-being over time. Similar studies examining the effects of text messaging interventions have been conducted in other specialty areas, but few in the psychiatric outpatient population and none of these specifically examining predictors of well-being.<sup>123</sup>

Four outcome measurements were obtained at three timepoints spaced roughly two months apart and controlling for baseline were used to measure well-being outcomes. Because age at recruitment showed significance in terms of adherence, this variable was

selected as input for best model selection. Gender was also selected as a variable of interest in the interactions for the models. Significant interactions were found in the final models for PSS, DSM-5 Symptoms, and Degner, but none for WHODAS. Specifically, visit\*group were predictors for stress, gender and gender\*visit interactions were predictors for psychiatric symptoms, and age\*visit\*group and gender\*visit\*group were predictors for patient input to treatment. Despite not assessing other potential factors, the adherent and non-adherent groups are very comparable in numerous demographics and psychiatric measures studied.

Though not specifically analyzed in terms of predictors, similar outcomes were discussed in the literature. One study noted that technology enabled a more active role in care, though this was not something that was specifically measured. Significant improvements were noted between groups at baseline and post-intervention.<sup>29</sup> Another described an improved adherence to medication via self-report. The study also shows decrease in ED visits and improved quality of life.<sup>124</sup> Significant improvement in mental function but not in physical function was found in one study that also noted significant improvement in moderate, severe, and overall depression symptoms.<sup>63</sup> A final study noted that adherence measured as treatment engagement only showed improvement during the first 90 days. No changes were noted in the outcomes level of PTSD, depression, or quality of life. This last one was the only study that attempted to address whether engagement in care influenced outcomes. The authors suspect the reason for their null findings is that they anticipated poor baseline adherence.<sup>117</sup>

Those who were not adherent reported less stress than those who were adherent. It is possible that those who are not coming in for treatment or not taking their medications

are not feeling pressure to do so, suggesting that these are the individuals most in need of the intervention. Males reported more psychiatric symptoms over time while females reported less. Males also indicated a preference for more provider involvement in decision making, as did non-adherent females. This may suggest that, as time passes, males become more engaged and comfortable, and thus more forthcoming about their symptoms and desiring professional assistance. Non-adherence in females may also lend itself to seeking more support from the provider, whereas adherent females may feel empowered to make more independent treatment decisions. Older participants who were adherent demonstrated a similar pattern to adherent females, preferring to be more active in treatment decision-making than their younger counterparts. Conversely, those who were older and non-adherent showed a preference for greater provider involvement in management of treatment.

While several similar clinical variables are seen in the literature, none are further elaborated by the authors, nor are they carried through as potential predictors of outcomes, except as described above in the PTSD study.<sup>117</sup> Where participants had unipolar depression and AUD, all had engaged in psychotherapy in an inpatient program prior to the study, and participation in numerous follow-up outpatient programs was noted in the participant demographics.<sup>29</sup> The DM study noted depression as one of the baseline variables.<sup>124</sup> In the nationwide study, all participants had depression at baseline and level of depression was a main focus of the study.<sup>63</sup> The PTSD study did list co-occurring diagnoses of depression, anxiety, substance use disorder, schizophrenia, and bipolar disorder. Service-connected disability length of stay in a residential program and outpatient mental health visits in the past year were also reported as clinical variables.<sup>117</sup>

Several limitations were evident in this study. Potential bias and constraints to generalizability could be introduced due to the study being conducted at a single site, with patients of only one prescriber. Due to the relatively small sample size, the study may have been underpowered. Texting system logistics coupled with a diminishing recruitment pool made for difficulties in recruiting a larger sample. Additionally, while the study was ongoing, the clinic changed its policies regarding accepted insurance. This caused the loss of a small number of participants, which may have also impacted power in the small sample.

This study did not blind either the researcher or the participants to randomization, which could also introduce bias in the form of Hawthorne effect. This effect may have been mitigated by the possibility that the intervention lost some of its novelty over time. If participants discussed the study with others while in the waiting room, or if non-participants overheard conversation between participants and Front Desk personnel, contamination may have occurred. Due to lack of electronic linkage to the appointment system at the clinic, rescheduled appointments could introduce the potential for loss of information.

Adherence could potentially respond to various clinical factors. Because the study showed no significant findings in this regard between those who received text messages and those who did not, there were no findings to consider in further analyses. Ceiling effects leading to minimal outcome changes may have resulted due to the self-reporting of data. Lastly, those who agreed to participate in the study may already be more inclined to adhere to appointments and medications.

It is important to note the standard practice in psychiatric medication management for intervals between visits to differ, as they did for participants in this study. Timing of follow-up visits is dependent on the patient's response and progression at each visit with the prescriber. The relatively short per-participant study cycle of four months may create limited opportunity for detecting significance in cases where the return visit is spaced too closely to the previous visit. Because closer follow-up visits are typically scheduled when the patient is new to the prescriber, when medications have changed, or when the patient is not as stable as previously, these situations may influence participant responses differently than if more time passed between visits. Likewise, the four-month cycle may also have influenced outcomes by virtue of the limitations posed by the relatively short overall timeframe.

Despite its limitations, numerous strengths were noted in the study. No significant differences were detected between the adherent and non-adherent groups, except for age, where older ages are generally associated with increased adherence.<sup>64,133,134</sup> Study participants were quite diverse in a number of areas and the study examined more clinical factors of interest than seen in similar literature. The measurement instruments were generally quickly administered and easy to understand, and engagement of patients during a regular follow-up visit was efficient.

### **Conclusion**

Appointment and medication adherence are complex issues and impact almost all healthcare providers and organizations today. Adherence also plays a role in patient outcomes. This study begins to identify some areas of significance as they relate to

adherence and predictors for several measures of well-being in a psychiatric outpatient population.

Few studies have specifically examined the predictive role of adherence in outcomes representative of patient well-being in the field of psychiatry. Some have presented, independently, adherence as a separate outcome variable alongside well-being outcomes. This study first demonstrates that the use of text messaging to improve adherence in the psychiatric outpatient population is feasible. Then it demonstrates that the resulting adherence and other variables of interest are significantly related to well-being in this population.

The study provides a good platform for larger studies in the future to further explore not only the technological aspects, but also shed more light on the connection between adherence and health outcomes. A larger study also has the potential to explore this connection in sub-populations. Future studies over longer periods may also provide useful data.

## **CHAPTER 5 DISCUSSION, IMPLICATIONS, AND RECOMMENDATIONS**

This chapter provides a summary of the overall dissertation project highlighting the major findings of the three manuscripts. Discussion also includes overall study strengths and limitations as well as implications for practice and recommendations for future research.

### **Summary of Findings**

#### **Manuscript 1/Chapter 2**

The manuscript entitled “The Use of Phone Technology in Outpatient Populations: a Systematic Review,” presents a published systematic review of literature conducted to detect gaps in the literature on the use of text messaging reminders for patients in overall practice. This review guided the pilot study and specifically focused on literature in the field of psychiatry, as well focused on Hispanics. The literature was initially searched in March 2013 for all articles to that point, due to the relative novelty of the use of technology in healthcare, and articles prior to 2004 were subsequently discarded.

Articles reviewed were almost evenly distributed in global quality according to the QATQS criteria.<sup>109</sup> The review found that phone technology was successful in various settings and populations, and overall outcomes improvement. Phone technology largely consisted of direct communication, text messaging, and IVR. In general, studies in psychiatry favored the use of direct messaging and IVR but, across disciplines, text messages were used successfully with Hispanic populations.<sup>40,41,49,112,113,116</sup> Compared to previous reviews, a trend was found toward use of technology to enhance communication and increase confidence in the health system.

Technology was shown to improve psychiatric health outcomes in depression, functioning, and quality of life, as well as engagement in medication adherence, continuation of treatment, and engagement in care.<sup>29,63,65,66,76,114,115,119</sup> Improved outcomes in other disciplines were also realized in medication and appointment adherence, and in management of chronic illness.<sup>40,78,112,116,118</sup>

Two overarching themes resulted from this literature review. First, that the use of mobile phone technology can be used successfully in any number of populations, including those that may have previously been difficult to reach or were not engaged in the healthcare system. Second, this literature review highlights the need for more studies in the field of psychiatry to exploit more advanced mobile technology in patient engagement for improved outcomes.

### **Manuscript 2/Chapter 3**

The manuscript titled “Do Text Reminders Improve Follow-Up Appointment and Medication Adherence in Psychiatric Outpatient Populations?” in Chapter 3 addresses Aim 1 of this study. This aim seeks to determine whether, if exposed to the text messaging intervention, patients show improvements in follow-up appointment adherence and psychiatric medication adherence over three reminder intervals. This Aim had three hypotheses, which are shown below with related results:

- H<sub>1</sub>: Patients who receive a text messaging intervention will have greater follow-up appointment adherence than those who do not receive the intervention.

In the study, the ITT group was found to have better appointment adherence than the TAU group over three reminder intervals that were included in the analysis. These

results did not demonstrate significance and are similar to what has been reported in the literature, both in psychiatry and other specialties.<sup>34,39,112</sup>

- H<sub>2</sub>: Patients who receive a text messaging intervention will have greater psychiatric medication adherence than those who do not receive the intervention.

In the area of medication adherence, again the ITT group demonstrated slightly better results than the TAU group, particularly in the latter two of the three measurement intervals. These differences were also not significant though trending toward improvement. Similar results have been seen in other studies in psychiatry.<sup>30,33,36</sup> Some studies in other specialties have demonstrated the same,<sup>43,124</sup> while others have achieved significant results.<sup>56</sup>

- H<sub>3</sub>: The association between text messaging and any improvement will still be present once potential personal and environmental confounding factors are held constant.

Because significance was not achieved between the ITT and TAU groups for any of the clinical factors, evaluation of these would not add appreciably to the study results. Accordingly, this hypothesis was not explored.

### **Manuscript 3/Chapter 4**

The final manuscript in Chapter 4, titled “The Effects of Adherence on Psychiatric Symptoms and Mental and Physical Well-Being” focuses on study Aim 2, seeking to determine in what way(s) overall adherence resulting from the intervention has changed level of functioning. The results for appointment adherence and medication adherence from the previous manuscript were combined to create one variable, overall adherence, which was then used as the independent variable for the analyses in Chapter 4. Analysis of baseline data yielded a significant difference between adherent and non-

adherent groups for age, thus age was chosen as a confounder for further analyses. Gender, while not demonstrating significance between the groups, was also chosen as a confounder for several reasons. First, women are more likely to seek help for mental health issues than men, something reflected in that this study's data included more than twice as many female than male participants. Second, the literature routinely explores gender differences as these may influence and be influenced by not only biology but may also have social connections. Lastly, though more females than males were included in this study, the non-adherent group had a higher proportion of females than the adherent group, raising the question of how gender may have factored into adherence.

Linear Mixed Methods were used to produce models for best fit. Significant interactions were detected for the PSS-10 (perceived stress), the DSM-5 (psychiatric symptoms), and the Degner CPS (input to treatment), but not for the WHODAS 2.0 (disability level). Gender and age were both relevant in the interactions. Below are further discussions of the study results in the context of the two hypotheses associated with this second Aim:

- H<sub>1</sub>: Patients who have overall adherence will show improvements in functioning.

The dependent variable disability level (WHODAS) was used to describe functioning. A decision was made to also use input to treatment (Degner) as a dependent variable. Though it was not initially specifically defined as such, input to treatment was still measured at baseline and at the two follow-up interviews. Given the iterative nature of the theory of Self-Efficacy, which guided this research, because the study may have elicited changes in the input to treatment measurement over time, it was redefined as an outcome that could be used to analyze functioning.

The best fit model for disability level yielded no significant interactions, while two significant interactions were detected in the model for input to treatment (Table 5.1). The interactions of age\*visit\*group and gender\*visit\*group were found to be predictors for input to treatment. In the model, the age\*visit\*group interaction shows that, for older participants in the non-adherent group, their Degner scores increased over time, while for those in the adherent group scores decreased. The gender\*visit\*group interaction results demonstrated that, irrespective of adherence status, Degner scores increased for males. Females in the non-adherent group likewise had increased scores while scores decreased for females who were adherent. The higher the score, the more involvement is desired of the provider, while a lower score demonstrates a preference for more patient-driven healthcare decision making.

**Table 5.1. Input to Treatment (Degner)**

<i>Effect</i>	<i>Estimate</i>	<i>SE</i>	<i>95% CI Lower Bound</i>	<i>95% CI Upper Bound</i>
Fixed Effects				
Intercept	0.86	1.57	-2.24	3.96
Visit	0.76	0.58	-0.38	1.91
AdhGroup	3.05	1.91	-0.71	6.81
AdhGroup(0)*Visit	-1.40	0.72	-2.82	0.03
Age	0.03	0.03	-0.03	0.10
Age*Visit	-0.01	0.01	-0.03	0.01
Age*AdhGroup(0)	-0.07	0.04	-0.15	0.01
Age*Visit*AdhGroup(0)	0.03	0.02	0.00	0.06
Gender	2.18	1.83	-1.42	5.78
Gender*Visit	-0.94	0.68	-2.28	0.41
Gender*AdhGroup(0)	-3.53	2.21	-7.89	0.83
Gender*Visit*AdhGroup (0)	1.71	0.85	0.03	3.39
Random Effects				
Between subjects	0.50	0.10	0.33	0.76
Within subjects	0.37	0.05	0.28	0.47

- H<sub>2</sub>: Patients who have overall adherence will show decreased psychiatric symptoms.

Psychiatric symptoms were captured in two dependent variables, perceived stress level (PSS) and psychiatric symptoms (DSM5). For both of these variables the LMM models yielded significant interactions.

For perceived stress the visit\*group interaction was a predictor (Table 5.2). The model demonstrates that, over the four-month period in the study, those in the non-adherent group had significantly decreased PSS scores while those who were in the adherent group had significantly increased scores. Higher PSS scores meant increased perceived stress while lower scores indicated a decrease in same.

**Table 5.2. Perceived Stress Level (PSS)**

<i>Effect</i>	<i>Estimate</i>	<i>SE</i>	<i>95% CI</i>	
			<i>Lower Bound</i>	<i>Upper Bound</i>
Fixed Effects				
Intercept	19.69	1.63	16.48	22.90
Visit	0.33	0.58	-0.83	1.48
AdhGroup(0)	3.37	2.11	-0.79	7.54
Visit*AdhGroup(0)	-1.60	0.79	-3.17	-0.04
Random Effects				
Between subjects	42.43	7.73	29.69	60.62
Within subjects	19.83	2.56	15.39	25.54

Gender and gender\*visit interactions emerged as predictors for psychiatric symptoms (Table 5.3). According to the model, males reported significant increases in DSM5 scores while females reported significant decreases across four months in the study. Higher scores were indicators of more psychiatric symptoms, lower scores were evidence of fewer symptoms.

**Table 5.3. Symptoms (DSM5)**

<i>Effect</i>	<i>Estimate</i>	<i>SE</i>	<i>95% CI</i>	
			<i>Lower Bound</i>	<i>Upper Bound</i>
Fixed Effects				
Intercept	22.09	1.55	19.04	25.14
Visit	-0.95	0.55	-2.04	0.15
Gender(0)	-5.96	2.88	-11.65	-0.27
Gender(0)*Visit	2.16	0.99	0.21	4.11
Random Effects				
Between subjects	80.39	14.22	56.84	113.69
Within subjects	26.56	3.49	20.52	34.37

This study was unique in that no others were found in the literature that specifically examined adherence, an outcome variable resulting from an intervention, as a predictor of well-being. Most other studies examine adherence and well-being outcomes relative to a specific intervention, but not in terms of correlation or causality between one another. Studies have shown significant improvements in quality of life, depression symptoms and mental function, and treatment engagement.<sup>63,117,124</sup>

In this study the report of lower stress levels by those who were not adherent suggest that these patients may feel less pressure to become invested in their care. These very people may be the ones most in need of treatment. By the same token, older participants, as well as females in the non-adherent group may prefer more provider involvement in treatment because they do realize they are in need of the assistance. Older participants and females who were adherent and preferred less provider involvement in clinical decision-making, may feel more in control and capable of handling their treatment decisions. Males may engage more in treatment over time, which could explain the increase in reported symptoms and the preference for more provider involvement in decision-making.

## **Study Strengths**

Various strengths were shown by the study. Most importantly, the study randomized well, as demonstrated by the lack of significant differences between intervention and control groups. The diverse clinic population allowed inclusion of numerous clinical factors of interest which were readily available in the clinic EHR and electronic chart repository. Additionally, the instruments used for well-being measurement were easy to obtain, understand, and use, allowing for effective patient engagement and efficient administration. Finally, the commercial texting program was easy to learn and execute, allowing the researcher the ability to schedule and send text reminders very consistently.

## **Study Limitations**

### **Size Limitations**

Overall, the size of the study population was a limitation and may have been underpowered. This relatively small pool of eligible patients was possibly further decreased in size and power by a policy change at the clinic regarding accepted insurances. Being conducted at a single site with patients seeing a single prescriber could introduce bias as well as limit generalizability of findings.

### **Human Limitations**

Researcher and participants were not blinded to randomization, possibly introducing a Hawthorne effect among participants, though this may have been countered by loss of novelty over progression of the study. There was a risk of contamination if patients in the waiting room discussed the study or overheard others discussing the study.

Lastly, those who agreed to participate in the study may already be more inclined to adhere to appointments and medications.

### **Data Limitations**

Self-reported data may have had a ceiling effect, which could impact the level of any improvements noted. Adherence in this population was high, making it quite difficult, if not impossible, to achieve significance. Clinical factors could potentially have been used for more in-depth analysis had the study revealed significant findings between the intervention and control groups.

### **Technical and Practice Limitations**

The commercial SMS system was independent of the clinic's in-house scheduling system. If not closely coordinated, there was potential for loss of information where any text message scheduling was concerned. In psychiatric medication management it is standard practice to schedule follow-up appointments according to a patient's response and reported progress at each appointment. As a result, the time between appointments differed for study participants. The four-month study cycle for each participant may have imposed limitations on ability to schedule text reminders.

### **Implications for Practice**

Though the main outcomes of appointment and medication adherence in response to the text reminder intervention of this study were not significant, the results were still generally in line with the literature. This would suggest there is value in using text appointment reminders in practice. There exist a number of commercial SMS systems and capabilities, both integrated with and independent of EHR systems. Most practices have already moved to electronic scheduling systems and are at least in the process of

adopting an EHR system, if they have not already. Because appointment adherence is a problem that plagues every type of healthcare practice, those that avail themselves of SMS capability will likely benefit in terms of improved appointment adherence. Regular attendance at appointments improves the patient-provider relationship which plays an important role in patients' medication adherence and overall stability and good health, which cannot help but cascade into improved well-being.

### **Recommendations for Future Research**

The lessons learned in this study yield several recommendations for future research. As shown by the literature review, while psychiatry is increasing in its adoption of technology, research in this specific discipline is still behind that in other specialties. Overall, the field of psychiatry would benefit from more studies involving technology. Text messaging is easy to implement and is within the grasp of even the most difficult to reach populations. The results of this study suggest that larger studies with less adherent patients over longer periods of time would yield richer results. Appointments that are scheduled farther apart would benefit more from text reminders, as the passage of time makes them easier to forget. A longer study timeframe per participant would mimic more real-world medication management situations. Lastly, use of an SMS system linked to the appointment system would facilitate scheduling of text reminders and minimize potential for loss of data that exists when the two systems are independent.

### **Conclusion**

Appointment and medication adherence are very complex and multi-faceted issues, particularly in psychiatry. Other studies have demonstrated text message reminders to be helpful tools in patient adherence and well-being. While not yielding

significance, this study did show some improvement in both areas of adherence. These may have also impacted well-being, as some areas of significance as relates to predictors of well-being were identified in this study. This study helps set the stage for future studies to explore the iterative connections between technology, adherence, and health outcomes. A larger study may yield information of interest in sub-populations as well. Lastly, text reminder systems can help reduce barriers to care while helping practices meet mandated patient engagement goals.

## APPENDIX A MEASURES

### Independent variable

**Text Message** is a dichotomous variable indicating if the subject is in the intent to treat group (Y) or in the control group (N).

### Dependent variables

**Appointment Attendance** and **Medication Adherence** are dichotomous variables indicating adherence (Y) or non-adherence (N). Adherence to visit is obtained from the patient's chart while adherence to medication is obtained by patient report and, in some cases, the chart.

**Overall Adherence** is a composite of the data values recorded for visit and medication. If both individual variables show adherence (Y+Y), then there is overall adherence (Y); other combinations (Y+N, N+Y, N+N) indicate overall non-adherence (N).

**Mental and Physical Functioning** denotes the level of health and disability in six domains and is measured by the WHODAS 2.0 (see Appendix B for further details), which yields scores ranging from 0 to 100, indicating no disability to full disability, respectively. These scores may be recoded into three categories, Good, Fair, and Poor, for additional analysis.

**Psychiatric Symptoms** indicates level of symptomatology in 13 psychiatric domains and is measured by the DSM-5 Cross-Cutting Symptom Measure (see Appendix C for further details), which yields raw scores ranging from 0, indicating no symptoms to 52, indicating severe symptoms. These scores may also be recoded into three categories, Low, Moderate, and Severe levels of severity.

**Personal Factors:** age, gender, marital status, race, ethnicity, country of origin, primary language, education, employment, psychiatric diagnosis, number of hospitalizations, previous treatment.

**Environmental Factors:** number of medications, participation in therapy, input to treatment, previous treatment, stress level (see Appendix D for further details), patient input to treatment (see Appendix E for further details).

**Appendix Table A.1. Study variables: theoretical and operational definitions**

Variable	Theoretical Definition	Operational Definition	Measurement Level	How Assessed
<b>Main Input Variable: Intervention</b>				
Text Message (IV)	Customized readable message sent via SMS on cell or Smart Phone	Whether or not pt receives SMS message <ul style="list-style-type: none"> <li>• Y = intervention</li> <li>• N = control (standard clinical procedure)</li> </ul>	Dichotomous	<ul style="list-style-type: none"> <li>• Intent to treat group receives text and phone call</li> <li>• Control receives phone call (TAU)</li> </ul>
<b>Main Outcome Variables</b>				
Appointment attendance (DV)	Attendance at follow-up visits	Whether or not pt attends all follow-up visits <ul style="list-style-type: none"> <li>• Y = Pt attends all scheduled follow-up visits</li> <li>• N = Pt does not attend all scheduled follow-up visits</li> </ul>	Dichotomous	Pt records
Psych medication adherence (DV)	Taking medications as prescribed	Whether or not pt takes medications as prescribed by clinician <ul style="list-style-type: none"> <li>• Y = Pt takes as prescribed</li> <li>• N = Pt does not take as prescribed</li> </ul>	Dichotomous	Pt medication calendar, pt report
Overall adherence (DV)	Attendance and medications adherence	Combination of appointment and medication adherence: <ul style="list-style-type: none"> <li>• Y = visit(Y) and med(Y)</li> <li>• N = all other combinations</li> </ul>	Dichotomous	Based on med check visit attendance and psych medication adherence variables

Variable	Theoretical Definition	Operational Definition	Measurement Level	How Assessed
Mental and physical functioning (DV)	Health and disability measure in various domains	<p>Scores in 6 functional domains (cognition, mobility, self-care, getting along with people, life activities, participation) in last 30 days:</p> <ul style="list-style-type: none"> <li>• Scores range from 0 = no disability to 100 = full disability</li> <li>• Recode into three categories based on scores: <b>Good</b>, &lt; 34; <b>Fair</b>, 34-67; <b>Poor</b>, &gt; 67</li> </ul>	Continuous and Nominal	<ul style="list-style-type: none"> <li>• WHODAS 2.0 36-item Interviewer Administered</li> <li>• Spanish and English</li> <li>• Free</li> </ul>
Psychiatric symptoms (DV)	Mental health domains across psychiatric diagnoses	<p>Scores for 23 questions in 13 psychiatric domains (depression, anger, mania, anxiety, somatic symptoms, suicidal ideation, psychosis, sleep problems, memory, repetitive thoughts and behaviors, dissociation, personality functioning, and substance use) in last two weeks, highest domain score noted by clinician:</p> <p>0 = <b>None</b> – not at all  1 = <b>Slight</b> – rare, &lt; a day or two  2 = <b>Mild</b> – several days  3 = <b>Moderate</b> – more than half the days  4 = <b>Severe</b> – nearly every day</p> <ul style="list-style-type: none"> <li>• Sum of highest raw domain scores range from 0 = no symptoms to 52 = severe symptoms</li> <li>• Recode into three categories based on raw scores: <b>Low</b>, &lt; 13; <b>Moderate</b>, 14-26; <b>Severe</b>, &gt; 27</li> </ul>	Continuous and Nominal	<ul style="list-style-type: none"> <li>• DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure—Adult</li> <li>• English only</li> <li>• Free</li> </ul>

Variable	Theoretical Definition	Operational Definition	Measurement Level	How Assessed
<b>Personal Factors</b>				
Age	In years, start of study	18-65	Continuous	Pt records DOB
Gender	Identified gender per patient	Pt self-report <ul style="list-style-type: none"> <li>• Male</li> <li>• Female</li> </ul>	Dichotomous	Pt records
Marital status	Legal marital status	Pt self-report <ul style="list-style-type: none"> <li>• Single</li> <li>• Married or partnered</li> <li>• Divorced</li> <li>• Widowed</li> </ul>	Nominal	Pt records
Psychiatric diagnoses	Per DSM-5	Diagnoses by provider in any of three domains: Moods (anxiety, depression, PTSD, ADHD, bipolar, mood other); Persistent/severe (schizophrenia, psychotic other); Substance use <ul style="list-style-type: none"> <li>• Sum total of all diagnoses</li> </ul>	Continuous	Pt records
Medications	Psych medications pt currently taking	Total number of psychiatric medications pt is Rx'd	Continuous	Pt records
Race	Biological race	Pt self-report <ul style="list-style-type: none"> <li>• Black</li> <li>• White</li> <li>• Asian</li> <li>• Native American</li> <li>• Other</li> </ul>	Nominal	Pt records
Ethnicity	Ethnic group by birth, origin, or identification	Pt self-report <ul style="list-style-type: none"> <li>• Hispanic</li> <li>• non-Hispanic</li> <li>• Other</li> </ul>	Nominal	Pt records
Primary Language	As identified by pt	Pt self-report <ul style="list-style-type: none"> <li>• Spanish</li> <li>• English</li> <li>• Other</li> </ul>	Nominal	Pt records
Education	Formal education	Last grade completed <ul style="list-style-type: none"> <li>• Elementary/some high school</li> <li>• HS Grad/GED</li> <li>• Some college</li> <li>• Bachelors' degree or above</li> <li>• Vocational school or trades</li> </ul>	Nominal	Pt records

Variable	Theoretical Definition	Operational Definition	Measurement Level	How Assessed
Employment	Working inside or outside the home for financial compensation	Hours per week of employment for which pt receives financial compensation <ul style="list-style-type: none"> <li>• Employed full-time (&gt;20 hrs)</li> <li>• Employed part time (&lt; = 20 hrs)</li> <li>• Not employed</li> </ul>	Nominal	Pt records
Previous treatment	Number of times seen for medications in past year	Number of medication follow-up visits to clinic, private practice, crisis clinic, do not include inpatient hospitalizations	Continuous	Pt records, pt report
Number of hospitalizations	Number of times hospitalized for psych issues in past year	Number of inpatient hospitalizations only, do not include ER or crisis center visits	Continuous	Pt records, pt report
<b><i>Environmental Factors</i></b>				
Therapy	Whether or not pt is currently engaged in psychotherapy	Receiving therapy services at Vesta or other clinic/provider <ul style="list-style-type: none"> <li>• Yes</li> <li>• No</li> </ul>	Dichotomous	Pt records
Stress Level	Level of stress pt perceives in life	Score on 10 item scale measuring stress over last 30 days: 0 = <b>Never</b> 1 = <b>Almost never</b> 2 = <b>Sometimes</b> 3 = <b>Fairly often</b> 4 = <b>Very often</b> <ul style="list-style-type: none"> <li>• Sum of scores range from 0 = no stress to 40 = high stress</li> </ul>	Continuous	<ul style="list-style-type: none"> <li>• Perceived Stress Scale-10</li> <li>• English and Spanish</li> <li>• Free</li> </ul>

Variable	Theoretical Definition	Operational Definition	Measurement Level	How Assessed
Patient input to treatment	Degree of control pt wants in medical decision making	Using “pick one” approach, pt selects, from range of roles, the one closest to his Tx philosophy: A = Active, pt only; B = Active, pt considers provider input; C = Collaborative, shared responsibility; D = Passive, provider decides, considers pt input; E = Passive, provider only <ul style="list-style-type: none"> <li>• Active = A or B</li> <li>• Collaborative = C</li> <li>• Passive = D or E</li> </ul>	Nominal	<ul style="list-style-type: none"> <li>• Degner Scale</li> <li>• English only</li> <li>• Free</li> </ul>

## **APPENDIX B**

### **WORLD HEALTH ORGANIZATION DISABILITY ASSESSMENT SCHEDULE 2.0 (WHODAS 2.0)**

The WHODAS 2.0 is an instrument developed by the WHO to capture generic assessment of functioning as a common metric among adults, irrespective of illness condition or culture. The instrument follows the WHO International Classification of Functioning, Disability, and Health (ICF) framework, which uses the biopsychosocial model as its basis. Environmental and personal contextual factors influence health, which is seen along a continuum where increasing disability is related to the level of decreased functioning.<sup>135,136</sup>

The WHODAS 2.0 measures level of functioning, over the last thirty days, in six life domains: *cognition*, which encompasses communications and understanding; *mobility*, which is the ability to move and get around; *self-care*, which is personal hygiene and activities of daily and independent living; *getting along*, which is the way one interacts with others; *life activities*, which includes responsibilities at work or school, play, and home; and *participation*, which is involvement in society and community activities. Each domain contains four to eight five-point Likert scale items whose responses range from “none” to “extreme.” The instrument is available in three versions: (1) the full version has 36 questions and may be self-, proxy-, or interviewer-administered; (2) the short, 12-question version may also be self-, proxy-, or interviewer-administered; (3) the 12+24 version is a hybrid, adaptive instrument that may only be administered via interviewer or computer. Because the full, 36-item questionnaire is the most complete, takes only about 20 minutes to administer, and is the version referenced in the DSM-5,<sup>26,135</sup> this is the version chosen for this pilot.

The 36-item version of the WHODAS 2.0 demonstrates good psychometric properties across a variety of cultural and patient groups.<sup>135,137</sup> Test-retest reliability, which shows the instrument's capacity to perform well repeatedly, is shown by an intraclass correlation coefficient (ICC) of 0.98 for the six domains, overall, and ranging from 0.93 to 0.96 and 0.69 to 0.89 at the domain and item levels, respectively. Factor analyses reflect robust structures, across population and location, at both the general disability level (ICC range of 0.91-0.99) and the domain level (ICC range of 0.82-0.98). Total internal consistency is demonstrated by a Cronbach's  $\alpha$  of 0.96, showing a high level of correlation between items in the instrument; domain-level internal consistency is reflected in a Cronbach's  $\alpha$  range from 0.79 to 0.84. The WHODAS 2.0 shows good characteristics according to Item Response Theory (IRT), an indication of the instrument's utility across populations. Concurrent validity is shown by a high degree of correlation (r-values generally in the range of 0.45 to 0.65) between the six domains of the WHODAS 2.0 and other established and validated instruments measuring similar constructs. Effect sizes ranging from 0.44 to 1.38 show that responsiveness to change is also comparable to that of other established instruments. Subgroup analysis show domain and total scores in expected directions, demonstrating capacity of the WHODAS 2.0 to measure disability as intended and according to ICF definitions on which it is based.<sup>135,137</sup>

Simple and complex scoring are the two scoring options described in the instructions for calculating the WHODAS 2.0 summary scores. Simple scoring is merely a summation of the scores assigned to each Likert item response: "none" = 1, "mild" = 2, "moderate" = 3, "severe" = 4, and "extreme" = 5. Complex scoring is based on IRT and involves weighting of each domain item. The three steps involved in complex scoring are

recoding and summing items within each domain, summing scores from all six domains, and finally converting them to a 0-100 scale, where 0 = no disability and 100 = full disability. Complex scoring can be done via WHO computer program or by incorporating syntax from WHO for SPSS.<sup>135</sup> The DSM-5 recommends the use of average scores for each domain by dividing total domain score by number of items in that domain. For general disability scoring, the DSM-5 recommends dividing the sum of all raw scores by the total number of items, in this case 36.<sup>26</sup>

The WHODAS 2.0 is available for download from the WHO website. The instrument is free to use but prior to doing so, a user agreement must be completed and sent back to WHO headquarters in Geneva. Interviewers must be trained prior to administering the instrument. A manual provided by the WHO, the Measuring Health and Disability: Manual for WHO Disability Assessment Schedule – WHODAS 2.0 is used for training and is also accessible online.<sup>138</sup>



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
DISABILITY ASSESSMENT SCHEDULE 2.0

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Interview

## Section 4 Domain reviews

### Domain 1 Cognition

I am now going to ask some questions about [understanding and communicating](#).

**Show flashcards #1 and #2 to respondent**

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D1.1	<a href="#">Concentrating on doing something for ten minutes?</a>	1	2	3	4	5
D1.2	<a href="#">Remembering to do important things?</a>	1	2	3	4	5
D1.3	<a href="#">Analysing and finding solutions to problems in day-to-day life?</a>	1	2	3	4	5
D1.4	<a href="#">Learning a new task, for example, learning how to get to a new place?</a>	1	2	3	4	5
D1.5	<a href="#">Generally understanding what people say?</a>	1	2	3	4	5
D1.6	<a href="#">Starting and maintaining a conversation?</a>	1	2	3	4	5

### Domain 2 Mobility

I am now going to ask you about difficulties in [getting around](#).

**Show flashcards #1 and #2**

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D2.1	<a href="#">Standing for long periods such as 30 minutes?</a>	1	2	3	4	5
D2.2	<a href="#">Standing up from sitting down?</a>	1	2	3	4	5
D2.3	<a href="#">Moving around inside your home?</a>	1	2	3	4	5
D2.4	<a href="#">Getting out of your home?</a>	1	2	3	4	5
D2.5	<a href="#">Walking a long distance such as a kilometre [or equivalent]?</a>	1	2	3	4	5

**Please continue to next page...**



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
DISABILITY ASSESSMENT SCHEDULE 2.0

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Interview

### Domain 3 Self-care

I am now going to ask you about difficulties in [taking care of yourself](#).

Show flashcards #1 and #2

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D3.1	<a href="#">Washing your whole body?</a>	1	2	3	4	5
D3.2	<a href="#">Getting dressed?</a>	1	2	3	4	5
D3.3	<a href="#">Eating?</a>	1	2	3	4	5
D3.4	<a href="#">Staying by yourself for a few days?</a>	1	2	3	4	5

### Domain 4 Getting along with people

I am now going to ask you about difficulties in [getting along with people](#). Please remember that I am asking only about difficulties that are due to health problems. By this I mean diseases or illnesses, injuries, mental or emotional problems and problems with alcohol or drugs.

Show flashcards #1 and #2

In the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D4.1	<a href="#">Dealing with people you do not know?</a>	1	2	3	4	5
D4.2	<a href="#">Maintaining a friendship?</a>	1	2	3	4	5
D4.3	<a href="#">Getting along with people who are close to you?</a>	1	2	3	4	5
D4.4	<a href="#">Making new friends?</a>	1	2	3	4	5
D4.5	<a href="#">Sexual activities?</a>	1	2	3	4	5

Please continue to next page...



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
DISABILITY ASSESSMENT SCHEDULE 2.0

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Interview

## Domain 5 Life activities

### 5(1) Household activities

I am now going to ask you about activities involved in maintaining your household, and in caring for the people who you live with or are close to. These activities include cooking, cleaning, shopping, caring for others and caring for your belongings.

#### Show flashcards #1 and #2

Because of your health condition, in the past 30 days, how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D5.1	Taking care of your <u>household responsibilities</u> ?	1	2	3	4	5
D5.2	Doing your most important household tasks <u>well</u> ?	1	2	3	4	5
D5.3	Getting all the household work <u>done</u> that you needed to do?	1	2	3	4	5
D5.4	Getting your household work done as <u>quickly</u> as needed?	1	2	3	4	5

If any of the responses to D5.2–D5.5 are rated greater than none (coded as “1”), ask:

D5.01	In the past 30 days, on how many days did you reduce or completely miss <u>household work</u> because of your health condition?	Record number of days ____
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If respondent works (paid, non-paid, self-employed) or goes to school, complete questions D5.5–D5.10 on the next page. Otherwise, skip to D6.1 on the following page.



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
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Interview

## 5(2) Work or school activities

Now I will ask some questions about your work or school activities.

Show flashcards #1 and #2

Because of your health condition, in the past 30 days how much difficulty did you have in:		None	Mild	Moderate	Severe	Extreme or cannot do
D5.5	Your day-to-day work/school?	1	2	3	4	5
D5.6	Doing your most important work/school tasks well?	1	2	3	4	5
D5.7	Getting all the work <u>done</u> that you need to do?	1	2	3	4	5
D5.8	Getting your work done as <u>quickly</u> as needed?	1	2	3	4	5
D5.9	Have you had to work at a <u>lower level</u> because of a health condition?				No	1
					Yes	2
D5.10	Did you <u>earn less money</u> as the result of a health condition?				No	1
					Yes	2

If any of D5.5–D5.8 are rated greater than none (coded as “1”), ask:

D5.02	In the past 30 days, on how many days did you <u>miss work for half a day or more</u> because of your health condition?	Record number of days _____
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Please continue to next page...



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
DISABILITY ASSESSMENT SCHEDULE 2.0

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Interview

## Domain 6 Participation

Now, I am going to ask you about your participation in society and the impact of your health problems on you and your family. Some of these questions may involve problems that go beyond the past 30 days, however in answering, please focus on the past 30 days. Again, I remind you to answer these questions while thinking about health problems: physical, mental or emotional, alcohol or drug related.

### Show flashcards #1 and #2

In the past 30 days:		None	Mild	Moderate	Severe	Extreme or cannot do
D6.1	How much of a problem did you have <u>joining in community activities</u> (for example, festivities, religious or other activities) in the same way as anyone else can?	1	2	3	4	5
D6.2	How much of a problem did you have because of <u>barriers or hindrances</u> in the world around you?	1	2	3	4	5
D6.3	How much of a problem did you have <u>living with dignity</u> because of the attitudes and actions of others?	1	2	3	4	5
D6.4	How much <u>time</u> did you spend on your health condition or its consequences?	1	2	3	4	5
D6.5	How much have you been <u>emotionally affected</u> by your health condition?	1	2	3	4	5
D6.6	How much has your health been a <u>drain on the financial resources</u> of you or your family?	1	2	3	4	5
D6.7	How much of a problem did your <u>family</u> have because of your health problems?	1	2	3	4	5
D6.8	How much of a problem did you have in doing things <u>by yourself</u> for <u>relaxation or pleasure</u> ?	1	2	3	4	5



# WHODAS 2.0

WORLD HEALTH ORGANIZATION  
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Interview

H1	Overall, in the past 30 days, <u>how many days</u> were these difficulties present?	<b>Record number of days</b> ____
H2	In the past 30 days, for how many days were you <u>totally unable</u> to carry out your usual activities or work because of any health condition?	<b>Record number of days</b> ____
H3	In the past 30 days, not counting the days that you were totally unable, for how many days did you <u>cut back or reduce</u> your usual activities or work because of any health condition?	<b>Record number of days</b> ____

This concludes the interview. Thank you for participating.

## **APPENDIX C**

### **DSM-5 CROSS-CUTTING SYMPTOM MEASURE**

The DSM-5 includes a new section containing supplemental materials for diagnostic use. Among them are the Cross-Cutting Symptom Measures, developed at the recommendation of the DSM-5 Research Planning Conference on Dimensional Assessment and the DSM-5 Diagnostic Spectrum Study Group. Because numerous symptoms present across a variety of psychiatric diagnoses it is important to examine them in a systematic way to support diagnostic and treatment decisions, as well as to more fully engage patients in the treatment process. The measures are based upon the review of systems conducted in general medicine and are intended to serve as adjunctive tools in formulating a more comprehensive psychiatric diagnostic opinion and also as a mechanism for tracking patient symptoms over time. Instruments are available with adult or child focus. The adult version has the option to be self-administered or completed by a reliable informant if the patient is not of mental capacity to do so on his own. The child version is rated by parents or guardians of children aged 6 to 17, with an optional self-administered measure for children aged 11 to 17.<sup>26,130</sup>

Both adult and child instruments are available in two levels. Level 1 provides a basic overview of symptoms while Level 2 allows for further inquiry into specific areas reflecting scores above certain thresholds. This study will use the Level 1, adult self-administered version, which measures symptom severity, over the previous two weeks, in 13 psychiatric domains: depression, anger, mania, anxiety, somatic symptoms, suicidal ideation, psychosis, sleep problems, memory, repetitive thoughts and behaviors, dissociation, personality functioning, and substance use. Each domain contains one to

three five-point Likert scale items, for a total of 23 questions, with responses ranging from “none” (not at all) to “severe” (nearly every day).<sup>26</sup>

Because the DSM-5 Level 1 Cross-Cutting Symptom Measure—Adult is a newly developed scale, its clinical utility and reliability have been examined in clinical field trials in the U.S. and Canada.<sup>26,130</sup> Test-retest reliability was examined using two independent and randomly assigned clinicians conducting separate interviews anywhere from 4 hours to 14 days apart. Interpretation of intraclass correlation coefficients (ICC), rounded to two decimal places, for each individual domain question is based on the following categories: unacceptable = 0–0.39, questionable = 0.40–0.59, good = 0.60–0.79, and excellent = 0.80–1. All Level 1 items on the Adult questionnaire were rated “good” or “excellent,” (ICC score range from 0.64 to 0.97) with the exception of the two mania items, which fell into the higher level of the “questionable” category (ICC scores of 0.56 and 0.53 for Mania 1 and Mania 2, respectively). As noted in the results, the field trials did not test validity, though Level 2 follow-ups used scales with documented validity where possible. This new instrument is expected to enhance clinicians’ ability to diagnose and plan treatment, as well as to help patients understand symptoms in order to participate more fully in treatment.<sup>130</sup>

To score the Level 1 Cross-Cutting Symptom Measure, points are assigned to each Likert scale item response: “none” = 0, “slight” = 1, “mild” = 2, “moderate” = 3, and “severe” = 4. Using the highest score in each domain, as determined by the clinician, cutoffs are recommended for follow-up and additional inquiry using Level 2 tools. For substance use, suicidal ideation, and psychosis, follow-up recommended for a score of 1

(slight) or above; for other domains, follow-up recommended for a score of 2 (mild) or above.<sup>26</sup>

The DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure—Adult is free for use, without specific permissions or training, by clinicians and researchers. It is downloadable from the American Psychiatric Association website.<sup>139</sup>

## DSM-5 Self-Rated Level 1 Cross-Cutting Symptom Measure—Adult

Name: \_\_\_\_\_ Age: \_\_\_\_\_ Sex:  Male  Female Date: \_\_\_\_\_

If this questionnaire is completed by an informant, what is your relationship with the individual? \_\_\_\_\_

In a typical week, approximately how much time do you spend with the individual? \_\_\_\_\_ hours/week

**Instructions:** The questions below ask about things that might have bothered you. For each question, circle the number that best describes how much (or how often) you have been bothered by each problem during the **past TWO (2) WEEKS**.

		None Not at all	Slight Rare, less than a day or two	Mild Several days	Moderate More than half the days	Severe Nearly every day	Highest Domain Score (clinician)
I.	1. Little interest or pleasure in doing things?	0	1	2	3	4	
	2. Feeling down, depressed, or hopeless?	0	1	2	3	4	
II.	3. Feeling more irritated, grouchy, or angry than usual?	0	1	2	3	4	
III.	4. Sleeping less than usual, but still have a lot of energy?	0	1	2	3	4	
	5. Starting lots more projects than usual or doing more risky things than usual?	0	1	2	3	4	
IV.	6. Feeling nervous, anxious, frightened, worried, or on edge?	0	1	2	3	4	
	7. Feeling panic or being frightened?	0	1	2	3	4	
	8. Avoiding situations that make you anxious?	0	1	2	3	4	
V.	9. Unexplained aches and pains (e.g., head, back, joints, abdomen, legs)?	0	1	2	3	4	
	10. Feeling that your illnesses are not being taken seriously enough?	0	1	2	3	4	
VI.	11. Thoughts of actually hurting yourself?	0	1	2	3	4	
VII.	12. Hearing things other people couldn't hear, such as voices even when no one was around?	0	1	2	3	4	
	13. Feeling that someone could hear your thoughts, or that you could hear what another person was thinking?	0	1	2	3	4	
VIII.	14. Problems with sleep that affected your sleep quality over all?	0	1	2	3	4	
IX.	15. Problems with memory (e.g., learning new information) or with location (e.g., finding your way home)?	0	1	2	3	4	
X.	16. Unpleasant thoughts, urges, or images that repeatedly enter your mind?	0	1	2	3	4	
	17. Feeling driven to perform certain behaviors or mental acts over and over again?	0	1	2	3	4	
XI.	18. Feeling detached or distant from yourself, your body, your physical surroundings, or your memories?	0	1	2	3	4	
XII.	19. Not knowing who you really are or what you want out of life?	0	1	2	3	4	
	20. Not feeling close to other people or enjoying your relationships with them?	0	1	2	3	4	
XIII.	21. Drinking at least 4 drinks of any kind of alcohol in a single day?	0	1	2	3	4	
	22. Smoking any cigarettes, a cigar, or pipe, or using snuff or chewing tobacco?	0	1	2	3	4	
	23. Using any of the following medicines ON YOUR OWN, that is, without a doctor's prescription, in greater amounts or longer than prescribed [e.g., painkillers (like Vicodin), stimulants (like Ritalin or Adderall), sedatives or tranquilizers (like sleeping pills or Valium), or drugs like marijuana, cocaine or crack, club drugs (like ecstasy), hallucinogens (like LSD), heroin, inhalants or solvents (like glue), or methamphetamine (like speed)]?	0	1	2	3	4	

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## **APPENDIX D**

### **PERCEIVED STRESS SCALE-10 (PSS-10)**

The Perceived Stress Scale (PSS) was developed by Cohen, Kamarck & Mermelstein<sup>131</sup> to measure the degree of life stress as appraised by the individual. The development of this instrument arose from the premise that stressful events alone do not directly influence the development of disease states; rather, detrimental impacts to health are the result of the perception of life stressors by the individual experiencing them. According to Sheldon Cohen, one of the authors, the PSS is the scale most frequently used in the measurement of perceived stress, and has been used in a variety of mental, as well as physical, health studies.<sup>140</sup>

The PSS measures, in adults, the frequency with which stress was perceived, over the last month, according to responses to five-point Likert scale items ranging from “never” to “very often.” The instrument is available in its original, 14-item version (the PSS-14), a 10-item version (PSS-10), and a 4-item version (PSS-4). The 10-item version is the one recommended by the authors due to its superior level of reliability among the three versions and is the version selected for this pilot study.<sup>141</sup>

The PSS-10 shows good internal reliability, with a Cronbach’s  $\alpha = 0.78$ . Construct validity is supported by moderate correlations between the PSS-10 and other instruments measuring similar constructs—*r*-values reflect both positive and negative correlations (ranging from -0.27 to 0.39) depending on constructs measured.<sup>141</sup>

Values for items on the PSS-10 are assigned according to Likert scale responses: “Never” = 0, “Almost Never” = 1, “Sometimes” = 2, “Fairly Often” = 3, and “Very Often” = 4. Because items are positively and negatively worded, the four positively worded items (4, 5, 7, and 8) must be reversed prior to scoring. Sum of scores across all

items yield total scores ranging from 0 to 40.<sup>142</sup> The PSS-10 is found on Dr. Sheldon Cohen's website.<sup>142</sup>

## Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

Name \_\_\_\_\_ Date \_\_\_\_\_

Age \_\_\_\_\_ Gender (Circle): **M** **F** Other \_\_\_\_\_

**0 = Never    1 = Almost Never    2 = Sometimes    3 = Fairly Often    4 = Very Often**

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 1. In the last month, how often have you been upset because of something that happened unexpectedly? .....                 | 0 | 1 | 2 | 3 | 4 |
| 2. In the last month, how often have you felt that you were unable to control the important things in your life? .....     | 0 | 1 | 2 | 3 | 4 |
| 3. In the last month, how often have you felt nervous and "stressed"? .....  | 0 | 1 | 2 | 3 | 4 |
| 4. In the last month, how often have you felt confident about your ability to handle your personal problems? .....         | 0 | 1 | 2 | 3 | 4 |
| 5. In the last month, how often have you felt that things were going your way? .....                                       | 0 | 1 | 2 | 3 | 4 |
| 6. In the last month, how often have you found that you could not cope with all the things that you had to do? .....       | 0 | 1 | 2 | 3 | 4 |
| 7. In the last month, how often have you been able to control irritations in your life? .....                              | 0 | 1 | 2 | 3 | 4 |
| 8. In the last month, how often have you felt that you were on top of things? ..   | 0 | 1 | 2 | 3 | 4 |
| 9. In the last month, how often have you been angered because of things that were outside of your control? .....           | 0 | 1 | 2 | 3 | 4 |
| 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? ..... | 0 | 1 | 2 | 3 | 4 |

Please feel free to use the *Perceived Stress Scale* for your research.

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#### References

The PSS Scale is reprinted with permission of the American Sociological Association, from Cohen, S., Kamarck, T., and Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 386-396.  
 Cohen, S. and Williamson, G. Perceived Stress in a Probability Sample of the United States. Spacapan, S. and Oskamp, S. (Eds.) *The Social Psychology of Health*. Newbury Park, CA: Sage, 1988.

## **APPENDIX E CONTROL PREFERENCES SCALE**

The Control Preferences Scale (CPS) measures the degree to which a patient wishes to be in control of his personal treatment decisions. The scale was developed by Degner, Sloan, and Venkatesh,<sup>132</sup> with its origins in grounded theory about treatment decision-making during serious illness. The premise behind the CPS is that patients have distinct preferences about how involved they want to be in the treatment decision-making process, and that these preferences are influenced by psychosocial factors.

The scale is composed of five cards illustrating, with a cartoon and short description, a different degree of control on each one. These degrees of control range from more active to more passive roles. Control preferences are indicated by the patient by the order in which they place the cards after they are presented for comparison. In clinical applications, all cards are presented and the patient is able to select the card closest to his treatment preference.<sup>132</sup> This “pick one” approach will be used for this pilot study.

The CPS demonstrates scale reliability according to Coombs’ “50% plus 1” criteria, with scores of percent on dimension ranging from 58% to 66%. Construct validity is shown by the instrument’s origin and development in grounded theory, as well as its usefulness in epidemiological studies.<sup>132</sup>

The CPS is free and is in the original publication describing its use.<sup>132</sup> For this study, the scale will be used in a modified version from which patients can select their preference, such as the one found in the American College of Preventive Medicine Clinical Reference.<sup>3</sup>

- **Degner scale for eliciting patient's input in treatment decision-making.**
  - I prefer to make the final selection about which treatment I receive.
  - I prefer to make the final selection of my treatment after seriously considering my doctor's opinion.
  - I prefer that my doctor and I share responsibility for deciding which treatment is best for me.
  - I prefer that my doctor make the final decision about which treatment will be used, but seriously considers my opinion.
  - I prefer to leave all decisions regarding my treatment to my doctor.

## **APPENDIX F DESCRIPTION OF FIELD WORK**

This project is based on a 30-day pilot study that examined the feasibility of a cell phone IVR system to monitor medication adherence in a homeless population dually diagnosed with psychiatric and substance use disorders.<sup>75</sup> Though still a pilot study, this researcher built upon the initial smaller study to expand to a larger, more diverse population and to specifically focus on appointment adherence as a way to achieve medication adherence as well as improvement in areas related to well-being.

### **Site Selection**

A busy non-profit primary psychiatric outpatient setting was chosen for the study. This clinic is part of a larger community behavioral health system in a large urban metropolitan area in the Mid-Atlantic. The site was selected for its convenient access to both patients and researchers and is particularly rich site in that a large number of Hispanic patients are seen there, both for psychotherapy and medication management. This clinic is sensitive to this minority population, employing and contracting bilingual therapists and prescribers to ensure adequate provision of services.

### **Logistics**

The idea of the project was presented to the clinic's Administration, Medical Director, and Front Desk staff for buy-in. After receiving permission from the site to conduct the study there, approval to conduct the study with human subjects was obtained from the University of Maryland IRB. A commercial, web-based short message service (SMS) software solution was selected for scheduling and sending text messages. The researcher was able to obtain a substantially reduced rate for a one-year contract with the vendor upon providing proof of student status and demonstrating need for dissertation

research. Brief meetings were held to explain project details to the Medical Director and Front Desk staff and the project was launched.

### **Recruitment**

Lists of potential participants meeting eligibility criteria were extracted weekly from established patients in the clinic's electronic databases and reviewed with the primary prescriber, in this case the Medical Director, for final determination of eligibility. Patients were approached for participation at one of two times: either directly by the researcher in the waiting room prior to his or her medication management appointment, or by the psychiatrist during the medication management appointment, who then introduced the patient to the researcher. In either case, each patient initially met with the researcher after the appointment to review the project and to obtain consent. Baseline instruments were administered at time of consent. A total of 89 participants were recruited in this fashion and then randomized to ITT (n=47) or TAU (n=42).

### **Project Procedures**

The researcher then coordinated with the clinic's Front Desk staff to obtain next appointment dates for each participant. For those in the ITT group, text message appointment reminders were uploaded to the web-based SMS system. Weekly checks were conducted to ensure that SMS reminders were properly scheduled, and to enable the researcher to adjust in the event of a patient cancellation or appointment change. Scheduled messages were sent 24 hours prior to the appointment, 7 days a week, between the hours of 9am and 5pm.

Two additional appointments between the researcher and the participants were conducted at approximately two and four months after the initial meeting to administer

follow-up instruments. Other data from the EHR and separate electronic charting system were obtained at various points throughout the study, which ran on a rolling four-month schedule for each participant.

## REFERENCES

1. Sabaté E. *Adherence to Long-Term Therapies: Evidence for Action*. Geneva: World Health Organization; 2003.  
<http://apps.who.int/medicinedocs/pdf/s4883e/s4883e.pdf>. Accessed June 7, 2014.
2. American College of Preventive Medicine. MEDICATION ADHERENCE – IMPROVING HEALTH OUTCOMES A Resource from the American College of Preventive Medicine: A Time Tool. 2011:1-4.  
<http://c.ymcdn.com/sites/www.acpm.org/resource/resmgr/timetools-files/adherencetimetool.pdf>. Accessed June 8, 2014.
3. American College of Preventive Medicine. MEDICATION ADHERENCE – IMPROVING HEALTH OUTCOMES A Resource from the American College of Preventive Medicine: A Clinical Reference. 2011:1-17.  
<http://c.ymcdn.com/sites/www.acpm.org/resource/resmgr/timetools-files/adherenceclinicalreference.pdf>.
4. U.S. Department of Health and Human Services. Mental Health and Mental Disorders - Healthy People.  
<http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=28>. Published 2012. Accessed July 2, 2014.
5. Mitchell AJ, Selmes T. Why don't patients attend their appointments? Maintaining engagement with psychiatric services. *Adv Psychiatr Treat*. 2007;13(6):423-434.  
doi:10.1192/apt.bp.106.003202
6. Nelson EA, Maruish ME, Axler JL. Effects of discharge planning and compliance with outpatient appointments on readmission rates. *Psychiatr Serv*. 2000;51(7):885-889. <http://www.ncbi.nlm.nih.gov/pubmed/10875952>.
7. Greenberg Quinlan Rosner Research. Lack of medication adherence harms Americans' health: results from a U.S. national survey of adults.  
c\_2013\_public\_poll\_memo.pdf. Published 2013. Accessed July 2, 2014.
8. Colom F, Vieta E, Tacchi MJ, Sánchez-Moreno J, Scott J. Identifying and improving non-adherence in bipolar disorders. *Bipolar Disord*. 2005;7 Suppl 5:24-31. doi:10.1111/j.1399-5618.2005.00248.x
9. Sajatovic M, Biswas K, Kilbourne A, Fenn F, Williford W, Bauer M. Factors associated with prospective long-term treatment adherence among individuals with bipolar disorder. *Psychiatr Serv*. 2008;59(7):3-9.  
<http://journals.psychiatryonline.org/article.aspx?articleid=99557>. Accessed July 2, 2014.
10. Mitchell AJ, Selmes T. Why don't patients take their medicine? Reasons and solutions in psychiatry. *Adv Psychiatr Treat*. 2007;13(5):336-346.  
doi:10.1192/apt.bp.106.003194

11. Pew Research Center. » Mobile phone ownership. <http://www.pewinternet.org/chart/mobile-phone-ownership/>. Published 2018. Accessed March 11, 2018.
12. Rainie L. Cell phone ownership hits 91% of adults. *Pew Res Cent Internet Am Life Proj.* 2013. <http://www.pewresearch.org/fact-tank/2013/06/06/cell-phone-ownership-hits-91-of-adults/>.
13. Sims H, Sanghara H, Hayes D, et al. Text message reminders of appointments: a pilot intervention at four community mental health clinics in London. *Psychiatr Serv.* 2012;63(2):161-168. doi:10.1176/appi.ps.201100211
14. Kauppi K, Kannisto KA, Hätönen H, et al. Mobile phone text message reminders: Measuring preferences of people with antipsychotic medication. *Schizophr Res.* 2015;168(1-2):514-522. doi:10.1016/j.schres.2015.07.044
15. Albright K, Krantz MJ, Backlund Jarquín P, DeAlleaume L, Coronel-Mockler S, Estacio RO. Health Promotion Text Messaging Preferences and Acceptability Among the Medically Underserved. *Health Promot Pract.* 2015;16(4):523-532. doi:10.1177/1524839914566850
16. Anderson KO, Palos GR, Mendoza TR, et al. Automated pain intervention for underserved minority women with breast cancer. *Cancer.* 2015;121(11):1882-1890. doi:10.1002/cncr.29204
17. Macharia WM, Leon G, Rowe BH, Stephenson BJ, Haynes RB. An overview of interventions to improve compliance with appointment keeping for medical services. *JAMA.* 1992;267(13):1813-1817. <http://www.ncbi.nlm.nih.gov/pubmed/1532036>.
18. George A, Rubin G. Non-attendance in general practice: a systematic review and its implications for access to primary health care. *Fam Pract.* 2003;20(2):178-184. doi:10.1093/fampra/20.2.178
19. Kruse GR, Rohland BM, Wu X. Factors associated with missed first appointments at a psychiatric clinic. *Psychiatr Serv.* 2002;53(9):1173-1176. <http://www.ncbi.nlm.nih.gov/pubmed/12221319>.
20. Buttorff C, Ruder T, Bauman M. *Multiple Chronic Conditions in the United States.*; 2017. <https://www.rand.org/pubs/tools/TL221.html>.
21. Anderson G. *Chronic Care: Making the Case for Ongoing Care.*; 2010. <http://www.rwjf.org/en/library/research/2010/01/chronic-care.html>. Accessed July 2, 2014.
22. Fischer M a, Stedman MR, Lii J, et al. Primary medication non-adherence: analysis of 195,930 electronic prescriptions. *J Gen Intern Med.* 2010;25(4):284-290. doi:10.1007/s11606-010-1253-9

23. Fischer M a, Choudhry NK, Brill G, et al. Trouble getting started: predictors of primary medication nonadherence. *Am J Med.* 2011;124(11):1081.e9-22. doi:10.1016/j.amjmed.2011.05.028
24. Velligan DI, Weiden PJ, Sajatovic M, et al. The expert consensus guideline series: adherence problems in patients with serious and persistent mental illness. *J Clin Psychiatry.* 2009;70 Suppl 4:1-46; quiz 47-48.
25. Gilmer TP, Dolder CR, Lacro JP, et al. Adherence to treatment with antipsychotic medication and health care costs among Medicaid beneficiaries with schizophrenia. *Am J Psychiatry.* 2004;161(4):692-699. <http://www.ncbi.nlm.nih.gov/pubmed/15056516>.
26. American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders.* 5th ed. Arlington, VA: American Psychiatric Publishing, Inc; 2013.
27. Lacy NL, Reuter MD. Why We Don't Come: Patient Perceptions on No-Shows. *Ann Fam Med.* 2004;2(5):541-545. doi:10.1370/afm.123.INTRODUCTION
28. Killaspy H, Banerjee S, King M, Lloyd M. Prospective controlled study of psychiatric out-patient non-attendance: Characteristics and outcome. *Br J Psychiatry.* 2000;176(2):160-165. doi:10.1192/bjp.176.2.160
29. Agyapong VIO, Ahern S, McLoughlin DM, Farren CK. Supportive text messaging for depression and comorbid alcohol use disorder: single-blind randomised trial. *J Affect Disord.* 2012;141(2-3):168-176. doi:10.1016/j.jad.2012.02.040
30. Granholm E, Ben-Zeev D, Link PC, Bradshaw KR, Holden JL. Mobile assessment and treatment for schizophrenia (MATS): A pilot trial of an interactive text-messaging intervention for medication adherence, socialization, and auditory hallucinations. *Schizophr Bull.* 2012;38(3):414-425. doi:10.1093/schbul/sbr155
31. Ly KH, Ly AM, Andersson G. A fully automated conversational agent for promoting mental well-being: A pilot RCT using mixed methods. *Internet Interv.* 2017;10(October):39-46. doi:10.1016/j.invent.2017.10.002
32. Shingleton RM, Pratt EM, Gorman B, Barlow DH, Palfai TP, Thompson-Brenner H. Motivational Text Message Intervention for Eating Disorders: A Single-Case Alternating Treatment Design Using Ecological Momentary Assessment. *Behav Ther.* 2016;47(3):325-338. doi:10.1016/j.beth.2016.01.005
33. Stoner SA, Arenella PB, Hendershot CS. Randomized controlled trial of a mobile phone intervention for improving adherence to naltrexone for alcohol use disorders. *PLoS One.* 2015;10(4):1-15. doi:10.1371/journal.pone.0124613
34. Aguilera A, Bruehlman-Senecal E, Demasi O, Avila P. Automated Text Messaging as an Adjunct to Cognitive Behavioral Therapy for Depression: A Clinical Trial. *J Med Internet Res.* 2017;19(5):e148. doi:10.2196/jmir.6914

35. Henry BL, Moore DJ. Preliminary Findings Describing Participant Experience With iSTEP, an mHealth Intervention to Increase Physical Activity and Improve Neurocognitive Function in People Living With HIV. *J Assoc Nurses AIDS Care*. 2016;27(4):495-511. doi:10.1016/j.jana.2016.01.001
36. Moore DJ, Poquette A, Casaletto KB, et al. Individualized Texting for Adherence Building (iTAB): Improving Antiretroviral Dose Timing Among HIV-Infected Persons with Co-occurring Bipolar Disorder. *AIDS Behav*. 2015;19(3):459-471. doi:10.1007/s10461-014-0971-0
37. Kannisto KA, Korhonen J, Adams CE, Koivunen MH, Vahlberg T, Välimäki MA. Factors associated with dropout during recruitment and follow-up periods of a mHealth-based randomized controlled trial for mobile.net to encourage treatment adherence for people with serious mental health problems. *J Med Internet Res*. 2017;19(2):1-15. doi:10.2196/jmir.6417
38. Muench F, Van Stolk-Cooke K, Kuerbis A, et al. A randomized controlled pilot trial of different mobile messaging interventions for problem drinking compared to weekly drink tracking. *PLoS One*. 2017;12(2):1-17. doi:10.1371/journal.pone.0167900
39. Välimäki M, Kannisto KA, Vahlberg T, Hätönen H, Adams CE. Short text messages to encourage adherence to medication and follow-up for people with psychosis (mobile.net): Randomized controlled trial in Finland. *J Med Internet Res*. 2017;19(7):1-25. doi:10.2196/jmir.7028
40. Arora S, Peters AL, Agy C, Menchine M. A mobile health intervention for inner city patients with poorly controlled diabetes: proof-of-concept of the TExT-MED program. *Diabetes Technol Ther*. 2012;14(6):492-496. doi:10.1089/dia.2011.0252
41. Fischer HH, Moore SL, Ginosar D, et al. Care by cell phone: text messaging for chronic disease management. *Am J Manag Care*. 2012;18(2):e42-e47.
42. Fortmann AL, Gallo LC, Garcia MI, et al. Dulce digital: An mHealth SMS based intervention improves glycemic control in hispanics with type 2 diabetes. *Diabetes Care*. 2017;40(10):1349-1355. doi:10.2337/dc17-0230
43. Nundy S, Mishra A, Hogan P, Lee SM, Solomon MC, Peek ME. How Do Mobile Phone Diabetes Programs Drive Behavior Change?: Evidence From a Mixed Methods Observational Cohort Study. *Diabetes Educ*. 2014;40(6):806-819. doi:10.1177/0145721714551992
44. Agboola S, Jethwani K, Lopez L, Searl M, O'Keefe S, Kvedar J. Text to move: A randomized controlled trial of a text-messaging program to improve physical activity behaviors in patients with type 2 diabetes mellitus. *J Med Internet Res*. 2016;18(11):1-23. doi:10.2196/jmir.6439
45. Anzaldo-Campos MC, Contreras S, Vargas-Ojeda A, Menchaca-Díaz R, Fortmann

- A, Philis-Tsimikas A. Dulce Wireless Tijuana: A Randomized Control Trial Evaluating the Impact of Project Dulce and Short-Term Mobile Technology on Glycemic Control in a Family Medicine Clinic in Northern Mexico. *Diabetes Technol Ther.* 2016;18(4):240-251. doi:10.1089/dia.2015.0283
46. Brivio E, Gatti F, Galimberti C, Gambini P, Binello M. Effect of telephone calls and text messages on goal attainment in a Ehealth coaching service. *Annu Rev CyberTherapy Telemed.* 2015;13:135-138. doi:10.3233/978-1-61499-595-1-135
  47. Foley P, Steinberg D, Levine E, et al. Track: A randomized controlled trial of a digital health obesity treatment intervention for medically vulnerable primary care patients. *Contemp Clin Trials.* 2016;48:12-20. doi:10.1016/j.cct.2016.03.006
  48. Petrie KJ, Perry K, Broadbent E, Weinman J. A text message programme designed to modify patients' illness and treatment beliefs improves self-reported adherence to asthma preventer medication. *Br J Health Psychol.* 2012;17(1):74-84. doi:10.1111/j.2044-8287.2011.02033.x
  49. Evans WD, Wallace JL, Snider J. Pilot evaluation of the text4baby mobile health program. *BMC Public Health.* 2012;12:1031-1040. doi:10.1186/1471-2458-12-1031
  50. Hou MY, Hurwitz S, Kavanagh E, Fortin J, Goldberg AB. Using daily text-message reminders to improve adherence with oral contraceptives: a randomized controlled trial. *Obstet Gynecol.* 2010;116(3):633-640. doi:10.1097/AOG.0b013e3181eb6b0f
  51. Lakkis N a, Atfeh AM a, El-Zein YR, Mahmassani DM, Hamadeh GN. The effect of two types of sms-texts on the uptake of screening mammogram: a randomized controlled trial. *Prev Med (Baltim).* 2011;53(4-5):325-327. doi:10.1016/j.ypmed.2011.08.013
  52. Gallegos D, Russell-Bennett R, Previte J, Parkinson J. Can a text message a week improve breastfeeding? *BMC Pregnancy Childbirth.* 2014;14:374. doi:10.1186/s12884-014-0374-2
  53. Free C, Knight R, Robertson S, et al. Smoking cessation support delivered via mobile phone text messaging (txt2stop): a single-blind, randomised trial. *Lancet.* 2011;378(9785):49-55. doi:10.1016/S0140-6736(11)60701-0
  54. Cobos-Campos R, Apiñaniz Fernández de Larrinoa A, Sáez de Lafuente Moriñigo A, Parraza Diez N, Aizpuru Barandiaran F. Effectiveness of Text Messaging as an Adjuvant to Health Advice in Smoking Cessation Programs in Primary Care. A Randomized Clinical Trial. *Nicotine Tob Res.* 2016;(February 2018):ntw300. doi:10.1093/ntr/ntw300
  55. Bernstein SL, Rosner J, Toll B. Texting to promote tobacco abstinence in emergency department smokers: A pilot study. *Acad Emerg Med.* 2015;22(5):S74.

doi:10.1111/acem.12644

56. Dale LP, Whittaker R, Jiang Y, Stewart R, Rolleston A, Maddison R. Text message and internet support for coronary heart disease self-management: Results from the text4heart randomized controlled trial. *J Med Internet Res*. 2015;17(10):1-17. doi:10.2196/jmir.4944
57. Park KH, Song MR. The effects of postdischarge telephone counseling and short message service on the knee function, activities of daily living, and life satisfaction of patients undergoing total knee replacement. *Orthop Nurs*. 2017;36(3):229-236. doi:10.1097/NOR.0000000000000332
58. Thomsen T, Aadahl M, Beyer N, et al. The efficacy of motivational counselling and SMS reminders on daily sitting time in patients with rheumatoid arthritis: A randomised controlled trial. *Ann Rheum Dis*. 2017;76(9):1603-1606. doi:10.1136/annrheumdis-2016-210953
59. Chen Z-W, Fang L-Z, Chen L-Y, Dai H-L. Comparison of an SMS text messaging and phone reminder to improve attendance at a health promotion center: a randomized controlled trial. *J Zhejiang Univ Sci B*. 2008;9(1):34-38. doi:10.1631/jzus.B071464
60. da Costa TM, Salomão PL, Martha AS, Pisa IT, Sigulem D. The impact of short message service text messages sent as appointment reminders to patients' cell phones at outpatient clinics in São Paulo, Brazil. *Int J Med Inform*. 2010;79(1):65-70. doi:10.1016/j.ijmedinf.2009.09.001
61. Leong KC, Chen WS, Leong KW, et al. The use of text messaging to improve attendance in primary care: a randomized controlled trial. *Fam Pract*. 2006;23(6):699-705. doi:10.1093/fampra/cml044
62. Milne RG, Horne M, Torsney B. SMS reminders in the UK national health service: an evaluation of its impact on "no-shows" at hospital out-patient clinics. *Health Care Manage Rev*. 2006;31(2):130-136. <http://www.ncbi.nlm.nih.gov/pubmed/16648692>. Accessed April 4, 2014.
63. Aubert RE, Fulop G, Xia F, Thiel M, Maldonato D, Woo C. Evaluation of a depression health management program to improve outcomes in first or recurrent episode depression. *Am J Manag Care*. 2003;9(5):374-380.
64. Castle T, Cunningham MA, Marsh GM. Antidepressant medication adherence via interactive voice response telephone calls. *Am J Manag Care*. 2012;18(9):e346-55.
65. Cook PF, Emiliozzi S, Waters C, El Hajj D. Effects of telephone counseling on antipsychotic adherence and emergency department utilization. *Am J Manag Care*. 2008;14(12):841-846.
66. Ell K, Katon W, Xie B, et al. One-year postcollaborative depression care trial

- outcomes among predominantly Hispanic diabetes safety net patients. *Gen Hosp Psychiatry*. 2011;33(5):436-442. doi:10.1016/j.genhosppsy.2011.05.018
67. Aharonovich E, Stohl M, Cannizzaro D, Hasin D. HealthCall delivered via smartphone to reduce co-occurring drug and alcohol use in HIV-infected adults: A randomized pilot trial. *J Subst Abuse Treat*. 2017;83:15-26. doi:10.1016/j.jsat.2017.09.013
  68. Depp CA, Ceglowski J, Wang VC, et al. Augmenting psychoeducation with a mobile intervention for bipolar disorder: A randomized controlled trial. *J Affect Disord*. 2015;174:23-30. doi:10.1016/j.jad.2014.10.053
  69. Guarino H, Acosta M, Marsch LA, Xie H, Aponte-Melendez Y. A Mixed-Methods Evaluation of the Feasibility, Acceptability, and Preliminary Efficacy of a Mobile Intervention for Methadone Maintenance Clients. *Psychol Addict Behav*. 2016;30(1):1-11. doi:10.1037/adb0000128
  70. Hidalgo-Mazzei D, Reinares M, Mateu A, et al. Is a SIMPLe smartphone application capable of improving biological rhythms in bipolar disorder? *J Affect Disord*. 2017;223(July):10-16. doi:10.1016/j.jad.2017.07.028
  71. Janevic MR, Aruquipa Yujra AC, Marinec N, et al. Feasibility of an interactive voice response system for monitoring depressive symptoms in a lower-middle income Latin American country. *Int J Ment Health Syst*. 2016;10(1):1-12. doi:10.1186/s13033-016-0093-3
  72. Kuhn E, Kanuri N, Hoffman JE, Garvert DW, Ruzek JI, Taylor CB. A randomized controlled trial of a smartphone app for posttraumatic stress disorder symptoms. *J Consult Clin Psychol*. 2017;85(3):267-273. doi:10.1037/ccp0000163 [doi]
  73. Niendam TA, Tully LM, Iosif AM, et al. Enhancing early psychosis treatment using smartphone technology: A longitudinal feasibility and validity study. *J Psychiatr Res*. 2018;96(May 2017):239-246. doi:10.1016/j.jpsychires.2017.10.017
  74. Wenzel SJ, Arney MF, Weinstock LM, Gaudiano BA, Miller IW. An Open Trial of a Smartphone-assisted, Adjunctive Intervention to Improve Treatment Adherence in Bipolar Disorder. *J Psychiatr Pract*. 2016;22(6):492-504. doi:10.1097/PRA.0000000000000196
  75. Burda C, Haack M, Duarte AC, Alemi F. Medication adherence among homeless patients: a pilot study of cell phone effectiveness. *J Am Acad Nurse Pract*. 2012;24(11):675-681. doi:10.1111/j.1745-7599.2012.00756.x
  76. Galloway GP, Coyle JR, Guillén JE, Flower K, Mendelson JE. A simple, novel method for assessing medication adherence: capsule photographs taken with cellular telephones. *J Addict Med*. 2011;5(3):170-174. doi:10.1097/ADM.0b013e3181fcb5fd

77. Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev.* 1977;84(2):191-215. <http://psycnet.apa.org/journals/rev/84/2/191/>. Accessed July 2, 2014.
78. Lorig K, Ritter PL, Villa F, Piette JD. Spanish diabetes self-management with and without automated telephone reinforcement: two randomized trials. *Diabetes Care.* 2008;31(3):408-414. doi:10.2337/dc07-1313
79. Naylor MR, Naud S, Keefe FJ, Helzer JE. Therapeutic Interactive Voice Response (TIVR) to reduce analgesic medication use for chronic pain management. *J Pain.* 2010;11(12):1410-1419. doi:10.1016/j.jpain.2010.03.019
80. Riley WT, Rivera DE, Atienza AA, Nilsen W, Allison SM, Mermelstein R. NIH Public Access. 2011;1(1):53-71. doi:10.1007/s13142-011-0021-7.Health
81. Allen B, Bazargan-Hejazi S. Evaluating a tailored intervention to increase screening mammography in an urban area. *J Natl Med Assoc.* 2005;97(10):1350-1360.
82. Haapala I, Barengo NC, Biggs S, Surakka L, Manninen P. Weight loss by mobile phone: a 1-year effectiveness study. *Public Health Nutr.* 2009;12(12):2382-2391. doi:10.1017/S1368980009005230
83. McCann T V, Clark E, Lu S. The self-efficacy model of medication adherence in chronic mental illness. *J Clin Nurs.* 2008;17(11c):329-340. doi:10.1111/j.1365-2702.2008.02354.x
84. World Health Organization. Promotion of mental well-being. [http://www.searo.who.int/en/Section1174/Section1199/Section1570\\_16037.htm](http://www.searo.who.int/en/Section1174/Section1199/Section1570_16037.htm). Published 2011.
85. World Health Organization. WHO | mental health. [http://www.who.int/topics/mental\\_health/en/](http://www.who.int/topics/mental_health/en/). Published 2012.
86. Youssef A, Alharthi H, Khaldi O Al, Alnaimi F, Alsubaie N, Alfariss N. Effectiveness of text message reminders on nonattendance of outpatient clinic appointments in three different specialties: A randomized controlled trial in a Saudi Hospital. *J Taibah Univ Med Sci.* 2014;9(1):23-29. doi:10.1016/j.jtumed.2013.10.001
87. Moczygamba LR, Osborn RD, Lapane KL. Adherence to behavioral therapy and psychiatry visits in a safety-net setting in Virginia, USA. *Health Soc Care Community.* March 2014;1-10. doi:10.1111/hsc.12102
88. Junod Perron N, Dao MD, Righini NC, et al. Text-messaging versus telephone reminders to reduce missed appointments in an academic primary care clinic: a randomized controlled trial. *BMC Health Serv Res.* 2013;13:125. doi:10.1186/1472-6963-13-125

89. Koshy E, Car J, Majeed A. Effectiveness of mobile-phone short message service (SMS) reminders for ophthalmology outpatient appointments: observational study. *BMC Ophthalmol.* 2008;8:9. doi:10.1186/1471-2415-8-9
90. Cohen J. QUANTITATIVE METHODS IN PSYCHOLOGY A Power Primer. *Psychol Bull.* 1992;112(1):155-159.
91. Grzywacz JG, Quandt SA, Marín A, et al. Feasibility of interactive voice response methods in health behavior research with immigrant Latinos. *Am J Health Behav.* 2013;37(2):238-247. doi:10.5993/AJHB.37.2.11
92. Imagining the Internet. <http://www.elon.edu/e-web/predictions/150/1870.xhtml>. Accessed January 18, 2015.
93. Kumar S, Zahn C. Mobile communications: evolution and impact on business operations. *Technovation.* 2003;23(6):515-520. doi:10.1016/S0166-4972(02)00120-7
94. Arthur C. The History Of Smartphone Timeline. The Guardian. <http://www.theguardian.com/technology/2012/jan/24/smartphones-timeline>. Published 2012. Accessed June 8, 2014.
95. International Telecommunications Union. The World in 2014 - ICT Facts and Figures. *Int Telecommun Union.* 2014;(in 2008). <http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf>.
96. Zickuhr K, Smith A. *Digital Differences.*; 2012. <http://pewinternet.org/reports/2012/digital-differences.aspx>.
97. Fair Isaac. FICO Global Survey: 80% of Smartphone Users Interested in Health Care Alerts | FICO™. <http://www.fico.com/en/newsroom/fico-global-survey-80-of-smartphone-users-interested-in-health-care-alerts>.
98. Smith A. *Smartphone Ownership 2013.*; 2013. <http://www.pewinternet.org/2013/06/05/smartphone-ownership-2013/>.
99. Fox S, Duggan M. Mobile Health 2012. Pew Internet: Washington, D.C. [http://www.pewinternet.org/~media/Files/Reports/2012/PIP\\_MobileHealth2012\\_FINAL.pdf](http://www.pewinternet.org/~media/Files/Reports/2012/PIP_MobileHealth2012_FINAL.pdf). Published 2012.
100. Lopez M, Gonzalez-Barrera A, Patten E, Center P. *Closing the Digital Divide: Latinos and Technology Adoption.*; 2013. [http://www.pewhispanic.org/files/2013/03/Latinos\\_Social\\_Media\\_and\\_Mobile\\_Tech\\_03-2013\\_final.pdf](http://www.pewhispanic.org/files/2013/03/Latinos_Social_Media_and_Mobile_Tech_03-2013_final.pdf). Accessed June 8, 2014.
101. WHO | Mental disorders. <http://www.who.int/mediacentre/factsheets/fs396/en/>. Accessed February 25, 2015.

102. Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. *Epidemiol Rev.* 2010;32:56-69. doi:10.1093/epirev/mxq004
103. Krishna S, Boren SA, Balas EA. Healthcare via Cell Phones: A Systematic Review. *Telemed e-Health.* 2009;15(3):231-240. doi:10.1089/tmj.2008.0099
104. Gurol-Urganci I, de Jongh T, Vodopivec-Jamsek V, Atun R, Car J. Mobile phone messaging reminders for attendance at healthcare appointments ( Review ) SUMMARY OF FINDINGS FOR THE MAIN COMPARISON. *Cochrane Database Syst Rev.* 2013;(12). doi:10.1002/14651858.CD007458.pub2.Copyright
105. Vodopivec-Jamsek V, De Jongh T, Gurol-Urganci I, Atun R, Car J. Mobile phone messaging for preventive health care ( Review ). *Cochrane Database Syst Rev.* 2012;(12).
106. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Ann Intern Med.* 2009;151(4):264-269.
107. Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA Statement for Reporting Systematic Reviews and Meta-Analyses of Studies That Evaluate Health Care Interventions: Explanation and Elaboration. *Ann Intern Med.* 2009;151(4):W-65–W-94.
108. Higgins J, Green S, (editors). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0.* The Cochrane Collaboration. www.cochrane-handbook.org. Published 2011.
109. National Collaborating Centre for Methods and Tools. Quality Assessment Tool for Quantitative Studies. Hamilton, ON: McMaster University. (Updated 13 April, 2010). <http://www.nccmt.ca/registry/view/eng/14.html>. Published 2008.
110. Thomas BH, Ciliska D, Dobbins M, Micucci S. A Process for Systematically Reviewing the Literature: Providing the Research Evidence for Public Health Nursing Interventions. *Worldviews Evidence-Based Nurs.* 2004;1(3):176-184.
111. Armijo-Olivo S, Stiles CR, Hagen N a, Biondo PD, Cummings GG. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. *J Eval Clin Pract.* 2012;18(1):12-18. doi:10.1111/j.1365-2753.2010.01516.x
112. Arora S, Burner E, Terp S, et al. Improving attendance at post-emergency department follow-up via automated text message appointment reminders: a randomized controlled trial. *Acad Emerg Med.* November 2014. doi:10.1111/acem.12503

113. Arora S, Peters AL, Burner E, Lam CN, Menchine M. Trial to examine text message-based mHealth in emergency department patients with diabetes (TEXT-MED): a randomized controlled trial. *Ann Emerg Med.* 2014;63(6):745-54.e6. doi:10.1016/j.annemergmed.2013.10.012
114. Ashing K, Rosales M. A telephonic-based trial to reduce depressive symptoms among Latina breast cancer survivors. *Psychooncology.* 2014;23(5):507-515.
115. Badger TA, Segrin C, Hepworth JT, Pasvogel A, Weihs K, Lopez AM. Telephone-delivered health education and interpersonal counseling improve quality of life for Latinas with breast cancer and their supportive partners. *Psychooncology.* 2013;22(5):1035-1042.
116. Kolodziejczyk JK, Norman GJ, Barrera-Ng A, et al. Feasibility and effectiveness of an automated bilingual text message intervention for weight loss: pilot study. *JMIR Res Protoc.* 2013;2(2):e48. doi:10.2196/resprot.2789
117. Rosen CS, Tiet QQ, Harris AHS, et al. Telephone monitoring and support after discharge from residential PTSD treatment: A randomized controlled trial. *Psychiatr Serv.* 2013;64(1):13-20.
118. Sieverdes J, Patel S, Davidson L, Treiber F. mHealth medication and blood pressure self-management program in Hispanic hypertensives: a proof of concept trial. *Smart Homecare Technol TeleHealth.* 2013;2(2):1. doi:10.2196/resprot.2633
119. Wu S, Ell K, Gross-Schulman SG, et al. Technology-facilitated depression care management among predominantly Latino diabetes patients within a public safety net care system: comparative effectiveness trial design. *Contemp Clin Trials.* 2014;37(2):342-354. doi:10.1016/j.cct.2013.11.002 [doi]
120. U.S. Department of Health and Human Services. Healthy people 2020: mental health and mental disorders. <http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=28>. Published 2012.
121. SANOU B. ICT Facts & Figures. The world in 2015. *Itu 150 Años (1865 - 2015).* 2015;6. doi:10.1787/9789264202085-5-en
122. Centers for Medicare and Medicaid Services (CMS). Explore Measures - Improvement Activities - Quality Payment Program. <https://qpp.cms.gov/measures/ia>. Accessed May 22, 2017.
123. Duarte AC, Thomas SA. The Use of Phone Technology in Outpatient Populations: A Systematic Review. *Open Nurs J.* 2016;10(Suppl 1: M3):45-58. doi:10.2174/1874434601610010045
124. Arora S, Peters A, Burner E, Nok Lam C, Menchine M. Trial to examine text message-based mHealth in emergency department patients with diabetes (TEXT-

- MED): a randomized controlled trial. *Ann Emerg Med.* 2014;63(6):745-54.e6. doi:10.1016/j.annemergmed.2013.10.012
125. Schectman JM, Schorling JB, Voss JD. Appointment adherence and disparities in outcomes among patients with diabetes. *J Gen Intern Med.* 2008;23(10):1685-1687. doi:10.1007/s11606-008-0747-1
  126. Choudhry NK, Glynn RJ, Avorn J, et al. Untangling the relationship between medication adherence and post-myocardial infarction outcomes: medication adherence and clinical outcomes. *Am Heart J.* 2014;167(1):51-58.e5. doi:10.1016/j.ahj.2013.09.014
  127. Simpson HB, Maher MJ, Wang Y, Bao Y, Foa EB, Franklin M. Patient adherence predicts outcome from cognitive behavioral therapy in obsessive-compulsive disorder. *J Consult Clin Psychol.* 2011;79(2):247-252. doi:10.1037/a0022659
  128. Duarte AC, Storr CL, Thomas SA, Wilson M. Do text reminders improve follow-up visit and medication adherence in psychiatric outpatient populations? *manuscript.* 2017.
  129. World Health Organization. WHODAS 2.0 36-item version, interviewer-administered. [http://www.who.int/classifications/icf/WHODAS2.0\\_36itemsINTERVIEW.pdf?ua=1](http://www.who.int/classifications/icf/WHODAS2.0_36itemsINTERVIEW.pdf?ua=1). Accessed July 2, 2014.
  130. Narrow WE, Clarke DE, Kuramoto SJ, et al. DSM-5 field trials in the United States and Canada, Part III: development and reliability testing of a cross-cutting symptom assessment for DSM-5. *Am J Psychiatry.* 2013;170(1):71-82. doi:10.1176/appi.ajp.2012.12071000
  131. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983. <http://www.jstor.org/stable/2136404>. Accessed July 2, 2014.
  132. Degner L, Sloan J, Venkatesh P. The Control Preferences Scale. *Can J Nurs Res.* 1997;29(3):21-43. <http://europepmc.org/abstract/MED/9505581>. Accessed July 2, 2014.
  133. Kaplan-Lewis E, Percac-Lima S. No-Show to Primary Care Appointments: Why Patients Do Not Come. *J Prim Care Community Health.* 2013;4(4):251-255. doi:10.1177/2150131913498513
  134. Norris JB, Kumar C, Chand S, Moskowitz H, Shade SA, Willis DR. An empirical investigation into factors affecting patient cancellations and no-shows at outpatient clinics. *Decis Support Syst.* 2014;57(1):428-443. doi:10.1016/j.dss.2012.10.048
  135. Üstün T. *Measuring Health and Disability: Manual for WHO Disability Assessment Schedule WHODAS 2.0.* (Üstün T, Kostanjsek N, Chatterji S, Rehm J,

- eds.). Geneva; 2010.  
<http://books.google.com/books?hl=en&lr=&id=h9fhLNiaRTgC&oi=fnd&pg=PR1&dq=Measuring+Health+and+Disability+Manual+for+WHO+Disability+Assessment+Schedule&ots=6qHY9a8uAw&sig=IHCcOTDxRs6310qFv3Kpic0e-3s>.  
 Accessed July 2, 2014.
136. World Health Organization. *Towards a Common Language for Functioning, Disability and Health: ICF*. Geneva; 2002.  
<http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Towards+a+Common+Language+for+Functioning+,+Disability+and+Health+ICF#0>. Accessed July 2, 2014.
137. Ustün TB, Chatterji S, Kostanjsek N, et al. Developing the World Health Organization Disability Assessment Schedule 2.0. *Bull World Health Organ*. 2010;88(11):815-823. doi:10.2471/BLT.09.067231
138. World Health Organization. WHO | WHO Disability Assessment Schedule 2.0 WHODAS 2.0. <http://www.who.int/classifications/icf/whodasii/en/>. Published 2014. Accessed July 2, 2014.
139. American Psychiatric Association. Online Assessment Measures | psychiatry.org. <http://www.psychiatry.org/practice/dsm/dsm5/online-assessment-measures>. Published 2014. Accessed July 2, 2014.
140. The Regents of the University of California. MacArthur SES & Health Network | Research. <http://www.macses.ucsf.edu/research/psychosocial/stress.php>. Published 2008. Accessed July 2, 2014.
141. Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, eds. *The Social Psychology of Health*. Newbury Park, CA: Sage; 1988:31-67.
142. Cohen S. Laboratory for the Study of Stress, Immunity and Disease. <http://www.psy.cmu.edu/~scohen/>.