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Interactive Voice Response—An Innovative Approach to Post-Stroke Depression Self-Management Support

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Abstract

Background—Automated interactive voice response (IVR) call systems can provide systematic monitoring and self-management support to depressed patients, but it is unknown if stroke patients are able and willing to engage in IVR interactions. We sought to assess the feasibility and acceptability of IVR as an adjunct to post-stroke depression follow-up care.

Methods and Results—The CarePartner program is a mobile health program designed to optimize depression self-management, facilitate social support from a caregiver, and strengthen connections between stroke survivors and primary care providers (PCPs). Ischemic stroke patients and an informal caregiver, if available, were recruited during the patient's acute stroke hospitalization or follow-up appointment. The CarePartner program was activated in patients with depressive symptoms during their stroke hospitalization or follow-up. The 3 month intervention consisted of weekly IVR calls monitoring both depressive symptoms and medication adherence along with tailored suggestions for depressive symptom self-management. After each completed

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Interactive Voice Response and Post-stroke Depression

Compliance with Ethical Standards:

Conflict of Interest: None

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

IVR call, informal caregivers were automatically updated, and, if needed, the subject's PCP was notified.

Of the 56 stroke patients who enrolled, depressive symptoms were identified in 13 (23%) subjects. Subjects completed 74% of the weekly IVR assessments. A total of 6 subjects did not complete the outcome assessment, including 2 non-study related deaths. PCPs were notified 5 times, including 2 times for suicidal ideation and 3 times for medication non-adherence.

Conclusions—Stroke patients with depressive symptoms were able to engage in an IVR call system. Future studies are needed to explore the efficacy of an IVR approach for post-stroke self-management and monitoring of stroke-related outcomes.

Introduction

Approximately 30% of stroke survivors experience post-stroke depression.[1] Post-stroke depression is associated with poorer stroke outcomes, including greater healthcare utilization and an increased risk of disability and death.[2–5] Depression among stroke patients is treatable,[67, 8] and limited data suggest that treatment and reduction in depressive symptoms is associated with improved functional outcomes.[9, 10] However, studies show that post-stroke depression is undertreated,[11, 12] suggesting the need for innovative strategies to identify and treat stroke survivors with depression.

Interactive voice response (IVR) systems, a form of mobile health technology, initiate outgoing automated phone calls during which users respond to recorded queries using their touch-tone phones. Based on their responses, the patients can receive tailored feedback during the same call, and clinicians can receive alerts identifying patients who need additional assistance.[13] An IVR program was shown to be feasible among patients with depression recruited from primary care clinics, and it may improve their medication adherence.[14] An IVR system has yet to be tested among stroke survivors with depressive symptoms, but it could be ideal for this population for multiple reasons. First, depression is a chronic disease that requires frequent contact with the medical system, but stroke survivors often face limited mobility, making it difficult to get to appointments. Second, an IVR intervention can be implemented without requiring patients to purchase or interact with new devices – both of which are barriers for patients who are older and/or socioeconomically vulnerable. IVR systems also have several advantages over telephone support provided by clinical staff, including the capability to perform calls easily outside of business hours, consistency of tailored messages, potential for cost-effective care, and ease of dissemination and implementation.[15] Mobile technology may also provide a means to increase social support, which may improve depressive symptoms and recovery.[16, 17]

The feasibility of IVR-based interventions among stroke patients is unknown. Given the unique physical and language challenges of stroke survivors, understanding whether and how such systems might improve post-stroke depression self-management is particularly important. This study assessed the feasibility and acceptability of the stroke CarePartner program, an IVR-based intervention to optimize depression self-management. It does this through weekly depressive symptom assessments and tailored feedback, facilitation of social support from a caregiver, and strengthening connections between stroke survivors and

primary care providers (PCPs) via emergency alerts. Specifically, we evaluated program engagement, the number of alerts sent to PCPs, changes in depressive symptoms, and subject's satisfaction with the program.

Methods

Overview and study subjects

This was a single center pilot study of stroke patients and their informal caregivers (if available). Stroke patients were enrolled between June 2013 and July 2014 from the University of Michigan Hospital stroke unit and from January 2014 to July 2014 from the University of Michigan Stroke clinic. Adult subjects were enrolled if they had an ischemic stroke and were able to use a touchtone phone. Patients were excluded if they were aphasic or had cognitive impairment as assessed by the primary medical team or the research team such that informed consent was not possible. Additional exclusion criteria included being discharged to a nursing home; diagnosis of bipolar disorder, schizophrenia, post-traumatic stress disorder, or psychosis; an active prescription for an antipsychotic; and suicidal ideation during enrollment or hospitalization. Patients were also excluded if their PCPs were not willing to receive automatic alerts based on the IVR assessments. Participants were encouraged to enroll with a CarePartner, i.e., adult family member or friend who was able and willing to receive email or telephone feedback based on the stroke patient's depressive symptom status. This study was approved by the University of Michigan Institutional Review Board.

At the time of enrollment, patients' depressive symptoms were measured in-person using the Patient Health Questionnaire (PHQ-9).[18] The CarePartner program was activated at enrollment if the patient had a PHQ-9 score of ≥10. Patients scoring <10 at baseline were administered the PHQ-9 over the phone by the research team at 4 and 8 weeks post-stroke. If at any time the participant had a PHQ-9 score of ≥10, the CarePartner program was activated. Because hospital recruitment was slower than expected, we made the following modifications to the protocol: (1) enrolled eligible patients from the stroke clinic; (2) expanded eligibility to include patients with a PHQ-9 score ≥ 5 if 2 or more of the points were from the PHQ-2;[18] and (3) changed the timing of calls to administer the PHQ-9 to 6 and 12 weeks post-stroke hospitalization (Figure 1). If the patient met the depressive symptom enrollment criteria, a fax was sent to his/her PCP notifying the PCP that the patient had indicated a willingness to enroll in the Stroke CarePartner intervention. The PCP was given 48 hours to opt out of the program, in which case the IVR program was not activated.

Stroke CarePartner Intervention

The CarePartner IVR program has been used in many chronic conditions.[19] In this study, the CarePartner Depression program, which has been tested in a primary care depression population, was used.[14] The Stroke CarePartner intervention consisted of weekly IVR calls to subjects with a focus on self-management of depressive symptoms, feedback and assistance for "CarePartners," and alerts to the subject's PCP in the event of a significant change in the subject's status (Figure 2). Once activated into the Stroke CarePartner program, subjects received information sheets detailing the goals of the program, including

tips for talking to their doctors, guidelines for the CarePartner program, and a National Institute of Mental Health booklet on depression. Subjects were also given log books where they were encouraged to write down PCP appointments, note the need for medication refills, and document medication adherence. Subjects then received weekly IVR calls for 3 months on days and times that they selected. The CarePartner system made up to 3 call attempts at times selected with automatic re-calls in the event of a busy signal or no answer. During each IVR interaction, subjects completed the PHQ-9, as well as questions concerning their general health, medication adherence, and side effects. Based on their responses, subjects received tailored and structured feedback supporting depressive symptom self-management.[14] The recorded call content and messaging road map were developed with input from psychiatrists, PCPs, and experts in IVR design and health behavior change.[14] Calls lasted between 5–15 minutes, depending on the number and severity of problems reported.

For participants who enrolled with a CarePartner, those CarePartners received information sheets detailing the goals of the program, log books for tracking subjects' symptoms, and additional educational materials about depression. Based on subjects' weekly IVR assessments, the CarePartner received structured emails or IVR calls with feedback about the subject's status with suggestions for how the CarePartner could support depressive symptom self-management. CarePartners were notified immediately via an IVR call if the subject reported: 1) suicidal thoughts or a suicidal plan, 2) "rarely or never" taking the depression medication as prescribed, and 3) side effects that are making the subject consider taking less medication. Structured fax alerts were sent automatically to the subject's PCP if the subject reported: 1) medication non-adherence or 2) PHQ-9 >15 twice in the last month. The PCP was also notified of the research team's suicide management plan.

Suicidal Ideation

The following actions were taken if suicidal ideation (scoring >0 on question 9 of the PHQ-9) was identified during the IVR assessment: 1) the subject was given the opportunity to be connected directly to suicide hotline during the IVR call; 2) the subject was advised during the IVR call to call 911 or visit the local emergency department; 3) the CarePartner was notified via an IVR call and instructed to contact the subject; 4) the research team was notified by fax and the subject was contacted by the research team and/or the study psychiatrist as soon as possible to establish a plan; and 5) the suicide management plan was relayed to the subject's PCP.

Outcomes

Subjects completed an in-person or telephone survey at the time of enrollment in the IVR program and again at the 3 month completion of the intervention. Additional data regarding subjects' IVR call completion and reported problems were collected automatically via the CarePartner system.

Statistical Analysis

Descriptive statistics were used to characterize subjects' demographics. The baseline and post-intervention depressive symptom scores were compared using a Wilcoxon signed rank sum test. Analyses were performed using Stata 11.0.

Results

Subjects were enrolled from June 13, 2013 to July 17, 2014. A total of 344 stroke patients were assessed for eligibility, of which 288 patients were excluded (Figure 3), the most common reasons being refusal (n=62) and cognitive impairment (n=53). The remaining 56 subjects were enrolled, of which 47 were recruited from a stroke unit and 9 were recruited from a stroke clinic. A total of 13 subjects were activated into the Stroke CarePartner program. Most subjects (11/13) met depressive symptom criteria at baseline; the remaining two subjects were activated after reporting significant depressive symptoms during one of the follow-up screening interviews. Subjects' median age was 62 (IQR 55, 69) and 85% were non-Hispanic white (Table 1). The majority of subjects enrolled with a CarePartner (n=11 or 85%). There were no PCPs who opted out.

Subjects received a total of 123 weeks of IVR assessments. Of these, 91 assessments were completed, yielding an assessment completion rate of 74%. PHQ-9 scores of 10 or over were recorded during 16% of assessments.

Of the 13 subjects activated into the Stroke CarePartner program, 6 did not complete the outcome interview. Two deaths occurred, one from non-ischemic cardiomyopathy and the other of metastatic adenocarcinoma of unknown primary. Two subjects reported they were improved and did not feel they needed the intervention any more. One subject moved after the unexpected death of his wife and elected to drop out during the life transition. Finally, one subject completed all the IVR assessments but not the outcome interview. Of the 7 subjects who completed the program, IVR assessments were completed on average of 9.4 out of 12 weeks (78%). PHQ-9 scores improved from a median score of 11 (IQR 7–13) at baseline to a mean of 4 (IQR 1–7, p=0.11) at follow-up. There was no difference in age or baseline depressive symptoms between those who completed the study and those who did not complete the study.

There were 5 PCP notifications in the 123 week of calls (4.0%). PCPs were notified for two different subjects. One subject generated three notifications regarding anti-depressant medication non-adherence. The other subject reported suicidal ideation during two calls. This subject was contacted by the study team immediately and followed up shortly thereafter by the PCP where this subject's antidepressant regimen was changed and outpatient mental health counseling was initiated.

Subjects and CarePartners who completed the program reported that the service was easy to use and provided valuable information. One subject noted: "It was nice to know that there was someone calling to check on me. Gave me an avenue to check on if I was depressed." Similarly, another subject noted, "Using the program opened my eyes to dangers and pitfalls [of depressive symptoms after stroke]. Gets you thinking about things to help yourself.

Started meds because of program." All participants and CarePartners rated the quality of the program as good or excellent and would recommend it to a friend. All but one subject thought it helped him/her deal more effectively with depressive symptoms.

Discussion

This pilot study found that stroke patients with depressive symptoms were able to engage in an IVR-based intervention that encouraged depressive symptom self-management, facilitated social support, and supported doctor-patient relationships. Furthermore, the burden on the PCPs was minimal. Among patients who completed the stroke CarePartner program, there was a trend towards decreased depressive symptom burden. However, this should be interpreted with caution given the absence of a control group, the small sample size, and the significant loss to follow-up.

Mobile health technology is appealing due to its low cost, scalability, and fidelity of the intervention. Post-stroke depression is a condition that waxes and wanes, requiring ongoing monitoring and assistance that typically is not available to patients in most practices.[1, 11] While the prevalence of post-stroke depression remains nearly constant over time, different patients will be affected with depressive symptoms at different time points.[1, 11] IVR systems such as this may be an optimal method to screen for post-stroke depressive symptoms and bring these treatable symptoms to the attention of the stroke survivors and their care teams. Future studies could also consider IVR-based interventions for post-stroke medication adherence, rehabilitation or for routine assessment of functional status post-stroke.

Many challenges were observed in this feasibility study. First, enrollment into the IVR-based intervention was initially very low. This challenge was addressed by expanding the criteria to include a more representative sample of stroke patients, including those with milder depressive symptoms and those seen in an outpatient clinic, as well as extending the depressive symptom screening timeframe. About half of stroke survivors completed the program, and these subjects completed three quarters of the IVR assessments. The IVR completion rate is similar to that of subjects in an IVR depression intervention but lower than that of subjects enrolled in IVR heart failure and cancer programs.[6, 19] Although the first 3–6 months after a stroke are the time of greatest neurologic recovery and depressive symptoms may hinder that recovery,[20, 21] this is also a very busy time for the stroke survivors as they participate in therapy and work to re-integrate into their communities. Thus, it may be that, for some stroke patients, IVR-based interventions may be more acceptable as a component of their longer-term survivorship plans. Further study of decreased call frequency with a longer duration of the program should be considered.

Our study had limitations. First, our small sample size and lack of a control group limit the assessment of the efficacy of the CarePartner intervention. We cannot exclude that the depressive symptoms identified during the acute stroke hospitalization were a result of the stroke rather than pre-existing depression. Nonetheless, early depressive symptoms are associated with increased post-stroke disability.[4] The exclusion of patients for cognitive and aphasia was not based on validated scales but rather a clinical or research determination which results in difficulty quantifying the degree of impairment and decreases the

generalizability of the intervention. Furthermore, the exclusion of stroke survivors with aphasia and cognitive impairment decreases the generalizability of the intervention. Alternate approaches in this population, such as caregiver-reported depression, and types of interventions such as medications or caregiver support could be considered.

We conclude that enrollment and activation of acute stroke patients with at least moderate depressive symptoms into an IVR-based intervention is feasible and acceptable to stroke survivors. Future studies should consider including chronic stroke patients with mild depressive symptoms, extending the calls longer into the post-stroke period, and an expanded focus on post-stroke self-management.

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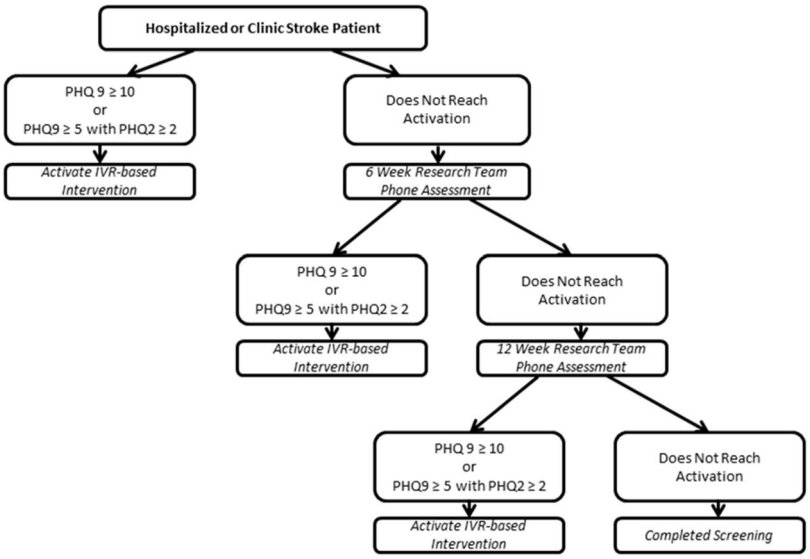

Figure 1.
Activation in the Stroke CarePartners IVR-Based Intervention

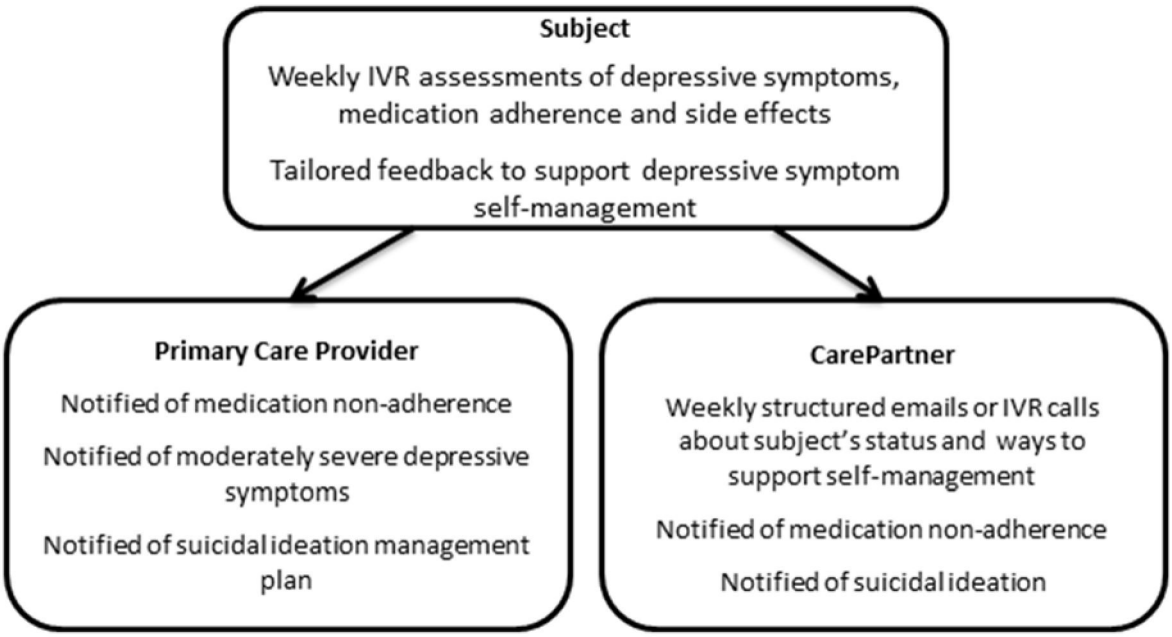

Figure 2.
Overview of the Components of the Stroke CarePartner Intervention

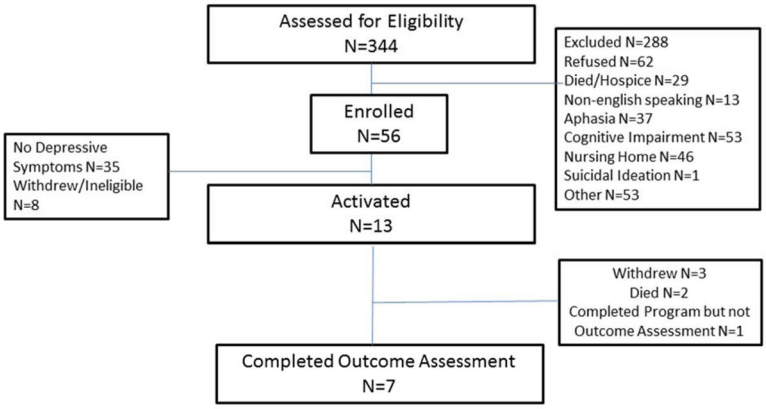

Figure 3.
Stroke CarePartner Participation

Table 1

Sociodemographics, CarePartner Characteristics and Insurance Status of Study Population (n=13).

Characteristic	**N (%)**
Women	6 (46)
Age, median (Q1, Q3)	62 (55, 69)
Non-Hispanic White	11 (85)
Married	7 (54%)
Household size, median (Q1, Q3)	2 (2, 4)
Education	
High school graduate	3 (23)
Some college-or 2 year college degree	6 (46)
College graduate	2 (15)
Advanced Degree	2 (15)
Insurance	
Private Insurance	2 (15)
Medicare	7 (54)
Local Health Insurance	1 (8)
Medicaid	3 (23)
CarePartner	
CarePartner	11 (84)
Spouse	3(23)
Child	2 (15)
Parent	1 (8)
Sibling	3 (23)
Other	2 (15)
Lives with Care partner	6 (46)