

## Integrated Telehealth Care for Chronic Illness and Depression in Geriatric Home Care Patients: The Integrated Telehealth Education and Activation of Mood (I-TEAM) Study

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**OBJECTIVES:** To evaluate an integrated telehealth intervention (Integrated Telehealth Education and Activation of Mood (I-TEAM)) to improve chronic illness (congestive heart failure, chronic obstructive pulmonary disease) and comorbid depression in the home healthcare setting.

**DESIGN:** Randomized controlled trial.

**SETTING:** Hospital-affiliated home healthcare setting.

**PARTICIPANTS:** Medically frail older homebound individuals (N = 102).

**INTERVENTION:** The 3-month intervention consisted of integrated telehealth chronic illness and depression care, with a telehealth nurse conducting daily telemonitoring of symptoms, body weight, and medication use; providing eight weekly sessions of problem-solving treatment for depression; and providing for communication with participants' primary care physicians, who also prescribed antidepressants. Control participants were allocated to usual care with in-home nursing plus psychoeducation (UC+P).

**MEASUREMENTS:** The two groups were compared at baseline and 3 and 6 months after baseline on clinical measures (depression, health, problem-solving) and 12 months after baseline on health utilization (readmission, episodes of care, and emergency department (ED) visits).

**RESULTS:** Depression scores were 50% lower in the I-TEAM group than in the UC+P group at 3 and 6 months. Those who received the I-TEAM intervention significantly improved their problem-solving skills and self-efficacy in managing their medical condition. The I-TEAM group had significantly fewer ED visits ( $P = .01$ ) but did not have significantly fewer days in the hospital at 12 months after baseline.

**CONCLUSION:** Integrated telehealth care for older adults with chronic illness and comorbid depression can reduce symptoms and postdischarge ED use in home health settings. *J Am Geriatr Soc* 62:889–895, 2014.

**Key words:** telehealth; home care; randomized trial; depression; integrated care

Longer life expectancy and costs are a challenge to the healthcare system in optimally serving older adults with chronic diseases who are at high risk of hospitalization. Approximately 20% of these individuals are readmitted to the hospital within 1 month of discharge.<sup>1</sup> Delivering telehealth services may provide an effective and efficient method to monitor symptoms of individuals receiving health care from home care agencies, improve communication with primary care providers, and deliver evidence-based treatments. In the United States, it is estimated that 21% of home health agencies offer telehealth services for cardiovascular disease, chronic obstructive pulmonary disease (COPD), and diabetes mellitus with the aim of reducing healthcare costs.<sup>2</sup> These agencies provide care at home to approximately 6 million older adults with chronic diseases.<sup>3</sup> Depression is prevalent in individuals with chronic diseases such as heart failure<sup>4</sup> and COPD,<sup>5</sup> yet it is underdetected or suboptimally treated<sup>6</sup> and is associated with disability and healthcare costs.<sup>7</sup> Previous research has demonstrated the effectiveness of integrated and collaborative depression care models in primary care and home care settings,<sup>8–11</sup> but to the knowledge of the authors of the current article, no randomized trial has examined the effect of telehealth care on chronic disease and comorbid depression in older adults receiving home care.

To fill this gap, the current study compared the results of a randomized controlled trial of Integrated Telehealth Education and Activation of Mood (I-TEAM), a telehealth care model for chronic illness and comorbid depression with those of usual in-home care plus psychoeducation

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(UC+P). The team targets homebound older adults based on recommendations of prior reviews to examine specific populations with chronic disease and factors associated with treatment outcome and care quality.<sup>12,13</sup>

Home care agencies offer individual-centered care coordination that extends disease management to more-effectively match disease-specific needs. Integration of care coordination is an important organizational goal in improving services for chronic disease.<sup>14</sup> Telehealth is suitable for older adults, with the aim of early detection and rapid action to reduce health deterioration and maintain functioning and independence. Telehealth offers an opportunity to improve routine care and clinical outcomes by combining chronic disease management and integrated depression care. The Chronic Care Model (CCM)<sup>15</sup> guided the study's I-TEAM intervention with applicable CCM components: self-management support, decision support (evidence-based guidelines integrated into practice), delivery system structure, and clinical monitoring. The integrated I-TEAM intervention included I-Team nurse telehealth training, nurse care coordination, use of evidence-based protocols for chronic illness and comorbid depression management, collaboration with primary care for medication management, electronic medical record, and evidence-based problem-solving treatment (PST) for depression delivered by the telehealth nurse.

## METHODS

This study was a randomized controlled trial of a 3-month integrated telehealth depression intervention compared with UC+P for older adults receiving home care. The hospital-affiliated institutional review board approved the project.

### Recruitment and Procedures

The sample was recruited from a single large hospital-affiliated home care agency that served some 9,000 outpatients during fiscal year 2010. The agency uses an integrated in-home-based chronic disease management approach that helps frail adults live independently in the community and avoid nursing home placement. The in-home program involves service coordination of a primary care physician, nurses, social workers, rehabilitation specialties, medication management, meals, and personal attendants to manage each individual's medical condition. The accredited agency offered services to low-income people living in a four-county urban, suburban, and rural region. The research team used the hospital's computerized medical records databases to identify individuals aged 65 and older who were above-average users ( $\geq 10$  days in the hospital in the past 12 months, seen in the emergency department (ED) in the last 2 months, or required  $\geq 3$  home care visits per week) and had a primary diagnosis of heart failure or COPD. Individuals who screened positive for depression as indicated by a Patient Health Questionnaire-2 (PHQ)<sup>16</sup> score of 3 or greater were included in the study. Exclusion criteria were cognitive impairment (Mini-Mental State Examination (MMSE) score  $< 24$ ) or a diagnosis of dementia based on chart review, inability to use a telemonitoring device because of physical disability, and behavioral

problems (e.g., agitation, delirium, paranoia) that would interfere with use of the device.

The research nurse contacted eligible individuals within 1 day after admission to home care. Individuals were screened for cognitive impairment and functional disability using the MMSE<sup>17</sup> and the activity of daily living scale.<sup>18</sup> During the referral interview with a research assistant, each individual's eligibility was reviewed, the study protocol was explained, informed consent was obtained, and baseline data were collected.

### Design

Figure 1 delineates the flow of individuals in the study. In all, 302 individuals were assessed for eligibility, 88 did not meet the ADL criteria, 73 did not have a positive depression screen, 26 declined, and 115 agreed to participate. Participants were randomly allocated to I-TEAM ( $n = 57$ ) or UC+P ( $n = 58$ ) using a computerized random number generator ensuring comparability across conditions. Fifty-one participants completed the I-TEAM intervention after six individuals were discharged to a nursing home or hospice. Similarly, 51 participants completed the UC+P intervention after seven individuals did not meet the criteria and were discharged to a nursing home or moved from the area. Forty-eight I-TEAM participants completed the trial, three participants could not be contacted during follow-up. Seven of the UC+P participants were dropped out or were rehospitalized during follow-up, leaving 46 participants completing the study. A blinded trained research interviewer assessed participants at baseline and 3 and 6 months, and a health utilization review was conducted at 12 months. An intention-to-treat methodology was used. Effort was made to collect data from participants who dropped out of the study. Computerized medical records were available for all individuals receiving home care. As part of routine care, assigned home care nurses informed participants in both conditions that their primary care physician would be notified of their depression status through a standardized letter sent by facsimile. Their primary care physicians, who received evidence-based study guidelines on antidepressants, assessed all study participants and prescribed antidepressants.

### I-TEAM Intervention

Participants were assigned an I-TEAM nurse within 5 days of referral. I-TEAM nurses were restricted to providing services to I-TEAM participants. The I-TEAM intervention included several integrated components: telemonitoring, chronic illness and depression care management, and PST for comorbid depression. Three nurses received telehealth training and provided chronic disease and depression care and PST for depression. The telehealth device<sup>19</sup> consisted of a small in-home monitor connected to an agency central station. Daily monitoring of weight, blood pressure, pulse, oxygen saturation, and temperature were conducted at a scheduled time based on participant preference. Participant data were displayed and assessed to ascertain which were of higher priority to intervene to allow immediate determination of nurse treatment tasks. The I-TEAM telehealth

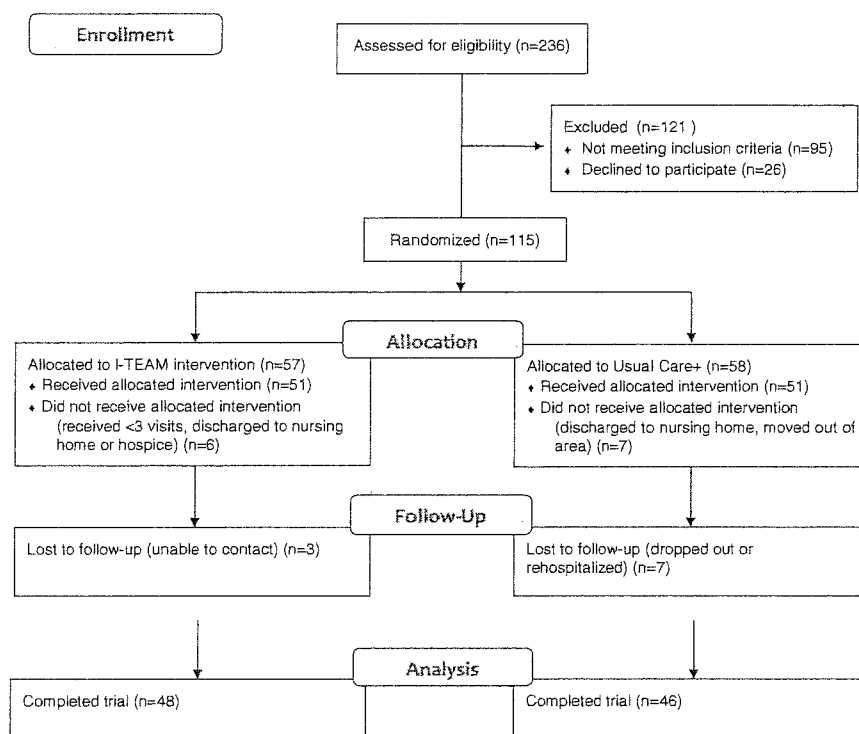


Figure 1. Flow diagram.

nurse contacted participants with abnormal readings for follow-up evaluation. I-Team nurses followed congestive heart failure (CHF) and COPD clinical practice guidelines. In combination with biometric symptom monitoring, trained I-TEAM nurses initiated brief integrated PST for comorbid depression over 8 weeks to increase problem-solving skills with chronic illness. PST is an empirically robust and individual-centered approach to treating depression.<sup>20,21</sup> Telehealth PST sessions over the telephone were completed in 35 minutes and followed a manual outlining a five-step process.<sup>22</sup> Tailored counseling followed published procedures,<sup>10,11</sup> including symptom monitoring, medication use, psychoeducation, problem-solving strategies, and behavioral activation. Nurses received 6 weeks of supervision to achieve competency as measured using the PST Therapist Fidelity Scale.<sup>10</sup>

UC+P participants received in-home services provided by registered home care nurses, under the direction of a primary care physician, who acted as care coordinators in managing the plan of care, which may have included one or more of the following services: physical therapy, social services, nutrition, and home aides. Usual care was augmented with psychoeducation, which included instruction on the disease process and counseling about the importance of daily monitoring of body weight, smoking cessation, diet, and medication adherence for managing their medical condition. Usual care nurses conducted 1-hour-long face-to-face home visits at least weekly over a 3-month period.

#### Outcome Measures and Data Collection

Two trained and blinded graduate research assistants collected pre- and postintervention data.

Depression Status was assessed using the Hamilton Depression Rating Scale (HAM-D)<sup>23</sup> and PHQ-9.<sup>16</sup>

Health and functional status was assessed using the Medical Outcomes Study 12-item Short-Form Survey (SF)-12 Physical Component and Mental Component subscales (PCS, MCS).<sup>24</sup> For individuals aged 75 and older, national mean PCS and MCS scores are 40.8 and 52.6, respectively.<sup>25</sup>

Problem-solving coping skills were assessed using the Social Problem-Solving Inventory—Revised<sup>26</sup> (SPSI-R). Higher scores reflect more-effective problem-solving ability in managing symptoms.

#### Patient Satisfaction Questionnaire

Three months after baseline, a six-item satisfaction questionnaire was used to assess provider communication, privacy, quality and acceptability of care, understanding of condition, quality of life, and treatment satisfaction.

#### Healthcare Use

Data were obtained on participant episodes of care, ED visits, and hospital admissions incurred over 12 months (before and after baseline) through the agency's healthcare use database.

#### Data Analysis

Baseline demographic characteristics were compared using independent-sample *t*-tests and chi-square tests. Intention-to-treat (ITT) analysis was conducted with all randomized participants kept in the analysis to assess intervention effectiveness. Random effects regression was the main analytical method used for assessing outcomes and the change

between baseline and follow-up measurements to test for the effects of condition, time, and interaction the between condition and time. This method controls for baseline score and covariates and includes missing case data.

## RESULTS

### Sample Characteristics

Of 302 individuals assessed for eligibility, 214 met ADL criteria; 63 of those were excluded (not meeting inclusion criteria), 26 declined to participate (12% refusal rate), and 115 consented. Baseline demographic data (Table 1) between participant groups were examined, and no differences were found. The sample was predominately female and had a mean age of 79, with 23% aged 85 and older. Fewer than 38% of participants were married, 55% lived alone, a majority had less than 12 years of education, and one-third had an annual income of less than \$14,000.

Baseline mean PHQ-9 and HAM-D scores indicated clinical depression and were not significantly different between treatment groups. Baseline ADL mean scores were equivalent between the groups, but SF-12 PCS mean scores for the UC+P (42.1) and the I-TEAM (42.3) indicated physical functioning (40.8) slightly above the mean for individuals aged 75 and older, which indicated slightly better physical function than the national norm for that age group.<sup>25</sup> SF-12 MCS mean scores for both groups indicated lower scores than national mean mental health scores for individuals in their age group. Participants in

both groups experienced less than one ED visit on average (UC+P = 0.8, I-TEAM = 0.7) and two or fewer episodes of care but required on average 14 days of hospitalization and were thus eligible for the study.

### Treatment Outcomes

Three- and 6-month mean PHQ-9, HAM-D, and SF-12 PCS and MCS scores for the UC+P and I-TEAM groups are reported in Table 2. At 3 months, the PHQ-9 findings revealed a statistically significantly lower mean score for I-TEAM participants (7.4) than for UC+P participants (13.6). Mean HAM-D scores revealed that both groups reported high depressive symptoms. I-TEAM mean scores at 3 months were half of baseline scores, whereas UC+P scores fell only 2 points. At 6 months, the trend continued, with the I-TEAM group experiencing significantly less depression (7.9) than the UC+P group (14.1). Similar findings were revealed when comparing HAM-D scores. I-TEAM HAM-D scores fell by half at 3 months, with significantly less-severe symptom levels than for UC+P. At 6 months, I-TEAM mean scores were significantly lower (17.4) than UC+P participant scores (10.4).

At 3 and 6 months, no significant between-group differences were found in participants' physical health status (SF-12 PCS), although SF-12 MCS mean scores revealed significant differences between groups at 3 and 6 months. Problem-Solving Skills Inventory scores at 3 months revealed a statistically significant difference between the treatment groups, with I-TEAM participants scoring higher

Table 1. Baseline Demographic, Symptom, Functioning, and Healthcare Use Variables

Variable	Usual Care Plus Psychoeducation (n = 58)	Integrated Telehealth Education Activation for Mood Intervention (n = 57)
Age, mean $\pm$ SD	78.3 $\pm$ 6.9	80.1 $\pm$ 7.8
Married, %	31.4	37.3
Education <12 years, %	53.1	51.2
Female, %	68.6	62.7
Income <\$14000, %	30.1	29.6
Living alone, %	60.8	55.3
Primary diagnosis, %		
Heart failure	74.1	80.7
Chronic obstructive pulmonary disease	25.8	19.2
Comorbid medical conditions, %		
Hypertension	47.3	46.1
Diabetes mellitus	23.9	24.3
Osteoarthritis	22.4	21.7
Mini-Mental State Examination score, mean $\pm$ SD	25.8 $\pm$ 0.6	25.1 $\pm$ 1.7
Number of activity of daily living limitations, mean $\pm$ SD	3.3 $\pm$ 1.8	3.5 $\pm$ 1.6
Hamilton Depression Rating Scale score, mean $\pm$ SD	17.8 $\pm$ 6.7	18.1 $\pm$ 6.9
9-item Patient Health Questionnaire score, mean $\pm$ SD	15.2 $\pm$ 5.8	14.9 $\pm$ 6.4
Medical Outcomes Study 12-item Short-Form Health Survey		
Physical Component Subscale score, mean $\pm$ SD	42.1 $\pm$ 11.5	42.3 $\pm$ 12.1
Mental Component Subscale score, mean $\pm$ SD	39.4 $\pm$ 8.1	39.7 $\pm$ 7.6
Number of emergency department visits in past 12 months, mean $\pm$ SD	0.8 $\pm$ 0.8	0.7 $\pm$ 0.9
Hospital days in past 12 months, mean $\pm$ SD	13.9 $\pm$ 9.9	14.3 $\pm$ 9.7
Episodes of care in past 12 months, mean $\pm$ SD	1.9 $\pm$ 1.2	2.0 $\pm$ 1.2

There were no statistically significant baseline differences between groups. SD = standard deviation.

Table 2. Clinical and Healthcare Use Outcomes According to Intervention Group After Baseline

Outcome	Usual Care Plus Psychoeducation (n = 48)	Integrated Telehealth Education Activation for Mood (n = 46)	P-Value
	Mean ± Standard Deviation		
<b>Clinical outcomes</b>			
Hamilton Depression Rating Scale			
3 months	18.6 ± 5.7	9.8 ± 5.6	.02
6 months	17.4 ± 6.3	10.4 ± 7.1	.05
Patient Health Questionnaire 9			
3 months	13.6 ± 5.6	7.4 ± 5.7	.01
6 months	14.1 ± 5.9	7.9 ± 5.3	.05
Medical Outcomes Study 12-item Short-Form Survey Mental Component Subscale			
3 months	42.8 ± 20.7	53.6 ± 21.7	.01
6 months	40.3 ± 27.4	52.1 ± 24.3	.05
Problem-Solving Skills Inventory			
3 months	8.4 ± 1.7	14.6 ± 1.9	.001
<b>Satisfaction with care (3 months only)</b>			
Satisfied with provider instructions	4.8 ± 1.4	4.6 ± 1.4	.27
Satisfied with instructions on privacy	4.6 ± 1.3	4.5 ± 1.3	.26
Care helped me stay healthier	4.1 ± 1.2	4.9 ± 1.6	.23
Better understanding of my condition	4.7 ± 1.5	4.6 ± 1.3	.21
Care made my life better	4.4 ± 1.2	4.3 ± 1.3	.15
Overall satisfaction	4.5 ± 1.3	4.4 ± 1.4	.28
<b>Healthcare use outcomes (12 months after baseline)</b>			
Emergency department visits	1.4 ± 1.2	0.6 ± 1.6	.03
Hospital days	10.5 ± 6.5	7.5 ± 4.3	.06
Episodes of care	1.8 ± 1.5	1.3 ± 1.0	.10

(14.62) than UC+P participants (8.49), reflecting greater problem-solving abilities. *T*-test analyses revealed no significant differences between groups in satisfaction scores, with all participants reporting general satisfaction with their care. Participants ranked highest on instructions that the nurse provided and having a better understanding of their chronic condition. Participants were also very satisfied with instructions on privacy.

Healthcare use data were gathered 12 months before and after initiation of treatment. *T*-test analyses revealed statistically significant between-group differences for the mean number of ED visits ( $P = .01$ ) and a positive trend towards the number of days hospitalized at 12-month post-baseline ( $P = .06$ ). No differences were found in number of participant episodes of care.

## DISCUSSION

An intervention for older adults receiving home care with complex conditions who were at risk for rehospitalization (I-TEAM) was tested. The trial demonstrated that integrating telemonitoring for chronic disease and treatment for depression had significant positive effects in the experimental participant group with diagnoses of heart failure or COPD. Integrating telehealth in the home care setting offered provider and individuals an opportunity for clinical decision support, a delivery system that reinforced self-efficacy, and a monitoring system of physical and mental health status. I-TEAM nurses were responsible for providing integrated care, instruction, and depression counseling. Daily nurse monitoring of data fostered

therapeutic rapport and clinical status changes prompting “just in time” consultation with the individual or primary care provider for modification of the treatment plan. I-TEAM nurses understood the needs of the individuals with depression and enhanced their coping skills using a manualized evidence-based PST treatment over an 8-week period.

The intervention was delivered using high-fidelity procedures, including training, self-report checklists, observation of treatment content and dosage, and clinical supervision by the first author. Research shows that trained interventionists implementing evidence-based treatments with high fidelity have improved clinical outcomes.<sup>27</sup> Telehealth participants informed their nurses that they felt a sense of security and had greater recognition of health symptoms and greater well-being over the treatment period. Participants were treated sooner than with usual face-to-face in-home care. Telehealth nurses were vigilant in assessing physical and mental health needs, with a simultaneous increase in access to care.

The study's design included random assignment of a small sample of older adults drawn from a not-for-profit home health agency affiliated with a large hospital system. Thus, it is not generalizable to all home care agencies. These were low-income, homebound individuals who required some assistance with ADLs. All individuals who were cognitively intact and at risk of rehospitalization were included in the study. The sample selection algorithm was based on administrative data regarding previous hospital admissions and functional status. Participants were assessed on depression status, physical and mental

functioning, and problem-solving skills. Study participants were statistically balanced between treatment groups in terms of primary diagnosis, reducing the potential for study bias. Despite uncertainty about delivery and participant acceptance of an integrated telehealth intervention for chronic illness and comorbid depression, the majority of participants completed the program during the treatment phase (0–3 months), with 91% of the sample continuing with symptom monitoring and problem-solving regarding daily life stressors during the maintenance phase (3–6 months). The PST intervention was educational in format and delivered around the participant's schedule for convenience and treatment adherence. Participants and the telehealth nurse jointly reviewed specific PST session material weekly. The PST depression treatment approach may be desirable for older persons who prefer talk therapy as an adjunct to medication, need daily structure, or lack the determination or drive for self-care during depressive episodes. This study supports the feasibility of a nurse-delivered integrated telehealth intervention for medically ill older adults receiving home care.

The scope of the study was limited to examining the effectiveness of the I-TEAM program in reducing depressive symptoms and healthcare services use in homebound medically ill elderly adults. Factors such as dosage of, adherence to, and effect of antidepressants and the amount of interaction between the I-TEAM nurse and participants were not examined. Their primary care physicians prescribed antidepressant medications for all participants in both conditions. The authors did not examine the influence of antidepressants on outcomes and are therefore unable to state whether it affected adherence to telehealth monitoring, alleviated symptoms, or reduced ED visits or hospitalizations. Future investigation of these factors may better clarify the effect of telehealth monitoring on outcomes. The study found significantly fewer ED visits and a trend toward fewer hospitalization days for I-TEAM participants than for those in the usual care group, although the study did not examine the related cost savings, which would provide further evidence of the efficacy of this integrated model.<sup>28,29</sup> Although the intervention revealed significant improvement in outcomes of elderly adults with CHF and COPD, the use of telehealth service should be expanded to include populations with a variety of diagnoses.

## CONCLUSION

Telehealth may be an effective strategy to lower ED usage rates for older adults with CHF or COPD. This study demonstrates that a real-world integrated telehealth service may improve clinical and healthcare use outcomes for medically ill depressed older adults receiving home care. The I-TEAM intervention is feasible and acceptable to individuals and providers. It uses evidence-based practices and can be delivered by trained telehealth nurses. The I-TEAM model can be used across urban, suburban, and rural home care agencies. The future of telehealth services is encouraging, with 42 states offering Medicaid coverage and 14 states having private insurance coverage for telehealth services; the Department of Veterans Affairs is a national telehealth provider. Rural counties and those with

medically underserved populations will likely benefit from telehealth services.

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**Author Contributions:** Gellis, Kenaley: study concept, design, acquisition and analysis of data, preparation of manuscript. Ten Have: study design, analysis, interpretation of data, tables.

**Sponsor's Role:** None.

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