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Feasibility and Impact of Telemonitor-Based Depression Care Management for Geriatric Homecare Patients

Thomas Sheeran, Ph.D., M.E.,¹ Terry Rabinowitz, M.D., D.D.S.,² Jennifer Lotterman, B.A.,³ Catherine F. Reilly, B.A., M.P.H.,³ Suzanne Brown, R.N.,⁴ Patricia Donehower, M.S.N., R.N.,⁵ Elizabeth Ellsworth, B.S.,⁶ Judith L. Amour, M.A.,² and Martha L. Bruce, Ph.D., M.P.H.³

¹Rhode Island Hospital and Alpert Medical School of Brown University, Providence, Rhode Island.

²University of Vermont College of Medicine and Fletcher Allen Health Care, Burlington, Vermont.

³Weill Cornell Medical College, White Plains, New York, New York.

⁴Visiting Nurse Services in Westchester, White Plains, New York.

⁵Visiting Nurse Association of Chittenden and Grand Isle Counties, Colchester, Vermont.

⁶United Homecare Services, Miami, Florida.

Abstract

Objective: The objective of this study was to test the feasibility, acceptability, and preliminary clinical outcomes of a method to leverage existing home healthcare telemonitoring technology to deliver depression care management (DCM) to both Spanish- and English-speaking elderly homebound recipients of homecare services. **Materials and Methods:** Three stand-alone, nonprofit community homecare agencies located in New York, Vermont, and Miami participated in this study. Evidence-based DCM was adapted to the telemonitor platform by programming questions and educational information on depression symptoms, antidepressant adherence, and side effects. Recruited patients participated for a minimum of 3 weeks. Telehealth nurses were trained on DCM and received biweekly supervision. On-site trained research assistants conducted in-home research interviews on depression diagnosis and severity and patient satisfaction with the protocol. **Results:** An ethnically diverse sample of 48 English- and Spanish-only-speaking patients participated, along with seven telehealth nurses. Both patients and telehealth nurses reported high levels of protocol acceptance. Among 19 patients meeting diagnostic criteria for major depression, the mean depression severity was in the “markedly severe” range at baseline and in the “mild” range at follow-up. **Conclusions:** Results of this pilot support the feasibility of using homecare’s existing telemonitoring technology to deliver DCM to their elderly homebound patients. This was true for both English- and Spanish-speaking patients. Preliminary clinical outcomes suggest improvement in depression severity, although these findings require testing in a randomized clinical trial. Im-

plications for the science and service of telehealth-based depression care for elderly patients are discussed.

Key words: home health monitoring, telehealth, telepsychiatry

Introduction

The use of home telemonitoring technology is growing at a rapid rate in the homecare industry. There are approximately 9,000 Medicare-certified homecare agencies in the United States, serving approximately 5 million elderly patients.¹ With 21% (1,900) of home health agencies using telehealth disease management systems and an estimated annual growth rate of 17%, telehealth is an area of significant growth.² In a recent nationwide survey of almost 1,000 representative homecare agencies, the most commonly reported use for home telemonitoring is the management of cardiac disease, followed by respiratory illness and diabetes, respectively.² Almost two-thirds of respondents acknowledged that their telehealth system was part of a chronic disease management program.² However, to our knowledge, few home health telemonitor programs include evidence-based depression care management (DCM).

With an estimated prevalence of approximately 14% for major depression and another 10% for minor depression, the rate of this illness in homecare is twice that of primary care and second only to nursing homes.^{3–5} A number of studies have documented the suffering and adverse consequences of geriatric depression, including poor quality of life, higher mortality from illness or suicide, adverse events such as falls and hospitalization, higher healthcare costs, and poor adherence to medical treatments.^{6–10} However, homecare patients often have little access to skilled depression care and most go untreated or inadequately treated, creating a significant public health problem.^{11,12}

Telehealth technology in homecare may offer an opportunity to increase access to depression treatment by incorporating evidence-based depression care guidelines into an agency’s existing telehealth infrastructure and coordinating service via a trained and supported telehealth nurse. This approach combines two important elements of both telehealthcare and depression care: (1) the use of telemonitor technology in homecare to manage chronic diseases, and (2) the “Collaborative Care” approach to DCM, which has demonstrated effectiveness in primary care settings (described later).^{13–15}

Among researchers and providers of mental health services, depression is increasingly recognized as an illness that should be managed as a chronic disease.^{16,17} Patients with prior episodes of depression are at increased risk for future episodes, and half or more

of depressed patients who receive guideline-consistent depression treatment only achieve partial improvement. Ongoing management may help prevent relapse or worsening of the illness.^{18–21} In primary care, a well-validated model for managing depression is the “collaborative care” approach: at least one professional staff member (typically nurse or social worker) is designated the Depression Care Manager, who works with the patient, the primary care physician, and a mental health consultant to treat depression, monitor improvement, and actively engage the patient in their mental health-care. Numerous studies have demonstrated that this model improves depression care and patient outcomes.^{14,22–25}

Researchers at The Weill Cornell Homecare Research Partnership and the University of Southern California have drawn upon this model to create successful DCM protocols for homecare, in which a visiting nurse serves the role of Depression Care Manager.^{13,16,26–28} A natural extension of this approach is to utilize an agency’s existing telemonitor technology to deliver this care, with the telehealth nurse serving the role of a centralized Depression Care Manager. Studies in primary care and the Veterans Administration have found that telehealth-based screening and collaborative care for depression is feasible and effective.^{29–32} Applying this model in homecare could address gaps in service by providing a clinician who (1) is a centralized care manager without the travel or other demands of a visiting nurse, (2) has on-site supervisory support and oversight, and (3) has immediate access to the patient via the in-home telemonitor and telephone. The sustainability demands of this approach are also reduced, because dramatically fewer nurses require training (often only 1–2 telehealth nurses per agency), compared with training all visiting nurses, and thereby placing fewer turnover-related training demands on the agency.

The goals of this pilot study were to test the feasibility, acceptability, and preliminary clinical outcomes of a protocol to use home telemonitoring technology to provide geriatric DCM to participating elderly homecare patients (Depression TeleCare Protocol). The protocol was developed for both English- and Spanish-only-speaking patients in order to evaluate the program in a diverse population. The intervention brought together (1) the existing approach in homecare for using telehealth technology to manage chronic disease and (2) the components of DCM found to be effective in adult and elderly-focused primary care and homecare settings.^{14,22–25} The primary outcomes were (1) success in implementing the protocol, (2) patient and telehealth nurse satisfaction with the protocol, and (3) patient pre-post depression severity outcomes.

Materials and Methods

PARTICIPANTS

This study was approved by the institutional review boards of Rhode Island Hospital, Weill Cornell Medical College, and the University of Vermont College of Medicine. English- and Spanish-speaking participants were recruited from three homecare agencies between November 2009 and May 2010. All three agencies were Medicare certified and located in Colchester, VT, White Plains, NY, and Miami, FL, providing care to a wide range of urban, suburban, and rural res-

idents with ethnic diversity. As a feasibility trial, we sought to have as many participants as possible who use the technology and, therefore, chose not to assign patients to a control group. All eligible and consenting participants received the intervention. Patients were eligible to participate if they were enrolled in homecare services, aged 65 and older, and potentially needing DCM, defined as (1) screening positive for depression on homecare’s Medicare-mandated intake form, the Outcome and Assessment Information Set (OASIS), (2) admitted to homecare with a diagnosis of depression, or (3) taking antidepressant medication at homecare admission. Patients were English or Spanish speaking, nonaphasic, not hearing impaired, nondemented, able to give consent, and able to use the telemonitor. Participants had to be able to receive the intervention for a minimum of 3 weeks.

Agency staff participants included four telehealth nurses from each of the three homecare agencies and three telehealth/clinical managers who completed satisfaction surveys.

DEPRESSION TELECARE PROTOCOL

In homecare, telemonitor technology is typically used to augment and support skilled care by visiting nurses and other professionals (e.g., physical therapy). Generally, patients are referred to homecare from a hospital, rehabilitation center, or primary care for skilled care related to medical conditions (e.g., congestive heart failure [CHF], wound care). The patient is assigned a visiting nurse or other professional, who goes to the patient’s home to provide care. Patients for whom telehealth is appropriate also receive a home health monitor in their home.

Figure 1 below shows a typical home health monitor, with peripherals that measure weight, blood sugar, heart rate, etc. These devices are part of an integrated disease management program at the agency and used to measure medical indicators associated with the patient’s primary illnesses. They are used daily, using a chime, synthetic voice through speakers (for some devices), and/or touch screen, and patients are prompted to measure weight, blood pressure, pulse, etc. Through an online interactive screen, these monitors also can “ask” patients simple questions about their health and healthcare needs and can provide basic education about illness, treatment, health, and wellness. Each of the three agencies participating in this



Fig. 1. Sample homecare telehealth monitor.

study used a different telehealth vendor, providing an opportunity to test the intervention across a variety of platforms.

The DCM model assigns a key professional staff member (e.g., nurse, social worker) to the role of Depression Care Manager.^{13–15,33} This individual coordinates depression care among the patient, the physician, and when needed, a mental health specialist. Key components include symptom assessment, treatment evaluation, patient education, and behavioral activation. This model needs to be adapted to the homecare and telehealth system. *Table 1* outlines the key components of collaborative depression care and how the tasks were adapted to telehealth in homecare.

All relevant protocol elements were created in English and Spanish, including telemonitor items and telehealth nursing materials (e.g., Patient Health Questionnaire [PHQ]-9 and antidepressant management guidelines). When available, we used established Spanish version measures (e.g., Spanish PHQ-9). Otherwise, we used a healthcare-certified translation company. A bilingual telehealth nurse delivered the Spanish version. Per *Table 1*, the telemonitors were programmed to briefly assess depression using the two-item PHQ-2, inquire about medication adherence (e.g., “have you been taking your medicine for depression as your doctor has prescribed?”)

Table 1. Collaborative Care for Depression, Modified to Homecare's Telehealth System

COLLABORATIVE DEPRESSION CARE COMPONENT	PRIMARY CARE: NURSE, SOCIAL WORKER, OR OTHER PROFESSIONAL ASSIGNED ROLE OF DEPRESSION CARE MANAGER	TELEHEALTH IN HOMECARE: TELEHEALTH NURSE ASSIGNED THE ROLE OF DEPRESSION CARE MANAGER
	HOW	HOW
1. Symptom assessment and tracking	PHQ-9 ^a administered during routine office visits.	PHQ-2 administered via telemonitor.
		PHQ-9 administered via telephone.
2. Monitor treatment (e.g., adherence, side effects)	Interview during routine office visits.	Telemonitor questions.
		Interview via telephone.
3. Patient education and activation	Education and goal-setting during office visits.	Basic education via telemonitor.
		Education and goal setting during telephone calls.
4. Consult with PCP and/or MH professional	On-site consultation. Phone and fax consults with MH professionals if off-site.	Phone and fax communication with PCP and/or mental health professionals.

^aPHQ-2/9: Two or Nine-item Depression Patient Health Questionnaire.

and side effects (e.g., “is your antidepressant medicine causing any unpleasant side effects or other problems?”), and provide simple education about depression and treatment adherence (e.g., “you should start to feel better within 2–4 weeks of starting your medicine. If you don't, tell your doctor or nurse”). The questions were developed to use the same format that home telemonitors typically use for other disease management and were intended to address each of the key domains while imposing as little burden as possible on patients.

Each of the agencies' telehealth nurses received a full day of training on the Depression TeleCare Protocol, which included all of the key collaborative care components described earlier. Telehealth nurses were trained on (1) depression diagnosis and assessment using the PHQ-9, (2) basic information about antidepressant medication and medication management, (3) patient education about depression and depression care (including pleasurable activities), and (4) professional communication and coordination.^{34,35} At the end of training, nurses were expected to have the skill set to review telemonitor items, interpret the data within the context of their training on depression care, their medical training, and their knowledge of the patient's health status, and contact patients via telephone as needed to follow-up on care, educate and reassure patients, encourage pleasurable activities, and assess depression status using the PHQ-9. Finally, telehealth nurses were expected to coordinate depression care with the patient's visiting nurse, primary care physician, and/or mental health professionals. Nurse competency was evaluated using knowledge tests and scenario-based roleplays.³⁶

In addition, we established procedures for suicide risk prevention, communication with other professionals, supervision and support, and care coordination among the telehealth nurse, visiting nurse, and primary care physician. Over the period of the study, the investigators and agencies held conference calls every 2 weeks to monitor study progress, discuss cases as needed, and respond to technical or implementation challenges. Between conference calls, cases and challenges also were discussed on an ad-hoc basis as the need arose.

DATA COLLECTION, MEASURES, AND ANALYSIS

On-site research assistants (RAs) collected research data at each of the three sites, going to patients' homes conducting baseline interviews within 5 days of start of care and completing follow-up interviews upon discharge. Each RA was brought to Cornell for training in the protection of human subjects, Health Insurance Portability and Accountability Act (HIPAA) research guidelines, recruiting participants, consenting procedures, and administration of study measures. RAs were supervised via weekly conference calls, during which all assessments were reviewed, reliability and validity issues were addressed, and implementation progress was monitored. Measures were the Structured Clinical Interview for DSM-IV (SCID), the Hamilton Depression Rating Scale, 24-item (HDRS), and a patient survey of satisfaction with the Depression TeleCare Protocol, using a measure adapted from Bratton and Short for geriatric patients, and items recommended by the Medicare Quality Improvement Organization for telemedicine.^{37–40} The Mini Mental State Exam was administered at baseline to exclude patients who had significant cognitive

impairment.⁴¹ Agency telehealth nurses and telehealth managers also completed a satisfaction survey adapted from Hicks et al.⁴² Descriptive statistics were used to characterize the participant demographics and user satisfaction. Pre and postdepression severity scores were compared using the Statistical Program for the Social Sciences (SPSS) general linear model repeated measures test of the null hypothesis of no within-subject differences at follow-up versus baseline.

Results

We recruited an ethnically diverse sample of 48 English- and Spanish-only-speaking patients (34% Hispanic, 14% African American, and 2% Native American). We also surveyed seven agency telehealth nurses and managers about their satisfaction with the Depression TeleCare Protocol and the degree to which they believed it helped their patients.

PATIENT CHARACTERISTICS

The patient characteristics are presented in *Table 2*. A total of 68 patients were identified as potential study participants. Thirteen (19%) refused participation, three (4%) could not be contacted, two (3%) had telemonitor problems, one (1.5%) was excluded because of diagnosis of bipolar disorder, and one (1.5%) was excluded because of high suicidality. Because of agency differences in record keeping, de-

identified demographic data were available on only a subset of patients who refused ($n=8$ of 13). However, we found no differences between participants and nonparticipants on age, marital status, race/ethnicity, or gender. The final sample consisted of 48 participants, a large proportion of which (27%) spoke only Spanish. Participants had a wide range of national origins, coming from nine different countries in North and South America, Europe, the Caribbean, and the Mediterranean. Country of origin was unknown for one patient.

Analysis of agency differences in patient characteristics indicated that there were significantly more Hispanic patients at the Miami agency (73%) than the White Plains (6%) or the Colchester (0%) agencies ($X^2(2)=13.3$; $p<0.001$). Additionally, the Miami agency had a higher percentage of patients without a high-school education (73%) than the Colchester (31%) or White Plains (18%) agencies ($X^2(4)=13.3$; $p=0.01$). Finally, although not statistically significant, the Colchester agency had a lower percentage of Black/African American patients (0%) compared with the White Plains (18%) and Miami (20%) agencies. With the exception of an overrepresentation of Hispanics, the demographics of this sample was similar to that of a national sample.¹

USER SATISFACTION AND ACCEPTABILITY

Both patients and telehealth nurses reported high levels of acceptability and satisfaction with the Depression TeleCare Protocol. The survey covered four broad outcomes: (1) ease of use and technical feasibility, (2) user enthusiasm for the service and willingness to use it again, (3) satisfaction with service delivery, and (4) self-reported outcomes.^{39,40} Overall, patient ratings of satisfaction were very high: 83% reported that they were satisfied or very satisfied with the protocol. A majority also reported that they quickly became comfortable using the equipment (78% in less than 1 week and 84% within two), that there were few technical problems (72%), that it improved care (58%), and that they would be willing to use it again (82%). Similarly, the telehealth nurses reported that with the majority of their patients, the Depression TeleCare Protocol was easy to implement (90%), that there were few technical problems (71%), that it improved care (70%), and that it improved depression outcomes

Table 2. Demographic Characteristics Pilot Study Participants ($n=48$)

CHARACTERISTIC	N	%	CHARACTERISTIC	N	%
Gender			Marital status		
Female	30	62	Married	14	29
Male	18	41	Widowed	22	46
Race/ethnicity			Separated/divorced	10	21
White	39	81	Never married	2	4
African American	6	13	Education		
Native American	2	4	Less than high-school education	19	40
Hispanic	13	27	High-school graduate/some college	19	40
Other	1	2	College graduate	10	21
Primary language			Living circumstances		
English	35	73	Alone	23	48
Spanish	13	27	With spouse/partner	16	33
			With others	9	19
	MEAN	SD			
Age (years): range = 66–98	76.2	7.7			

Table 3. Most Common Positive and Negative Comments to Telemonitor and Depression Protocol

POSITIVE FEEDBACK	FREQUENCY (%)
I felt more connected to the agency.	41%
The frequent checks from the telemonitor were comforting/reassuring.	30%
I better understood my depression.	30%
I was able to be more honest about my feelings.	27%
NEGATIVE FEEDBACK	FREQUENCY (%)
It was a burden/it complicated my life.	12%
I didn't like using a machine to discuss my feelings.	8%

(70%). Both patients (94%) and nurses (90%) believed that confidentiality was maintained. As anticipated, a proportion of patients were not satisfied with the protocol ($n = 4$; 8.3%). The most common reasons were resistance to using the technology to discuss depression and perceived burden. The most frequent positive and negative patient comments are provided in *Table 3*.

DEPRESSION OUTCOMES

Depression characteristics are presented in *Table 4*. At baseline, more than half of participating patients reported at least one of the two cardinal symptoms of depression: depressed mood or lack of interest or pleasure in activities (anhedonia). Nineteen (40%) of these patients met full diagnostic criteria for major depression, with a mean depression severity score in the “markedly severe” range on the Hamilton Rating Scale for Depression. Sixteen of these patients received follow-up interviews at the end of the intervention and had mean scores in the “mild” range, indicating significant improvement in depression severity.

TECHNICAL CHALLENGES

We encountered few technical challenges, with only three (6.3%) of the participating patients experiencing difficulties: one patient had a monitor that repeatedly depleted batteries and a second patient had a monitor that was not compatible with a phone line. One patient also had a monitor that did not respond (“froze”), but this was resolved soon after the patient reported it.

Discussion

The results of this pilot support the feasibility of using homecare’s existing telemonitoring technology to provide collaborative care for geriatric depression, and preliminary clinical findings suggest that patients’ depression indeed improved when they received the inter-

vention. This was true of both the Spanish- and English-speaking patients who participated. Even though all participants were elderly, were homebound, and had medical comorbidities, the protocol had high levels of acceptance among patients. Indeed, some patients commented that they could be more honest reporting their symptoms with the telemonitor, suggesting that for some patients who may feel stigmatized by having depression, telehealth-based care may in fact be more acceptable than in-person care. Telehealth nurses also accepted the protocol at high rates. Notably, agencies anecdotally reported that training and supervising a handful of telehealth nurses were considerably less burdensome than working with an entire field nursing staff. There were markedly few technical challenges, likely (in part) due to our use of the existing telemonitoring platform. Among the 16 patients who received both baseline and follow-up interviews, there was a substantial improvement in depression severity. Given the study design limitations, however (discussed later), these depression outcomes cannot be viewed as robust evidence of intervention effectiveness.

As a feasibility pilot, there were a number of limitations to the design and methods of this study. First was the lack of control group, so we could not control for unintended and extraneous effects. However, we viewed this as a favorable trade off in order to pilot the intervention with as many participants as were interested. This limitation also meant we were constrained to a pre-post design in evaluating clinical outcomes, which prevented control of historical and spontaneous remission effects related to depression outcomes. A third limitation was the lack of RA blindness, resulting in potentially exaggerated pre-post effect sizes. Finally, some inclusion criteria were broader than would be appropriate for a randomized, controlled trial. A fully powered randomized trial would be necessary to address these pilot limitations.

Delivering DCM to elderly homebound patients using the homecare agencies’ existing telehealth system, and using a chronic disease framework, may have contributed to the overall acceptance of the protocol, as both the technology platform and the disease management framework are familiar service approaches in homecare. Importantly, this model also is consistent with an emerging trend to integrate depression care with other medical disease management. For example, a recent large-scale multisite primary care trial found that collaborative care for patients with depression along with other chronic illnesses improved both medical and depression outcomes.⁴³ In the area of home telemonitoring, Turvey et al.³² found that a telehealth depression screen could successfully be integrated into a chronic illness program, with high acceptance rates. Thus, integrated medical and DCM, provided via existing delivery systems, may facilitate acceptance among clinicians and patients as well as improve medical and mental health outcomes.

Our findings also were consistent with several studies that have found successful results implementing telehealth-based depression care across a range of different modalities, such as live telephone, telephone-based interactive voice recording, and video-based depression care.^{29,32,44} Although this trend in the literature offers promise for reaching more patients across a range of platforms, we

Table 4. Depression Status for Study Participants ($n = 48$)

DEPRESSION STATUS	N (%)
Endorsed depressed mood and/or anhedonia (lack of interest or pleasure in activities)	29 (60%)
DSM-IV major depression	19 (40%)
MEAN (SD)	
Depression severity (HDRS) ^a for all participants ($n = 48$)	15.0 (8.1)
Depression severity for patients with DSM-IV depression diagnosis ($n = 19$)	21.4 (5.1)
Baseline and follow-up depression severity ($n = 16$ patients received baseline and follow-up interviews)	
Baseline HDRS	20.9 (5.0)
Follow-up HDRS	14.3 (10.2) ^b

^aHamilton Depression Rating Scale (24-item): score of 11 or higher suggests clinically significant depression.

^b $F(1,15) = 12.1$, $p = 0.003$.

still have a great deal to learn about the limits of these platforms. In 2009, the American Telemedicine Association released Evidence-Based Practice for Telemental Health and Practice Guidelines for Videoconferencing-Based Telemental Health.^{45,46} These documents provide both clinical and technical guidelines for providing mental health services at a distance and are an important step toward framing the parameters of providing quality telemental healthcare. However, in a rapidly growing and changing field, and with a growing, heterogeneous elderly population, there is a need to better understand which technology configurations work best for which patients and in what settings.

Finally, a protocol such as this is clearly not appropriate for all elderly patients receiving homecare services. There are minimal safety, patient capacity/willingness, and technology factors to consider. For example, there may be an interaction effect between attitudes about depression and attitudes about technology that influence acceptance, as suggested by some patients who felt they could be more open about their depression with the monitor, versus a small percentage of others who did not “like using a machine to discuss my feelings.” Depressed patients who are at high risk for suicide would likely not be appropriate for this intervention. In addition, patients would minimally need to have the sensory and cognitive ability to read, hear, and understand the monitor and the motor skills to press the appropriate buttons in response to it. Notably, usability factors in the telemonitor equipment are largely determined by the vendors who manufacture the products. The availability of large-print screens or high-volume speakers and headphones, for example, could increase access to a service such as this. However, these types of accommodations vary greatly among product producers. Even with the availability of accommodations to disabilities, we have a great deal to learn about how (or if) such impairments and accommodations would impact participation and outcomes in a telemental health program. Overall, many of these potential mediators or moderators to protocol acceptance and outcomes with this population are not well understood and require more in-depth investigation.

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Disclosure Statement

No competing financial interests exist.

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Address correspondence to:
 Thomas Sheeran, Ph.D., M.E.
 Department of Psychiatry
 Rhode Island Hospital
 593 Eddy St., Potter 300
 Providence, RI 02903

E-mail: tsheeran@lifespan.org

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