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Efficacy of Automated Telephone Continuing Care following Outpatient Therapy for Alcohol Dependence

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Abstract

Background—Relapse rates following cognitive behavioral therapy (CBT) for alcohol dependence are high. Continuing care programs can prolong therapeutic effects but are underutilized. Thus there is need to explore options having greater accessibility.

Methods—This randomized controlled trial tested the efficacy of a novel, fully automated continuing care program, Alcohol Therapeutic Interactive Voice Response (ATIVR). ATIVR enables daily monitoring of alcohol consumption and associated variables, offers targeted feedback, and facilitates use of coping skills. Upon completing 12 weeks of group CBT for alcohol dependence, participants were randomly assigned to either four months of ATIVR (n=81) or usual care (n=77). Drinking behavior was assessed pre- and post-CBT, then at 2 weeks, 2 months, 4 months, and 12 months post-randomization.

Results—Drinking days per week increased over time for the control group but not the intervention group. There were no significant differences between groups on the other alcohol-related outcome measures. Comparisons on the subset of participants abstinent at the end of CBT (n=72) showed higher rates of continuous abstinence in the experimental group. Effect sizes for the other outcome variables were moderate but not significant in this subgroup.

Conclusions—For continuing care, ATIVR shows some promise as a tool that may help clients maintain gains achieved during outpatient treatment. However, ATIVR may not be adequate for clients who have not achieved treatment goals at the time of discharge.

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Contributors

Drs. Helzer and Rose designed the study and wrote the protocol. Mr. Badger advised on study design and developed the statistical analysis plan. Ms. Skelly conducted the data management and statistical analyses. Ms. Ferraro coordinated the data collection and data entry, conducted literature searches, and provided summaries of previous research studies. Dr. Rose wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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Keywords

continuing care; alcohol dependence; cognitive behavioral therapy; Interactive Voice Response (IVR); randomized trial

1. Introduction

In the treatment of substance use disorders, continuing care refers to the stage of treatment following an initial episode of more intensive specialty treatment. There is considerable evidence that continuing care can prolong the therapeutic effects of the initial treatment (see Lash et al., 2011, and McKay, 2009 for reviews). The umbrella of continuing care encompasses a range of activities including self-help groups, home visits, and outpatient counseling reflecting various therapeutic orientations (e.g., Twelve-step, Cognitive-Behavioral Therapy (CBT), Motivational Enhancement), and delivered in group or individual contexts or by telephone. Regardless of treatment perspective, effective programs tend to be those that incorporate close monitoring of both substance use and therapeutic behaviors, actively deliver treatment rather than passively relying on patients' initiative to attend a traditional clinic or facility, and are available for greater than 3 months' duration (McKay, 2009; McKay et al., 2009).

As the field of continuing care research advances, experts have called for the development of more adaptive disease management such that treatment intensity can be modified in response to patient functioning (c.f., Position Statement from the Betty Ford Institute Consensus Research Conference on Extending the Continuum of Care, McKay et al., 2009). Furthermore, development of programs that are low cost, available on demand, and potentially portable is desirable because such programs may extend the reach of continuing care (Lash et al., 2007; McKay 2009). Automated interventions can convey these advances.

One recent example of an automated continuing care intervention is described in an administrative report by Klein et al. (2012), wherein a web-based mixed media support program was offered after discharge. The program incorporated video, patient journal, workbook of sessions, forum for fellowship, and a resource library delivered in a sequence of modules that all patients had access to for 18 months post-discharge from residential care. Results indicated wide variability in use of the program, but were encouraging: those who elected to use the system even once following discharge had, at the 6 month assessment, higher rates of continuous abstinence and greater number of days abstinent compared with those who never used the program after discharge. However, there was no control group so the results may be confounded with patient motivation.

Klein et al.'s (2012) online continuing care program demonstrates the promise of using newer communication technologies to facilitate patients' access to care from home and at any time of day. Randomized trials of other technology-based interventions have demonstrated efficacy for decreasing alcohol and drug use (see reviews by Moore et al., 2011, and Newman et al., 2011). The development of automated continuing care programs is justified because they can result in significant cost savings compared to clinician delivered treatments. They can be programmed to include features associated with efficacious

continuing care, such as extended monitoring of behavior and the provision of behavior contingent feedback. Furthermore, automated systems have the potential to incorporate adaptive treatment algorithms to accommodate within-patient variability in treatment response over time.

Automated telephone technology, in particular, offers the advantages of cost, simplicity, and universal accessibility. We and others have used Interactive Voice Response (IVR) systems to enhance and/or extend alcohol and other treatments in primary care outpatient practices (Helzer et al., 2008) and specialty treatment settings, both inpatient (Mundt et al., 2006) and outpatient (Hall and Huber, 2000; Hasin et al., 2013; Kranzler et al., 2004; Moore et al., 2013; Naylor et al., 2008; Rose et al., 2012; Simpson et al., 2005). These studies support the feasibility, patient acceptability, and/or efficacy of automated treatment enhancement programs, both during treatment (Hasin et al., 2013; Kranzler et al., 2004; Moore et al., 2013; Simpson et al., 2005) and post-treatment (Mundt et al., 2006; Naylor et al., 2008; Rose et al., 2012).

The IVR-based continuing care programs described in the literature have been quite variable in their contents and structure, and typically reflect a particular treatment orientation. Our multifaceted Alcohol Therapeutic Interactive Voice Response (ATIVR) continuing care program, described in detail in the methods section, was based on CBT techniques of self-monitoring thoughts, emotions, and behaviors, and strengthening inter- and intra-personal coping skills. In developing the ATIVR, our objectives were to mimic efficacious continuing care programs such as that of McKay et al. (2010) that offer self-monitoring, feedback, counseling, and therapist contact, albeit in a less intensive, patient directed format suited to IVR delivery. The ATIVR proved usable in pilot testing, and resulted in significant pre-post improvements in coping skills and abstinence rate. In this study, we tested the efficacy of ATIVR, hypothesizing that participants randomized to ATIVR would have better drinking related outcomes at 2- and 4-months following CBT compared with those in the usual care (no ATIVR) control condition.

2. Materials and methods

2.1. Participants and recruitment

Participants (N=158) were recruited from the community of Chittenden County, VT (population ca. 150,000) through clinic referrals, public service announcements, and local advertising online and in print. Criteria for study eligibility were: age 18 or older, diagnosis of current or lifetime DSM-IV Alcohol Dependence, past 90 days report of at least one drink and at least one symptom of Alcohol Abuse or Alcohol Dependence, and attendance at 8 or more outpatient CBT sessions. Candidates were excluded if they met criteria for dependence on a drug other than alcohol or marijuana, or reported using narcotics intravenously more than 5 times within the past year. Recruitment took place from August 2005 to February 2009, and final follow-up assessments were completed in August 2010. All procedures were approved by the University of Vermont Committee on Human Research in the Medical Sciences.

Participant characteristics are shown in Table 1. There were no significant differences between treatment and control groups in demographic or substance use characteristics. The ATIVR group trended toward higher alcohol consumption in the 30 days prior to randomization compared with the usual care group, but these differences were not significant.

2.2. Design and procedure

Potential participants were screened initially by phone for eligibility. Those meeting entry criteria completed an in person informed consent and intake assessment conducted by a trained research assistant (RA). Participants received compensation of \$25 for this interview. Consenting participants were enrolled in a 12-week program of outpatient group CBT treatment. Manualized treatment was provided by doctoral students and supervised by a PhD-level Clinical Psychology faculty member at a University outpatient clinic. A small number of participants were treated by a Certified Drug and Alcohol Abuse Counselor at the academic medical center who had adopted our CBT treatment manual during the course of this study. To be eligible for randomization and continued participation in the trial, participants were required to have completed a minimum of eight of the 12 CBT sessions.

At the conclusion of CBT, participants returned to the research office for an assessment, and were randomized in a 1:1 allocation to either ATIVR or usual care. Randomization was stratified based on whether subjects had legal issues pending relating to their alcohol use. Within each stratum, a blocked randomization was used to insure that an equal number of subjects were randomized to each of the two treatment conditions within each sequential block of 10 participants.

Participants randomized to ATIVR were trained in the use and features of the program (described below) by an RA and were given a Participant Manual. Participants were required to complete their first ATIVR call during this session, using a unique identifier. Research staff was present for technical support and/or questions about the system, but did not discuss nor observe the participant's responses to the system. Participants randomized to the experimental group were given access to the ATIVR for four months. Participants were encouraged to call daily, but were not paid for calling. In the first month, participants who missed two consecutive ATIVR calls received a single reminder phone call from an RA, who offered assistance with any technical difficulties and/or provided suggestions for remembering to call, as appropriate. In months 2–4, a reminder call was made if a participant missed three consecutive ATIVR calls.

Follow up interviews were conducted at 2-weeks, 2-months, 4-months, and 12-months post randomization (i.e., the 12-month assessment occurred 8 months after the active treatment phase ended). The 2-week interview was by phone; all other interviews were in person with a few exceptions at the 12-month assessment when an in person interview was not possible and the interview was conducted by phone. Participants were compensated \$25 for each interview. Reminder calls to participants were made before each scheduled assessment; in addition, a reminder letter was sent to participants one month before the 12-month assessment. Figure 1 diagrams the flow of participants through the study protocol. The retention rate for the 4-month assessment was 88%.

2.3. Experimental intervention

As illustrated in Figure 2, there were six primary components to the ATIVR. Participants were asked to complete a Daily Journal each day. The other features were presented as optional resources the participant could use as needed, but it was not expected that participants would necessarily want to or need to use these other features daily.

2.3.1. Daily journal—Sixteen items assessed mood states, craving, confidence in abstaining, number of risk situations, time with non-users, sobriety support, substance free recreation, coping management, and use of coping skills. Participants were instructed to respond to items based on the previous calendar day. If a participant indicated alcohol or drug use, a follow up question for the current day's use was asked. If a participant reported current use and missed a previous day's call, they were asked to report on alcohol and drug use for that missed day and any previous missed days up to one week prior. If a participant's daily journal indicated alcohol or drug use, high craving, low confidence, and/or low coping levels, that report was "red flagged" as indicating high risk. These participants received a feedback message as described in section 2.3.2.

2.3.2. Targeted daily feedback—Automated feedback was provided based on the participant's current and previous responses. Five groups of feedback messages were programmed based on presence or absence of red flags and use history. Specifically, tailored feedback was created for the following scenarios: 1) consistent drug or alcohol use (more than three days of use); 2) use yesterday or today only; 3) no use but other red flags; 4) no red flags and no current use but some use within the past three days; and 5) more than three days abstinent. Participants reporting no red flags were given a congratulatory message.

2.3.3. CBT skills encouragement—This was introduced as the "Skill of the Day" and directed all participants to one of the following 12 skills sessions in sequential order: coping with cravings and urges; managing thoughts about using; problem solving; refusal skills; coping with a risk or lapse; managing stress; cognitive restructuring; anger management; social support; listening; assertiveness, or increasing pleasant activities. Participants were then directed to the main menu that provided other ATIVR elements, plus contact numbers of substance use disorder treatment services.

2.3.4. Coping skills review—Participants could access a verbal review of the 12 skills learned during group CBT. Each was approximately 2–3 minutes long.

2.3.5. Coping skills practice—Participants were given the opportunity to practice ten of the CBT skills "in vivo." The length of the practice varied from 2 to 10 minutes.

2.3.6. Monthly personalized therapist message—Summary reports based on each participant's responses to the daily journal were created at the end of each month. Based on these reports, therapists recorded personalized messages for each participant that included comments on progress, encouragement, attention to CBT skills, and suggestions. Each message was personalized based on the participant's answers to the daily questionnaires and their participation in group treatment. This feature was included as a means for providing

therapist contact, which is associated with greater efficacy of computerized treatments for substance use disorders (Newman et al., 2011).

2.4. Measures

2.4.1. Eligibility and demographics—Patients self-reported their basic demographic data.

A modified Form 90 (Project Match, 1997) was used to ascertain participants' employment, treatment/living experiences, medications, and other drug use. The Form 90 has demonstrated internal consistency and test-retest reliability (Tonigan et al., 1997). Criterion-related validity has been supported within alcohol dependent clinical populations (Scheurich et al., 2005).

Current and lifetime substance use disorders and symptoms of major depression were assessed using the Diagnostic Interview Schedule (DIS; Segal, 2010). The DIS has shown reliability and validity when administered by physicians and lay interviewers (Malgady et al., 1992).

2.4.2 Alcohol consumption—The Timeline Follow Back (TLFB; Sobell and Sobell, 1995) was used to assess retrospective alcohol consumption. The TLFB is an interviewer-administered calendar-based tool in which participants are asked to recall their daily alcohol consumption in standard drink units (12 oz beer, 5 oz wine, or 1 oz distilled spirits). Prior studies have demonstrated the concordance of self-reported drinking via TLFB against collateral reports of drinking, alcohol-related consequences, and biochemical assessments (Cooper et al., 1981; Maisto et al., 1979; O'Farrell et al., 1985; Sobell et al., 1986). The TLFB administered at the time of randomization covered the time period back to 30-days prior to CBT enrollment (median=136 days; mode=121 days). TLFB administrations at subsequent time periods covered the intervening time period back to the prior assessment to ensure continuous drinking data. Obtained data were used to calculate quantity and frequency of alcohol use in each time period, and were the basis for the defined outcomes of time to three consecutive drinking days and to three consecutive heavy drinking days (4 female, 5 male).

2.4.3. Participant perceptions—A Debriefing Questionnaire and Interview was developed specifically for this project and administered at the four-month assessment. Participants assigned to the ATIVR provided quantitative ratings of their experience using the program, and their perception of ATIVR's usefulness and perceived benefit. The self-report instrument was followed by an interview to solicit open-ended comments.

2.5. Statistical Methods

Participants in the ATIVR and usual care conditions were compared on demographic and baseline characteristics using chi square tests for categorical measures and t-tests for continuous variables. Log rank tests were used to compare groups on time to three consecutive drinking days and three consecutive heavy drinking days. Cox regression was used to evaluate the relative risks of these outcomes while adjusting for baseline frequency

of alcohol use (i.e. drinking days per week). Repeated measures analyses of covariance were used to compare groups at 2-weeks, 2-months and 4-months on frequency and quantity of alcohol use. Covariates were participants' pre-CBT and pre-randomization values (post-CBT) of each outcome. Simple effects (i.e. group comparisons within time and time comparisons within group) were evaluated based on partial F-tests. Models based on generalized estimating equations (GEE) were used to examine period prevalence of alcohol use and heavy use during the 30 days prior to the 2- and 4-month assessments. Bonferroni adjusted chi square tests were used when GEE models failed to converge due to cell frequencies of zero. Analyses of frequency, quantity and period prevalence were repeated for the subset of participants who were abstinent during the 30 days prior to randomization. These secondary analyses that focused on the abstinent subset were exploratory in nature.

The study was estimated to have power $(1-\beta) = 0.80$ using $\alpha=.05$ to detect a moderate effect size (Cohen's $d=0.45$) for primary analyses of all randomized participants. Retrospective exploratory analyses of the subset of participants abstinent at the end of CBT had estimated power 0.80 to detect relatively large effect sizes (Cohen's $d=0.70$). The sample sizes associated with the analyses at each time period are specified in Figure 1. There was no differential follow-up rate across groups. All analyses were performed using SAS statistical software Version 9.2 (SAS Institute, Cary, NC).

3. Results

3.1. ATIVR System Usage

Participants were scheduled to make four months (120 days) of calls. On average, 42% of their scheduled calls were completed (median=38, IQR 17 to 65). The typical calling behavior was for participants to engage with the system initially and make reasonably regular calls, then after some period of time discontinue calls altogether. The mean duration of engagement with ATIVR (i.e., number of days to last call) was 95 days of a possible 120, and the mean call rate during their period of engagement was 57% (median=58, IQR 35 to 73).

The Skills Review option was accessed by 72% of participants ($n=58$), a median of 5 times [IQR = 2 to 12]. The skills accessed by the highest number of participants were cognitive restructuring and coping with cravings: 42 participants used each of these at least once.

The Skills Practice option also was accessed by 72% of participants ($n=58$), with a median usage of 5 times [IQR = 1 to 12]. The two most frequently accessed skills were visualization ($n=42$) and refusal skills ($n=34$).

Personalized therapist feedback messages were available after the first month, and were replaced monthly so long as the participant completed at least one Daily Journal in the preceding month. Ninety-five percent of these messages were retrieved; the messages not retrieved (5%) were those that were recorded for participants who then made no additional calls (i.e., they did not access the system at all after the therapist's message was left).

Participants provided feedback about their experiences using the ATIVR system on the Debriefing Questionnaire. Overall, they found the system easy to use (88% responded

“somewhat” or “very easy”), and each feature was rated somewhat or very useful by the preponderance of respondents who attempted them. The therapist monthly message was rated the highest (76% said somewhat or very useful). Eighty-four percent of participants indicated that the ATIVR encouraged them to practice more coping skills in their daily lives. Participants indicated their reasons for calling the ATIVR, the most frequent of which was because they generally found it helpful (93%), and specifically that it was helpful as a daily review of progress (81%). Notably, patients also called because they felt obligated to do so for the research (88%). Patients who discontinued use of the ATIVR most commonly stated it was because they were too busy (60%) or found calling inconvenient (62%). Most thought the four month duration of the calling period was just right (52%) or too long (42%).

Additional feedback was solicited through RA debriefing interviews with the participants. One theme that emerged was about forgetting to make the call; it was suggested we have the system make outbound calls. Other suggestions pertained to changing the functionality or design of the ATIVR, such as making it easier to resume incomplete calls, or tailoring the ATIVR content/advice/skills to the individual. Only four participants said they stopped calling because they preferred human contact instead of the automated telephone.

3.2. Alcohol-related outcomes: Group comparisons

3.2.1. Time-to-event analyses—Survival plots for days to three consecutive drinking days and three consecutive heavy drinking days (4 female, 5 male) are displayed in Figure 3A and 3B. The time to three consecutive drinking days did not significantly differ between participants randomized to ATIVR calling and usual care groups (Log-Rank test, $p=.29$). By the end of the four month intervention period, 43% of ATIVR participants and 38% of usual care participants had at least one episode of three consecutive drinking days. Time to three consecutive heavy drinking days was similar across the two randomized groups, with no evidence of group differences (Log-Rank test, $p=.99$). By the end of the four months, 19% of ATIVR participants and 21% of control participants had drunk heavily on three consecutive days. Because alcohol use was somewhat higher in the ATIVR calling group at intake and through the last 30 days of CBT (Table 1), Cox-regressions also were performed to compare the groups on the above measures after adjusting for these baseline differences. The estimated relative risk comparing ATIVR to control participants was $RR=1.43$ [95% CI: 0.85 to 2.39] for three consecutive drinking days and $RR=0.84$ [95% CI: 0.41 to 1.72] for three heavy drinking days, neither of which was significant.

3.2.2. Quantity/frequency outcomes—In addition to the time-to-event analyses, participants randomized to the two groups were compared on frequency and quantity of alcohol use and period prevalence as reported by their TLFB assessed at 2-weeks, 2 months and 4-months. There were no significant group differences on any of these alcohol related outcome measures (Table 2). There was evidence of increases in both frequency and consumption over time ($p < .05$). For drinking days per week, the trend over time was significantly different between groups ($p=.04$). This significant interaction was a result of significant increase in the control group over time, but no change in the ATIVR group across the assessment intervals. With respect to period prevalence, approximately half of control participants reported any drinking during the 30-days prior to both the 2-month and

4-month assessments while for participants randomized to the ATIVR group the corresponding rates were 57% at 2-months but 47% at 4-months. Similar trends were observed in the percentage of participants reporting drinking heavily, with approximately a quarter of control participants at both 2 and 4-months compared to ATIVR participants who declined from 31% at 2-months to 21% at 4-months.

3.3. One year follow-up

3.3.1. Period prevalence—Seventy-four percent of participants ($n=60$) in the ATIVR group and 79% of participants in the control group ($n=61$) were available at the 1-year follow-up. No differences were evident in either the percent that reported drinking in the last 30 days (48% for both groups) or excessive drinking in the last 30-days (ATIVR 28% vs control 31%, $p = .73$).

3.4. ATIVR effects on participants who were abstinent at the end of CBT

Exploratory analyses were performed on the basis that continuing care programs (such as ATIVR) target individuals who have achieved their treatment goals. Forty-two percent of ATIVR participants ($n=34$) and 49% ($n=38$) of controls ($p=.35$) reported no alcohol use in the 30 days prior to randomization, which generally corresponded to the last 30 days of participants' CBT treatment. There were no significant differences in baseline characteristics between ATIVR and control groups in this abstinent subset. Similar to the full randomized sample, ATIVR participants tended to have greater alcohol consumption at baseline compared to control participants [18.7 vs. 12.9 drinks/week, $p=.24$]

3.4.1 Time-to-event analyses—Survival plots for days to three-consecutive drinking days and three-consecutive heavy drinking days (4 female, 5 male) are displayed in Figure 4A and 4B. Neither measure was significantly different between groups (Logrank test, $p=.16$ and $p=.26$ respectively).

3.4.2. Quantity/frequency outcomes—Measures of frequency and quantity of alcohol consumption are shown in Table 3. Average number of drinking days ($p=.06$) and average weekly consumption ($p=.09$) were not significantly different for participants randomized to the ATIVR and control groups, but moderate effect sizes were observed on both measures. The two groups also did not differ in the number of drinks per drinking day at any assessment. Fewer participants in the ATIVR group reported drinking in the 30-days prior to the 2- and 4-month assessments ($p=.04$; Cohen's $d=0.51$). No participants reported drinking heavily in the ATIVR-group at 4-months compared to 16% in controls ($p=.04$; Cohen's $d=.61$).

At the 1-year follow-up, no significant differences were observed between groups in either the percentage of participants who reported drinking in the last 30-days (15% for ATIVR vs. 31% for controls, $p=.16$) or those drinking excessively in the last 30-days (8% ATIVR vs. 25% controls, $p=.08$).

4. Discussion

Of the drinking outcomes examined, only drinking days per week showed evidence of differential change over time between groups. The ATIVR group did not increase across the follow-up assessments and the usual care group did; however, there was no evidence of a group difference in drinking days per week at the 4-month follow-up. One factor that may partially account for the lack of observed differences between groups has to do with a measurement bias inherent in the use of TLFB to ascertain retrospective drinking quantity in a group who has prospectively self-monitored their alcohol consumption over the same time period. The self-monitoring may serve a rehearsal function, such that the TLFB reports are more accurate (i.e., they underestimate to a lower degree) in the self-monitoring group than the control group. Individuals using daily ATIVR may have improved recall accuracy on the TLFB, and this improved accuracy may obscure a true difference between groups.

The limited evidence of an experimental effect was surprising because ATIVR incorporated a number of features of successful continuing care programs: ongoing monitoring of symptoms and therapeutic behavior, convenient access to the treatment, and feedback (both automated and therapist-delivered) about symptoms with encouragement to engage with therapeutic behavior. The absence of strong overall treatment effects leads us to speculate on possible improvements or modifications to the ATIVR that might increase its efficacy while still capitalizing on the utility of an automated delivery system. First, the uni-modal interface may not have been engaging enough to fully support the range of learning styles and preferences of the users. In particular, audio delivery of the skills reviews and rehearsals may not be optimal. While the simplicity and ubiquity of telephones is a primary advantage for ATIVR, it may also be a drawback for more complex treatment components and/or for those who are not auditory learners. The audio-only medium may not have allowed some participants to fully engage with the content.

Second, ATIVR might better be incorporated into active treatment as well as post-treatment. The other automated treatment enhancement systems described in the literature (Hasin et al., 2013; Klein et al., 2012; Kranzler et al., 2004; Moore et al., 2013; Mundt et al., 2006; Simpson et al., 2005) were initiated pre-discharge and/or were limited entirely to the period of active treatment. Perhaps if ATIVR was initiated prior to discharge, participants could gain some familiarity with it while still under the care of a clinician who could support its ongoing use. In designing the current trial, we considered using this strategy; however, such a design would require randomization at the level of the group and not the individual. Not only was this design not feasible in our setting that used rolling group admissions, but it would have sacrificed equal treatment prior to randomization.

Third, perhaps an ATIVR or other automated system could take greater advantage of the if-then programming capabilities which would enable an individualized, adaptive disease management approach where monitoring of patient behaviors and symptoms would be more explicitly linked to adjustments in treatment intensity (McKay, 2009). Such individualized treatment approaches are the most clinically useful; however, they are difficult to evaluate empirically because in effect each participant receives a different treatment. In this study, we included features of adaptive disease management in that we provided brief feedback at the

time of every call that was responsive to what the patient had reported that day and previous days, and we also included monthly review of symptom reports by the patient's own clinician. We encouraged participants to utilize the available coping skills reviews and rehearsals on the ATIVR, but perhaps promoting self-directed care was inadequate for some patients who were struggling and needed professional care. Future automated programs could incorporate more precise algorithms to recognize when "stepping up" of care is warranted, and more active engagement by clinicians when return to professional treatment is indicated.

Fourth, it is conceivable that participants may not have received an adequate dose of ATIVR, at an average of 42% call compliance across 120 days. Taking into account that participants engaged in the treatment for an average of 95 days and called 57% of those days, the dose was actually much higher but for a shorter duration than offered. This suggests it's unlikely that a longer *duration* of treatment would have had an improved effect. Other IVR studies have shown call rates between 35% and 83%, with the higher rates reported by IVR programs that were initiated during the active treatment phase. There is some evidence for a dose-response effect of automated continuing care programs following discharge from residential treatment for alcohol dependence. Klein et al. (2012) found that patients who used more of their web-based treatment modules after discharge had a higher abstinence rate than patients who used none or very few. Mundt et al. (2006) noted that missed IVR reports were correlated with the severity of relapse in this population. In the current study, we observed a significant relationship between call compliance and treatment effect; however, this modest association was accounted for entirely by baseline drinking. In other words, those who drank less at baseline tended to call the ATIVR more and also drank less at follow-up. Perhaps if we had made completion of various components an expected instead of optional aspect of the program we might have seen an independent effect of call compliance. In addition, call compliance might have been improved with the incorporation of more engaging features, or technological enhancements such as outbound calls or text messages from the program to the participant.

Finally, and most importantly, this intervention may have targeted the wrong treatment population. In evaluating efficacy, one consideration is that all patients completing CBT were included in the trial, regardless of whether they were abstinent in the last 30 days of CBT. While average levels of consumption at each follow-up time point were well below those observed pre-CBT for both groups, only about half of participants (ATIVR $n=34$; control $n=38$) were completely abstinent at the end of CBT. Clinically, ATIVR as aftercare is most relevant for the subgroup of abstinent patients. It is unlikely that the other patients, who had not achieved primary treatment goals during active CBT, would do so with ATIVR or any other continuing care program. While the subsample was underpowered to detect statistically significant interactions, there was a significant group difference in abstinence rate at the 4 month follow up favoring the ATIVR group, and effect sizes for four out of five outcome measures were medium in magnitude. This suggests that we may have identified a relevant subgroup of individuals for whom continuing care programs might be most beneficial, or who should be studied in future clinical trials.

To our knowledge, this is the first randomized controlled trial of an automated continuing care program. The trial demonstrated a null effect of ATIVR for maintaining CBT outcomes in the 12-months following treatment completion. However, among the target population for continuing care, i.e., those few in this sample who achieved abstinence with CBT, an ATIVR effect was suggested. A statistically significant difference at follow-up on measures of abstinence and excessive drinking, despite the small sample size and low power, suggests a possible relapse prevention effect. For continuing care, ATIVR shows promise as a tool that may help clients maintain gains achieved during outpatient treatment, provided they have achieved treatment goals at the time of discharge. If ATIVR, or other such automated tools that are scalable to large populations, were found to be clinically effective it could substantially save provider time and reduce expenses. These results argue for the continued development and refinement of automated methods of support for individuals post-discharge from specialty alcohol treatment.

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Highlights

Alcohol Therapeutic Interactive Voice Response is a recovery support innovation.

12-week outpatient CBT treatment was efficacious in the full sample.

ATIVR outcomes were similar for both randomized groups at 4 month follow up.

Clients abstinent at the conclusion of CBT benefitted more from ATIVR continuing care.

Figure 1.
Participant Flow Diagram.

Figure 2. Alcohol Therapeutic Interactive Voice Response (ATIVR) features and branching structure. The six primary components are capitalized.

Figure 3.

Survival plots for days to three consecutive drinking days (top panel) and three consecutive heavy drinking days (bottom panel) for full sample. ATIVR, Alcohol Therapeutic Interactive Response, n=81; control group n=77. Heavy drinking is defined as 4 or more drinks on one occasion for females and 5 or more drinks for males.

Figure 4.

Survival plots for days to three consecutive drinking days (top panel) and three consecutive heavy drinking days (bottom panel) for abstinent participants only. ATIVR, Alcohol Therapeutic Interactive Response, n=34; control group n=38. Heavy drinking is defined as 4 or more drinks on one occasion for females and 5 or more drinks for males.

Table 1

Baseline Characteristics

Participant Characteristics	Overall (N=158)	Condition		p-value
		Control (N=77)	ATIVR (N=81)	
% male	53	53	53	.98
% married	65	62	67	.57
% employed full time	64	63	65	.81
% 4 year college degree	57	59	56	.75
age	48.66 (10)	48.12 (9)	49.17 (10.70)	.52
years of regular alcohol use	17.94 (12.2)	17.59 (11.4)	18.27 (13)	.74
number of DSM criteria	4.34 (1.3)	4.44 (1.2)	4.24 (1.4)	.34
% used nicotine last 30 days	25	27	23	.58
% used marijuana last 30 days	9	10	7	.51
Alcohol use 30 days prior to CBT				
drinking days per week	3.46 (2.7)	3.31 (2.8)	3.60 (2.7)	.50
drinks per week	17.59 (18.37)	15.58 (16.42)	19.54 (20.00)	.18
drinks per drinking day	5.75 (4.3)	5.39 (3.9)	6.07 (4.6)	.37
heavy drinking days per week ^a	1.82 (2.3)	1.66 (2.3)	1.99 (2.4)	.37
% of ppts drinking	82	78	86	.18
% of ppts drinking heavily ^a	63	60	66	.43
Alcohol use 30 days prior to randomization				
drinking days per week	1.31 (1.9)	1.04 (1.7)	1.58 (2.1)	.08
drinks per week	5.78 (12.94)	4.94 (14.19)	6.57 (11.67)	.43
drinks per drinking day	4.11 (3.3)	4.08 (3.3)	4.14 (3.3)	.94
heavy drinking days per week ^a	0.52 (1.3)	0.39 (1.1)	0.65 (1.4)	.21
% of ppts drinking	54	51	58	.35
% of ppts drinking heavily ^a	32	29	36	.33

Note. Tabled values are means (standard deviations) unless noted. P-values correspond to t-tests for continuous measures and chi-squares for dichotomous measures. ATIVR = Automated Telephone Interactive Voice Response. CBT = Cognitive Behavioral Therapy.

^aDrinking heavily refers to meeting National Institute on Alcohol Abuse and Alcoholism threshold for high-risk drinking (5+/4+ drinks in a day for men/women).

Drinking Outcomes across Assessments

Table 2

Outcome variable		Assessment		ES	group	time	group x time	
		2-week	4-month				p-value	p-value
Drinking days per week	ATIVR	1.3 ± 0.2	1.4 ± 0.2	.17	.92	.01		.04
	Control ^a	1.1 ± 0.2	1.4 ± 0.2					
Drinks per week	ATIVR	5.3 ± 1.0	6.7 ± 1.0	.01	.39	.004		.27
	Control	3.1 ± 1.0	5.8 ± 1.0					
Drinks per drinking day	ATIVR	3.5 ± 0.4	4.0 ± 0.4	.08	.81	.006		.45
	Control	3.2 ± 0.4	4.3 ± 0.4					
Percent reported drinking (last 30 days)	ATIVR	N/A	57 ± 6	.04	.88	.03		.28
	Control	N/A	53 ± 6					
Percent reported drinking heavily ^a (last 30 days)	ATIVR	N/A	31 ± 6	.04	.91	.03		.42
	Control	N/A	28 ± 5					

Note. Tabled values are least square means ± standard error based on analyses of covariance, unless otherwise noted. ATIVR = Automated Telephone Interactive Voice Response. ES = Effect size at 4-month assessment, reported as Cohen's d.

^aDrinking heavily refers to meeting National Institute on Alcohol Abuse and Alcoholism threshold for high-risk drinking (5+/4+ drinks in a day for men/women).

* p<.05 for change over time within group.

Table 3

Drinking Outcomes across Assessments for Participants Abstinent at the End of CBT

		Assessment		ES	group	time	group x time
		2-week	4-month				
Drinking days per week	ATIVR	0.1 ± 0.2	0.1 ± 0.2	.46	.06	.21	.09
	Control	0.1 ± 0.1	0.5 ± 0.2				
Drinks per week	ATIVR	0.3 ± 1.3	0.1 ± 1.3	.43	.09	.16	.12
	Control	0.3 ± 1.2	3.8 ± 1.2				
Drinks per drinking day	ATIVR	2.6 ± 1.9	3.5 ± 1.9	.11	.57	.36	.80
	Control	3.4 ± 1.3	5.3 ± 1.1				
Percent reported drinking (last 30 days)	ATIVR	N/A	13 ± 6	.51	.04	.71	.63
	Control	N/A	10 ± 5*				
Percent reported Drinking Heavily ^b (last 30 days)	ATIVR	N/A	29 ± 7				
	Control	N/A	3 ± 3	.61	N/A ^a	N/A ^a	N/A ^a
	Control	N/A	13 ± 6				

Note. Tabled values are least square means ± standard error based on analyses of covariance, unless otherwise noted. CBT = Cognitive Behavioral Therapy. ATIVR = Automated Therapeutic Interactive Voice Response. ES = Effect Size at 4-month assessment, reported in Cohen's d.

^a GEE model did not converge due to no subjects reporting excessive drinking in ATIVR group at 4-months, significance based on Bonferroni adjusted chi-square tests within time point.

^b Drinking heavily refers to meeting National Institute on Alcohol Abuse and Alcoholism threshold for high-risk drinking (5+/4+ drinks in a day for men/women).

* p < .05 for ATIVR vs. Control