QUERI

e-Interventions for Alcohol Misuse

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PREFACE

Quality Enhancement Research Initiative's (QUERI) Evidence-based Synthesis Program (ESP) was established to provide timely and accurate syntheses of targeted healthcare topics of particular importance to Veterans Affairs (VA) clinicians, managers and policymakers as they work to improve the health and healthcare of Veterans. The ESP disseminates these reports throughout the VA, and some evidence syntheses inform the clinical guidelines of large professional organizations.

QUERI provides funding for four ESP Centers and each Center has an active university affiliation. The ESP Centers generate evidence syntheses on important clinical practice topics, and these reports help:

- develop clinical policies informed by evidence;
- guide the implementation of effective services to improve patient outcomes and to support VA clinical practice guidelines and performance measures; and
- set the direction for future research to address gaps in clinical knowledge.

In, 2009, the ESP Coordinating Center was created to expand the capacity of HSR&D Central Office and the four ESP sites by developing and maintaining program processes. In addition, the Center established a Steering Committee comprised of QUERI field-based investigators, VA Patient Care Services, Office of Quality and Performance, and Veterans Integrated Service Networks (VISN) Clinical Management Officers. The Steering Committee provides program oversight, guides strategic planning, coordinates dissemination activities, and develops collaborations with VA leadership to identify new ESP topics of importance to Veterans and the VA healthcare system.

Comments on this evidence report are welcome and can be sent to Nicole Floyd, ESP Coordinating Center Program Manager, at Nicole.Floyd@va.gov.

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EXECUTIVE SUMMARY

INTRODUCTION

Alcohol misuse is the third leading cause of preventable death in the United States and the third leading cause of morbidity and mortality worldwide. The associated costs amount to more than 1% of the gross national product in high- and middle-income countries. Substance use disorders, including alcohol use disorder (AUD), are among the most common and most costly conditions in Veterans presenting for treatment in the Veterans Health Administration (VHA) system.

Traditional treatment for AUD—intensive, but time-limited initial interventions, then less intensive follow-up care—can be prohibitive because of barriers such as sufficient funding, time, and adequately trained personnel. Even screening and brief interventions for less severe alcohol misuse, which have been recommended by the U.S. Preventive Services Task Force (USPSTF), require financial and clinical resource investments that can be problematic. Thus, electronic interventions (e-interventions) may prove a useful way to extend the reach of traditional interventions for alcohol misuse or AUD.

Eighty-seven percent of the U.S. population uses the Internet. Thus, e-interventions have the potential to reach those individuals with drinking problems who wish to remain anonymous; those who live at great distance from, cannot afford, or have little time for traditional therapy; and shift workers who need treatment to be available during non-standard business hours. Given that Veterans can encounter most, if not all, of these barriers to accessing care for alcohol misuse, e-interventions may prove a promising new avenue, especially for the younger, more Internet-savvy Veterans returning from Iraq and Afghanistan.

Definitions

Alcohol misuse: Excess daily consumption (>4 drinks/day in men, >3 drinks/day in women and men over age 65) or excess total consumption (>14 drinks/week in men, >7 drinks/week in women and men over age 65)

Alcohol use disorder (AUD): A disease characterized by the harmful consequences of repeated alcohol use (*eg*, social or physical problems), a pattern of compulsive use (*eg*, use in situations in which it is physically hazardous), and sometimes, physiological dependence on alcohol (tolerance or symptoms of withdrawal)

Standard drink: In the United States, a standard drink contains 14 grams alcohol, equivalent to:

- 12 ounces of beer (5% alcohol by volume)
- 5 ounces of wine (12% alcohol by volume)
- 1.5 fluid ounces of 80-proof spirits

Although prior reviews have evaluated computer-based interventions for alcohol misuse, our study includes a broader array of e-interventions, evaluates effects separately for student and non-student populations, and focuses on studies that report longer term, clinically important outcomes. In order to inform policy on alcohol misuse for VHA, we offer a systematic review of the randomized controlled trials (RCTs) assessing CD-ROM-based, web-based, interactive voice response (IVR), or mobile applications of e-interventions for alcohol misuse. We assess for changes in alcohol consumption, effects on medical health, and social or legal consequences of alcohol misuse.

METHODS

We conducted a primary review of the literature by systematically searching, reviewing, and analyzing the scientific evidence as it pertains to the following key questions (KQs):

- KQ 1: For e-interventions targeting adults who misuse alcohol or who have a diagnosis of AUD, what level, type, and modality of user support is provided, by whom, and in what clinical context?
- KQ 2: For adults who misuse alcohol but do not meet diagnostic criteria for AUD, what are the effects of e-interventions compared with inactive controls?
- KQ 3: For adults at high risk of AUD (*eg*, AUDIT-C ≥8), or who have a diagnosis of AUD, what are the effects of e-interventions compared with inactive controls?
- KQ 4: For adults who misuse alcohol, are at high risk of AUD, or have a diagnosis of AUD, what are the effects of e-interventions alone or used in combination with face-to-face therapy compared with face-to-face therapy alone?

Data Sources and Searches

In consultation with an expert librarian, we searched MEDLINE (via PubMed), The Cochrane Library, Embase, and PsycINFO from January 1, 2000, to August 18, 2014, for peer-reviewed, English-language RCTs. We used Medical Subject Heading (MeSH) terms and selected free-text terms for the conditions and therapy types of interest as well as the electronic delivery mode. We further reviewed the bibliographies of exemplar trials and systematic reviews. As a check for publication bias, we searched ClinicalTrials.gov to identify completed but unpublished trials.

Study Selection

Using prespecified inclusion and exclusion criteria, 2 trained investigators assessed titles and abstracts for relevance to the KQs. Full-text articles identified as potentially relevant were further examined by 2 investigators; disagreements were resolved through consensus. We included RCTs conducted in adults with alcohol misuse or AUD that compared an e-intervention to an inactive or active control and reported relevant outcomes at ≥6 months.

Data Abstraction and Quality Assessment

Data from included articles were abstracted into the final form by a trained investigator and confirmed by a second investigator. Data elements abstracted included patient descriptors, setting, features and dose of the e-intervention, characteristics of the comparator, and outcomes. When data were incomplete or missing, we contacted authors to request the data.

We assessed the quality (risk of bias) of each study using criteria specific for RCTs and summarized the overall risk of bias as low, moderate, or high. In addition to rating the quality of individual studies, we evaluated the overall strength of evidence (SOE) for selected outcomes as high, moderate, low, or insufficient using the domains: directness, risk of bias, consistency of treatment effects, precision of treatment effects, and risk of publication bias.

Data Synthesis and Analysis

While synthesizing abstracted data, we classified the e-interventions according to the level of supplementary human support provided, as follows:

- Level 1: No support; e-intervention only
- Level 2: Some support; e-intervention supplemented by non-counseling meetings with study staff
- Level 3: Therapeutic support; e-intervention supplemented by counseling with trained staff

We grouped studies into those that enrolled participants with alcohol misuse and those that enrolled participants at high risk of or with AUD. Because of important differences in the study samples and intervention designs, we planned a priori to analyze studies conducted in college student samples separately from studies conducted in other adult samples.

When meta-analysis was feasible—for alcohol consumption, meeting recommended alcohol consumption limits, binge drinking (students only), and social problems from drinking (students only)—we computed summary estimates of effect, stratified by condition for 6 and 12 months. The primary outcome—alcohol consumption—was measured using different units across trials. Therefore, we converted to a common unit (grams [g]/week) and combined using mean differences (MDs). Since studies used different outcome measures for social problems from drinking, we used the standardized mean difference (SMD) to summarize treatment effects. Dichotomous outcomes were analyzed using summary risk ratios (RRs). We evaluated for statistical heterogeneity in treatment effects using Cochran's Q and I^2 statistics. We planned subgroup analyses to explore potential sources of heterogeneity, specifying a priori: follow-up rates, treatment dose, and the level of support given with the intervention. However, planned subgroup analyses could not be performed because subgroups did not meet the prespecified minimum of 4 studies per subgroup. When there were at least 3 studies at low or moderate risk of bias, we performed sensitivity analyses to compute summary estimates after excluding studies at high risk of bias.

Where quantitative synthesis was not feasible, we analyzed the data qualitatively. We gave more weight to the evidence from higher quality studies. We focused on identifying patterns in the efficacy and safety of the interventions and finding potential reasons for inconsistency in treatment effects. When evaluating the overall SOE, we considered a difference of 3 standard U.S. drinks/week or an SMD $\geq$0.4 as clinically significant and defined precise effects as those with 95% confidence intervals (CIs) that excluded smaller effects.

RESULTS

Results of Literature Search

From 722 citations screened, we reviewed 84 full-text articles and identified 26 trials that met eligibility criteria. The populations were divided between college students (n=12) and other groups of adults (n=14). Men and women were both well-represented, and in the adult studies, the majority of participants had some college education. One study was conducted in a VA sample. Only 3 trials specifically recruited subjects who were at high risk of or had been

diagnosed with AUD. The other 23 trials recruited subjects who misused alcohol. Three trials examined IVR, and the other 23 compared an e-intervention with an inactive control. IVR is slightly different from what is generally thought of when the term "e-intervention" is used in that IVR is a technology that allows a computer to interact with humans through the use of voice and signaling over analog telephone lines. Six trials involved face-to-face therapy. A single trial used a mobile device as the delivery platform. The most commonly reported outcomes were effects on alcohol consumption, reductions in consumption to meet drinking limits, binge drinking, and the social and legal consequences of drinking.

Summary of Results for Key Questions (KQs)

KQ 1: Characteristics of and User Support for E-Interventions

Of 26 studies, only 12 relied on any type of supplementary human support, and only 4 of these included support of a therapeutic nature. Most of the studies examined a one-time intervention, delivered online or at a desktop computer, that compared an individual's alcohol consumption to their peer group norm. Generally, interventions designed for college students were less complex, having fewer and shorter sessions, and using a more limited number of strategies. Studies in other groups of adults were more intense, including studies that used therapeutic support ranging from 1.5 to 5 hours and that targeted subjects with more severe drinking problems. Other key findings are summarized below:

- Most interventions were a single session, designed to moderate alcohol consumption in individuals who screened positive on an alcohol questionnaire (*eg*, AUDIT or AUDIT-C).
- The most common components of the e-interventions were personalized normative feedback (PNF), information comparing an individual's alcohol consumption patterns to the normative behavior of a reference group, and psycho- or alcohol-specific education including the negative consequences of drinking.
- When supplementary human support was utilized (n=12), it was limited, consisting only of technical support from a research assistant in half the cases. In other cases, it was often given in combination with IVR or other telephonic or face-to-face treatment in subjects at high risk of or with AUD.
- Although many e-interventions for alcohol misuse have been studied, few have been evaluated in more than a single study meeting criteria for this review.

KQ 2: Effects of E-Interventions Compared with Inactive Controls in Adults who Misuse Alcohol

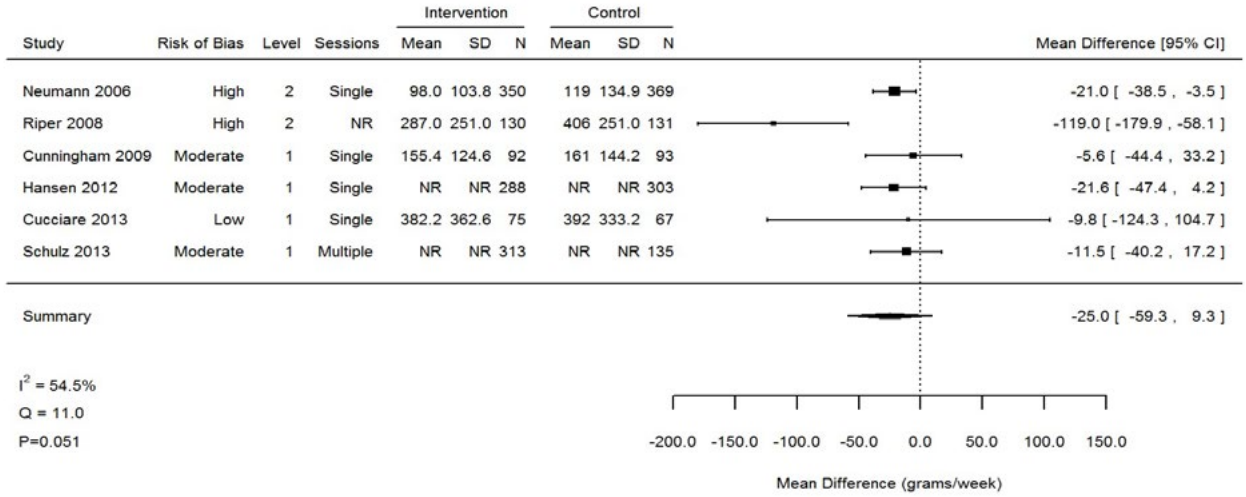
Twenty-two studies (13,929 participants) evaluated the effects of e-interventions versus inactive controls in participants with alcohol misuse. Most studies were judged to be at low (n=7) or moderate (n=12) risk of bias. Overall, the available data suggest that long-term effects of e-interventions on alcohol outcomes are modest or absent. Other key findings are summarized below:

- The most commonly reported outcome was weekly alcohol consumption, but treatment effects were relatively small and varied significantly across studies.

  - In 6 adult studies at 6-month follow-up, e-interventions were associated with a small, statistically insignificant reduction in alcohol consumption (MD -25.0 g/ week; 95% CI, -59.3 to 9.3; Figure ES-1). A sensitivity analysis limited to studies at low or moderate risk of bias found a small, statistically significant reduction in alcohol consumption (MD -14.7 g/week; 95% CI, -26.4 to -3.0).
  - In 8 student studies at 6-month follow-up, e-interventions were associated with a modest, statistically insignificant reduction in alcohol consumption (MD -12.4 g/ week; 95% CI, -26.6 to 1.9; Figure ES-2).

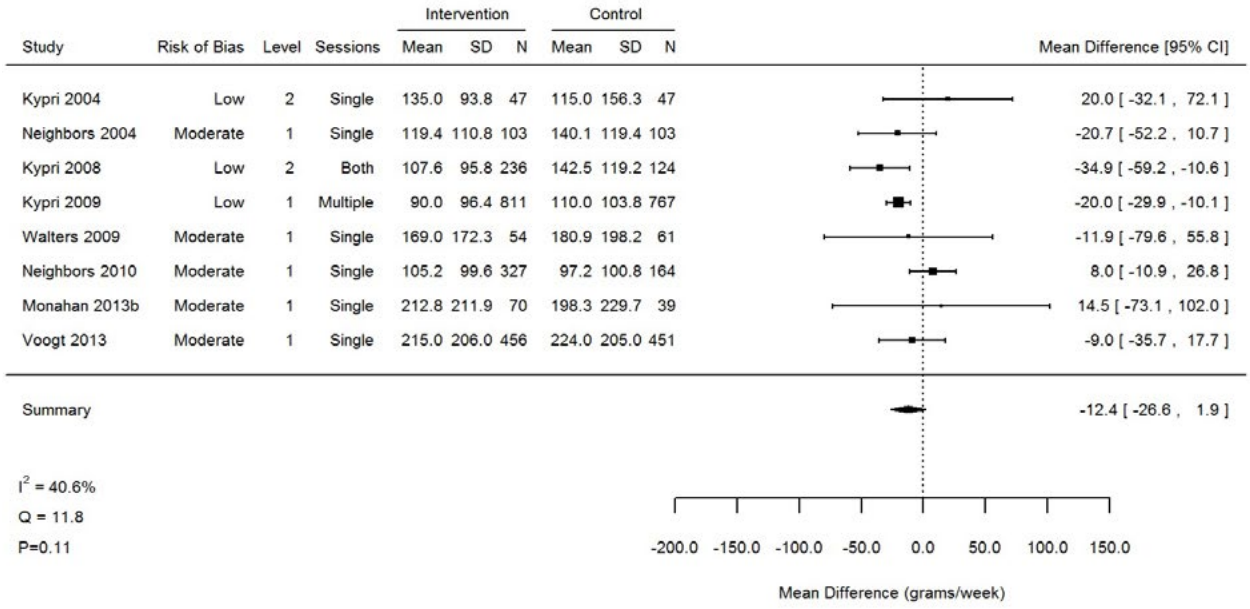
- Few studies in adults reported effects on meeting drinking limit guidelines (n=5), reducing binge-drinking episodes (n=2), or decreasing alcohol-related social problems (n=1).
- In 4 student studies, e-interventions did not result in a significant reduction in binge drinking (MD -0.1; 95% CI, -1.0 to 0.9) at 6 month follow-up.
- In 7 student studies, e-interventions showed no effect on the negative social consequences of alcohol (MD -0.04; 95% CI, -0.22 to 0.13) at 6-month follow-up.
- Longer term effects (≥6 months) of e-interventions on alcohol consumption and its associated effects on health and well-being were modest or absent in the data currently available.

Figure ES-1. Alcohol Consumption at 6 Months in Studies of Adults*



*Hansen 2012 and Schulz 2013: Means and SDs were not available, as only mean difference and CI were given.
Abbreviations: CI=confidence interval; N=number of participants; NR=not reported; SD=standard deviation

Figure ES-2. Alcohol Consumption at 6 Months in Studies of College Students



Abbreviations: CI=confidence interval; N=number of participants; SD=standard deviation

KQ 3: Effects of E-Interventions Compared with Inactive Controls in Adults at High Risk of AUD (eg, AUDIT-C ≥8) or with a Diagnosis of AUD

Only 3 studies (2 moderate, 1 high risk of bias) compared e-interventions with inactive controls in 533 patients with a diagnosis of AUD. Neither computerized feedback plus telephone counseling nor an IVR system decreased alcohol consumption or risk of relapse. A multi-component smartphone program used to support recovery following residential treatment increased abstinence (odds ratio [OR] 1.94; 95% CI, 1.14 to 3.31) and decreased risky drinking days at 12-month follow-up.

KQ 4: Effects of E-Interventions Alone or Used in Combination with Face-to-Face Therapy Compared with Face-to-Face Therapy Alone in Adults who Misuse Alcohol

Six trials (1090 participants) compared e-interventions alone or in combination with face-to-face brief motivational interviewing (BMI) with BMI alone. All studies enrolled individuals with alcohol misuse. They varied markedly with regard to setting, subject, and intervention characteristics. Studies were judged to be at low (n=2) or moderate risk of bias (n= 4). Overall, this diverse group of studies did not find a benefit of e-interventions alone or as an adjunct to face-to-face BMI compared with face-to-face BMI alone for college students or midlife primary care patients who misuse alcohol.

The effects of e-interventions alone (n=3) or in combination with BMI (n=3) versus BMI alone are summarized below:

- Combination of e-intervention plus BMI versus BMI alone in adults: IVR plus BMI was the only e-intervention compared with face-to-face treatment in non-collegiate populations. Two studies found no improvement in primary drinking outcomes with the addition of IVR.

- Combination of e-intervention plus BMI versus BMI alone in students: One study found no improvement in 12-month outcomes when computerized PNF was added to BMI.
- E-intervention versus BMI: All 3 head-to-head comparisons were conducted in college students. BMI was generally more effective. Both heavier alcohol consumption (50 g to 81 g more per week) and increased binge drinking frequency (2 to 2.5 more episodes per month) were associated with the e-intervention.

DISCUSSION

Key Findings and Strength of Evidence

We identified 26 RCTs involving over 14,000 participants with alcohol misuse, at risk of AUD, or with AUD. Participants were selected for these trials based on one or more alcohol consumption criteria, but only 3 studies based inclusion on an assessment of AUD. Studies were divided roughly equally between college students and other groups of adults. Adult participants were typically midlife (median age=41.4 years), and the majority had at least some college education, with baseline alcohol consumption in excess of 14 drinks per week. Most trials compared e-interventions with inactive controls. E-interventions were typically accessed online, consisted of one session lasting 30 minutes or less, and were completed without supplementary human support; PNF was the predominant strategy. A single trial used a mobile device as the delivery platform.

We summarize the SOE for selected outcomes in Table ES-1. Overall, there was low SOE that e-interventions compared to inactive controls did not decrease alcohol consumption outcomes in participants with alcohol misuse. In patients with AUD, a multicomponent smartphone application decreased the risk of relapse after residential treatment (SOE=low). Treatment effects varied across studies, and we were unable to explain the heterogeneity. Sensitivity analyses restricted to studies at low or moderate risk of bias were generally consistent with the primary analyses.

Consistent with previous literature, qualitative examination suggested that more intensive treatments were associated with larger decreases in alcohol consumption. Compared with face-to-face treatment, e-interventions alone or in combination with face-to-face treatment were not associated with decreased alcohol use. IVR e-interventions may be less effective than face-to-face treatment. Other outcomes were reported infrequently (*eg*, social or legal consequences of alcohol use, health-related quality of life) or not at all (*eg*, alcohol-related medical problems).

Table ES-1. Summary SOE Ratings

Outcome	Number of Studies (Participants)	Study Design/ Risk of Bias	Effect Estimate	SOE
KQ 2: E-intervention vs control in alcohol misuse				
Alcohol consumption (weekly)	17 (10,122)	RCT/Moderate	Statistically insignificant reduction of 2 U.S. standard drinks per week	Low
Met alcohol consumption limits	6 (4932)	RCT/Low	Statistically insignificant increase in adults: RR 1.22 (95% CI, 0.79 to 1.89)	Low
Alcohol consumption (binge drinking)	8 (5043)	RCT/Low	Small, statistically insignificant difference	Moderate
Alcohol-related social problems	8 (5765)	RCT/Low	No difference	Low (adults) Moderate (students)
KQ 3: E-intervention vs control in AUD				
Alcohol consumption (maintain abstinence)	3 (533)	RCT/Moderate	Increase in abstinence for adults with smartphone e-intervention: OR 1.94 (95% CI, 1.14 to 3.31) No difference with IVR or e-intervention feedback	Low Insufficient
Alcohol-related social problems	2 (409)	RCT/Moderate	No difference	Low
KQ 4:E-intervention vs face-to-face counseling				
Alcohol consumption (weekly)	3 (438)	RCT/Moderate	About 3.5 to 6 U.S. standard drinks/week higher with e-intervention in students	Low
Alcohol-related social problems	1 (210)	RCT/Moderate	Small, statistically insignificant difference in students	Insufficient
KQ 4: E-intervention + face-to-face counseling vs face-to-face counseling alone				
Alcohol consumption (weekly)	3 (668)	RCT/Moderate	No consistent difference	Low
Alcohol-related social problems	0	NA	No studies	Insufficient

Abbreviations: AUD=alcohol use disorder; CI=confidence interval; e-intervention=electronic intervention; IVR=interactive voice response; KQ=key question; NA=not applicable; OR=odds ratio; RCT=randomized controlled trial; RR=risk ratio; SOE=strength of evidence

Clinical and Policy Implications

We found a relatively small number of trials reporting longer term effects of e-interventions to address alcohol misuse. Based on the available literature, we generally found low strength of evidence of a small effect of e-interventions on longer term (≥6 months) alcohol misuse outcomes. Although prior research has found positive effects of e-interventions on alcohol consumption over the short term, those effects were also generally not maintained at longer term

follow-up. We also found limited evidence that e-interventions are not as effective as face-to-face treatment. Exploratory qualitative analyses suggest that more intensive interventions, with higher level supplementary human support (*eg*, phone counseling), could improve engagement and effectiveness. Our findings contrast with a review conducted for the USPSTF, which found that behavioral counseling decreased alcohol consumption by 3 to 4 drinks per week at long-term (≥12 months) follow-up. Most trials in the USPSTF review used multi-contact, in-person interventions, in contrast to the single-session, computer-delivered interventions in the present review. The USPSTF recommended that "health care providers should screen adults aged 18 years or older for alcohol misuse and provide brief behavioral counseling to reduce alcohol misuse for patients with risky or harmful drinking." Based on our review, e-interventions cannot currently be recommended as a substitute for in-person, multi-contact counseling.

If better e-interventions can be developed, they have the potential to overcome many barriers to conventional alcohol treatment felt by both patients (*eg*, distance, time, stigma) and professionals (*eg*, training, resources). Since annual screening with the AUDIT-C is already implemented in VA primary care clinics, effective e-interventions could meet a need for Veterans who decline traditional therapy.

Further research using other platforms and expanding the strategies employed are needed. VHA has introduced some smartphone applications (*eg*, assessment, referral), and e-interventions could be adapted to this medium, including cognitive-behavioral coping strategies and exercises tailored to the individual who would then be able to carry them with them and practice throughout the day. This is potentially very cost-effective both in terms of human resources and infrastructure expenditures. However, privacy and information security issues must be adequately addressed before initiation.

Strengths and Limitations

Our systematic review extends prior reviews by following a protocol-driven, transparent process, engaging stakeholders and policy makers, including the most recently published RCTs, and taking an inclusive approach to the definition of e-interventions. Nevertheless, there are important limitations.

Data could be biased because it was collected via self-report. It has been found that assessment itself is associated with decreased alcohol consumption similar to the placebo effect. There was relatively low intensity in most of the interventions, as well as low variability in the types of support offered in the interventions. These limitations constrained our evaluation of factors contributing to variable treatment effects and limit the reliability of the conclusions to be drawn about e-interventions as a general approach.

Applicability

The VHA screens Veterans annually for alcohol misuse with the AUDIT-C. Among those who screen positive, 80% have alcohol misuse, while 20% exceed the threshold for probable AUD. The majority of trials in this review used similar methods to enroll participants, and exclusion criteria were relatively few. Other reasons these results may have limited applicability to the VHA are that only one study was conducted in a VA sample and over one-half of the studies were conducted outside of the United States. In addition, the VA population tends to be older, less educated, and have more comorbidities than the participants in the included studies.

Research Gaps/Future Research

The finding that very low intensity e-interventions may yield small decreases in alcohol use supports further research to investigate whether higher intensity interventions would have longer term effects; whether e-interventions would be effective in patients who are older, have less education, or more comorbidities; whether more portable platforms such as iPods and smartphones would improve compliance; and whether e-interventions could be efficacious in patients with more severe problems with alcohol (*ie*, AUD). All of these questions could be answered by properly designed RCTs. There is also some question about the validity of self-reported outcomes. This could be addressed by studies that use bioverification measures or mobile monitoring.

Conclusions

We found limited evidence for small or no effects of e-interventions compared with controls on long-term (≥6 months) alcohol outcomes in participants who screened positive for alcohol misuse. Findings were even more limited for participants with AUD or comparisons of e-interventions to face-to-face treatment. Further research is needed to determine with higher confidence whether e-interventions can produce long-term benefits for alcohol-related outcomes. In particular, given the limited number and duration of intervention episodes in the studies reviewed, it is possible that these e-interventions were not designed to be robust enough to produce significant, enduring effects on alcohol misuse. As reported in previous reviews, brief in-person interventions produce sustained reductions in alcohol consumption in participants with alcohol misuse. Current evidence does not support substitution of e-interventions for brief, in-person treatment. Future research on e-interventions should include evaluations of more intensive or longer duration e-interventions for alcohol misuse.

ABBREVIATIONS TABLE

AUD	Alcohol use disorder
AUDIT	Alcohol Use Disorders Identification Test
AUDIT-C	Alcohol Use Disorders Identification Test for Clinicians
BMI	Brief motivational interviewing
CD-ROM	Compact disc read-only memory
CI	Confidence interval
e-intervention	Electronic intervention
g	Gram(s)
IVR	Interactive voice response
KQ	Key question
MD	Mean difference
MeSH	Medical Subject Heading
OR	Odds ratio
PNF	Personalized normative feedback
RCT	Randomized controlled trial
RR	Risk ratio
SMD	Standardized mean difference
SOE	Strength of evidence
USPSTF	U.S. Preventive Services Task Force
VA	Veterans Affairs
VHA	Veterans Health Administration