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Sustained Intervention Effects on Older Adults' Attitudes Towards Alcohol and Medication Interactions

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Abstract

Background: Older adults are at risk for experiencing alcohol and medication interactions (AMI) given concomitant alcohol and medication use. However, there have been limited efforts to develop and evaluate AMI prevention interventions.

Purpose: The current study examined sustained intervention effects on older adults' attitudes, awareness, and intentions regarding AMI.

Methods: A sample of N = 134 older adults completed assessments before and after exposure to AMI risk educational materials (Times 1 and 2). N = 97 participants (72%) were reached for a three-month follow-up phone call (Time 3).

Results: There was a positive linear trend over time in the number of identified AMI side effects. While knowledge of intervention messages remained high and stable over time, quadratic trends for perceived importance of AMI messages indicated positive short-term effects that did not sustain over time. Few differences by drinking status were found.

Discussion: This intervention had positive short-term effects on AMI awareness, intentions, and perceived messaging importance, but these short-term effects were only maintained over time for awareness.

Translation to Health Education Practice: This study provides Certified Health Education Specialists with a model for planning and evaluating a brief intervention to prevent AMI among older adults.

Background

Shifting demographic trends have led to the widespread use of alcohol-interactive medication among alcohol-consuming older adults.^{1,2} Currently, about 50–75% of older adult drinkers take alcohol-interactive medication, with antidepressants and analgesics as the most commonly used medication types among regular drinkers.^{3,4} Combining alcohol with alcohol-interactive medications is contraindicated for aging adults, as it increases the chance of medication interactions, poisonings, and even death.^{5,6} These negative consequences stem from age-related changes that affect how older adults respond to alcohol, including decreased metabolism of alcohol in the gastrointestinal tract as well as increased sensitivity and decreased tolerance to alcohol.⁷ Despite these associated risks, 60% of older adults exposed to alcohol-interactive medication report concomitant alcohol use.⁸

Of particular concern among the older adult population is increasing incidence of adverse drug reactions with alcohol involvement, also known as alcohol medication interactions (AMI). A recent analysis of data from the Drug Abuse Warning Network (DAWN) found that the estimated incidence of adverse drug reactions involving alcohol increased during 2005 to 2011 from about 5 to 7 visits per 100,000 females ages 55 and older and from about 12 to 15 visits per 100,000 males ages 55 and older.⁹ Research has also shown a 3000% increase in fatal medication errors related to alcohol and illicit drug use between 1983 and 2004⁵ and a 124% increase in older adult hospitalizations due to alcohol and medication poisoning between 2001 and 2012.¹⁰ Risk for AMI among older adults is in part due to their alcohol consumption rates. Prevalence estimates of adults about 60 years and older conclude 63% consuming alcohol in the past six months,⁸ 41% consuming alcohol at least weekly,⁴ and 44% having at least 12 drinks in the past year.¹¹

While prior research has shown evidence of an association between modest alcohol consumption and improved health status in adults,^{11,12} the health benefits of low-dose alcohol consumption have been called into question by evolving epidemiological literature and new research methodologies accounting for the health bias of alcohol abstainers. Experts in the field have called for increased caution when assuming any protective effects of moderate alcohol use, as alcohol remains a leading cause of health problems among adults.^{13,14} In particular, alcohol use by older adults can lead to adverse health outcomes alone and by creating adverse medication effects,¹⁵ making concomitant alcohol and medication use among older adults a major public health concern.¹⁶

The majority of older adult drinkers take both prescription and over-the-counter medications on a regular basis, including medications that are considered alcohol-interactive.^{1,3,8} Concurrent use of medications and alcohol can lead to harmful alcohol medication interactions,⁶ however estimating the prevalence of AMI among older adults is difficult given that AMI often goes under or undetected. Clinicians and older adults alike may not attribute short-term or mild AMI side effects, such as headaches, drowsiness, or dizziness,¹⁵ to AMI, and they may not seek medical attention for these symptoms. Furthermore, the intent of AMI can be equally intentional or unintentional, indicating a need for both mental health and educational interventions.¹⁰ More serious and long-lasting effects have also been found to be associated with concurrent alcohol and medication use, such as accidents, falls,

psychiatric consequences, seizures, respiratory depression, kidney failure, gastrointestinal bleeding, or worsening of preexisting disease states.^{15,17} Of particular concern are older adults with chronic alcoholic liver disease and cirrhosis, as these individuals have decreased ability to properly metabolize many over-the-counter and prescription medications.¹⁸

Despite the overwhelming risk of AMI in the older adult population, there has been limited research on interventions aimed at AMI prevention. Experts in the field have called for increased development and evaluation of community-level awareness campaigns and behavioral change programs for older adults that emphasize recommended drinking limits and age and disease-related risks of consuming alcohol,¹⁹ including increased dissemination of educational information.¹⁵ Additionally, the need for alcohol screenings when prescribing medications has been recognized.²⁰ Pharmacies have been successfully involved in community substance use-related health promotion programming,^{21–24} but such approaches have not been specifically applied to prevent alcohol medication interactions among older adults.

Accordingly, a brief, pharmacy-based educational intervention to prevent AMI among older adults was developed and evaluated. A prior evaluation of the short-term effects immediately post-intervention exposure showed positive changes in knowledge of AMI risk, AMI intentions, and perceived importance of AMI messaging.²⁵

Purpose

This study has two distinct aims: (1) examine the three-month sustained effects of a brief, pharmacy-based intervention on older adults' attitudes, awareness, and intentions for preventing alcohol and medication interactions; and (2) assess whether the three-month effects of the intervention differ by older adults' alcohol consumption status. Findings will guide intervention improvements as well as determine the utility of the intervention among older adults who are at risk for AMI (drinkers) and those who are not (non-drinkers).

Methods

A convenience sample of 134 older adults ages 59 and older who participated in a brief AMI risk educational intervention in four pharmacies in rural Virginia was analyzed. Participants viewed an informational poster, brochure, and public service announcement after completing a pre-test and before completing an immediate post-test. Participants were contacted three months later to participate in a brief follow-up phone call, and assessments measured participants' health status and behaviors as well as their awareness, attitudes, and intentions for preventing alcohol and medication interactions.

Intervention

This brief AMI prevention educational intervention consisted of an informational poster, brochure, and 60-second public service announcement that were developed by the research team. The intervention had four main learning objectives: 1) define AMI, 2) identify risk factors for AMI, 3) explain behavioral changes that reduce AMI risk, and 4) develop an emergency plan for experiencing an AMI. These educational materials were designed using

existing scientific literature and preliminary research with community pharmacists.²⁶ The key messages included in the intervention materials were grounded in the Health Belief Model^{27,28} and the Information-Motivation-Behavioral Skills Model (IMB).²⁹ The intervention poster included information on AMI symptoms and recognizing and decreasing AMI risk, as well as an emergency plan with a recommendations for someone that may be experiencing an AMI. The intervention brochure reinforced the poster information but also included more detailed steps on how to discuss AMI risk with a health professional and how alcohol consumption can interact with medications to cause serious and long-lasting health effects. In addition to information already provided in the poster and brochure, the public service announcement focused on AMI side effects and encouraged older adults to discuss AMI risk with their family and friends. Highlighting the severity of AMI health consequences, the susceptibility of older adults to experience an AMI, and specific cues to action older adults can take to prevent an AMI are all in concordance with the constructs of the Health Belief Model that contribute to behavior change. In addition, providing general AMI information as well as skills needed to decrease AMI risk are consistent with constructs of the IMB model that are necessary for health behavior change.

Data Collection

This research was approved by the Institutional Review Board (IRB) at the University of Maryland College Park. From September 2015 to August 2016, a research assistant visited four pharmacies 12 times each, for a total of 48 site visits. Each pharmacy allowed the research assistant to set up a table near the register with information on study eligibility, but recruitment did not interfere with the business operations of the site. Individuals visiting the pharmacy were asked to participate in the study by the research assistant or at the recommendation of the pharmacy staff. Once the participant agreed to participate, they provided informed consent and took a brief paper and pencil pre-test consisting of 56 questions to assess their AMI attitudes and awareness prior to exposure to the intervention materials. After completing the baseline assessment, participants remained at the table and were given time to review the poster and brochure, as well as view the public service announcement on a laptop computer. Participants were allowed to take as long as they needed to review the intervention materials before taking a 26-item post-test. The majority of assessment items were a multiple-choice format.

In addition to the baseline and immediate post-intervention assessments (Time 1 and Time 2), participants were contacted three months after the intervention to participate in a brief follow-up phone call (Time 3). All participants were contacted a minimum of four times to participate in the follow-up assessment, and $n = 97$ participants were reached (72% follow-up rate). Completion of the follow-up assessment was significantly associated with being employed and having a higher household income.

Measures

Sample characteristics—All sample characteristics were measured at pre-test, prior to intervention exposure. Participants provided their age, gender, race, marital status, education, employment status, past-year household income, and current medication intake (none, over-the-counter medications only, prescription medications only, or both over-the-

counter and prescription medications). Participants were also asked to indicate if they had consumed any alcohol in the past 30 days, with the following response options: (1) no alcohol consumption; (2) yes, typically 1 drink/day or less (no more than 30 drinks); (3) yes, typically 2 drinks/day (no more than 60 drinks); or (4) yes, typically 3 drinks/day or more. For analytical purposes, a dichotomous variable was computed to represent status as a past-month drinker.

AMI awareness—At all three time points, participants were asked about whether medications and alcohol can be used safely together and the safe level of alcohol consumption when taking medications. In addition, participants were asked about what medications they believe are potentially dangerous when taken with alcohol; the identified medications included Tylenol, Advil, Aleve, prescription pain treatment medications, and psychiatric treatment medications. A continuous variable ranging from 0 to 5 was created to represent the number of dangerous medications indicated. Participants were also asked about 17 possible AMI side effects, including vomiting, falls, and shortness of breath. A continuous variable ranging from 0 to 17 was created to represent the number of AMI side effects indicated.

AMI intentions—At all three time points, participants responded yes, no, or maybe to whether they would be willing to talk to their doctor about AMI risk, change how much alcohol they consumed to prevent an AMI, talk to friends and family about AMI risk, and be an advocate for safe alcohol and prescription drug use. Dichotomous variables were created that combined the yes and maybe response options for each of these items.

AMI knowledge/importance—At all three time points, participants were asked about their knowledge and perceived importance of seven key intervention messages concerning alcohol consumption, AMI severity, and AMI prevention. To assess knowledge, participants indicated whether the messages were true or false. To assess importance, participants selected a numerical option from 1 (very important) to 5 (not very important). See Table 3 for a full list of the key AMI messages.

Statistical Analyses

Analyses were conducted using all available data at each time point, and descriptive statistics (frequencies, means, and standard deviations) were computed for each variable of interest. Chi-squared tests and independent t-tests were used to examine the association between sample characteristics and status as a past-month drinker, and results showed a significant ($p < 0.05$) association between drinking status at baseline and marital status, education, and income. These demographic variables, including drinking status, were included as potential confounders in all subsequent analyses.

Generalized estimating equations (GEE) were used to examine trends in all variables of interest over the three time points. Linear models were fit for variables with a scale response (perceived importance, dangerous medications, and AMI side effects), ordinal logistic models were fit for AMI awareness variables measured on an ordinal scale, and binary logistic models were fit for knowledge of key AMI messages and AMI intention variables.

Orthogonal polynomial contrasts were used to test for linear and quadratic trends over time for all variables with a scale or binary response. All models included a drinking group by time interaction term to examine whether time trends differed based on status as a past-month drinker.

Additional analyses were completed for variables that either displayed both linear and quadratic trends or that had a significant change over time but unidentifiable trend shapes. For these variables, GEE models were fit that individually examined change from pre to post-test and then post-test to three-month follow-up.

Results

Participants ranged in age from 59 to 94 years old, with a mean age of 72 (see Table 1). The sample ($N = 134$) was 63% female, 95% non-Hispanic white, and 82% married or widowed. The majority of participants had a high school education or higher, two-thirds were retired, and about half had a past-year household income of \$50,000 or less. Ninety-five percent of the sample was currently taking medications, with 60% taking both over-the-counter and prescription medications, and 33% taking prescription medications only. At baseline, 58 participants (43%) had consumed alcohol in the past month. Baseline drinking status was significantly associated with marital status, education, and income, with drinkers more likely to be divorced, highly educated, and have higher household income than non-drinkers.

AMI awareness

At baseline, the majority of participants indicated that medications and alcohol can rarely (22%) or never (44%) be used together, and no significant change in opinion was found on either post-intervention assessment. While only 29% of participants indicated on the pre-test that no more than one drink a day was a safe amount of alcohol to consume when also taking medications, this finding significantly increased to 58% on the post-test and remained stable at the three-month follow-up at 51% (see Table 2).

When participants were asked to identify potential AMI side effects from a list of 17 possibilities, the mean number of side effects correctly identified was 10.3 (pre-test), 12.5 (post-test), and 15.0 (three-month follow-up assessment). Results from the trend analysis showed a significant linear trend, with number of identified AMI side effects increasing over time (see Table 2). Similarly, a significant linear trend was found for the number of dangerous medications when taken with alcohol that participants correctly identified at each time point. Out of five possible medications, there was a significant increase from a mean of 2.6 medications on the pre-test, 3.1 medications on the post-test, and then 3.7 medications on the three-month follow-up assessment.

AMI intentions

At baseline, 74%, 67%, 85%, and 71% of participants were willing to talk to their doctor or pharmacist about AMI risk, change their alcohol consumption to prevent an AMI, talk to friends and family about AMI risk, and act as a community advocate for AMI prevention, respectively (see Table 2). There was a significant quadratic trend over time for willingness to talk to a doctor or pharmacist about AMI risk, with the percentage of participants

increasing to 81% on the post-test and then decreasing to 55% at the three-month follow-up. While this trend was apparent in the overall sample, results differed based on status as a past-month drinker. While the percentage of drinkers willing to talk to their doctor about AMI risk stayed consistent from post-test to follow-up at about 90%, the percentage significantly declined from 73% to 28% among non-drinkers from post-test to follow-up.

The percentage of participants willing to change their alcohol consumption to prevent an AMI and act as an advocate for AMI prevention showed both significant quadratic and linear trends over time, but further analyses revealed no significant change from pre to post-test but significant linear declines from post-test to follow-up. While about 70% of the sample were willing to change their alcohol consumption to prevent an AMI on the pre-test and the post-test, there was a significant decline to 47% of participants at the three-month follow-up. Similarly, there was no significant change in the percentage of participants willing to act as a community advocate from the pre-test (71%) to the post-test (76%), but there was a significant linear decline to 59% of participants at the three-month follow-up. The percentage of participants willing to talk to their friends and family about AMI risk remained stable over time, nearing 90%.

Perceived knowledge and importance of AMI messaging

With the exception of two messages, almost 100% of participants correctly indicated that each of the AMI messages were true at all three time points (see Table 3). At each time point, about 80% of participants correctly indicated that “Alcohol consumption can be dangerous at any level” was true. Results from the trend analysis revealed a significant quadratic trend over time for knowledge of the message “It is important to drink no more than one drink a day”. The percentage of participants correctly indicating this message was true increased from 59% on the pre-test to 93% of the post-test, and then decreased to 81% on the three-month follow-up.

Also seen in Table 3, the pre-test showed high baseline levels of importance of key AMI messages when participants ranked them on a scale from one (very important) to five (not very important). Mean scores on the pre-test ranged from 1.09 for “AMI can be potentially dangerous, and even life threatening” to 2.14 for “It is important to consume no more than one drink a day”. Post-intervention, perceived importance increased for all seven statements, and these increases were significant for four out of the seven statements, three of which pertained to safe levels of alcohol consumption. There were significant quadratic trends over time for these four statements (see Table 3), as perceived importance decreased from post-test to follow-up.

Discussion

The primary goal of this brief, pharmacy-based educational intervention was to increase awareness and attitudes regarding alcohol and medication interactions and to have these effects remain stable three months after exposure. Results showed that this desired outcome was achieved for the number of participants correctly indicating that older adults should consume no more than one drink a day, which was a prominent message of the intervention. In addition, while identification of both AMI side effects and medications that may be

potentially dangerous when mixed with alcohol increased immediately post-intervention, these increases were not only sustained, but were surpassed when participants were assessed again three months later.

The intervention also had positive effects in the short-term that were not maintained over time. Knowledge and perceived importance of the message “Alcohol consumption can be dangerous at any level” increased from pre to post-test but decreased from post-test to follow-up, and a similar trend was found for the perceived importance of three other messages on safe alcohol consumption, health consequences, and side effects. Another indicator of dissipating intervention effects over time was high, stable willingness to change alcohol consumption to prevent an AMI and act as a community advocate for AMI prevention from pre to post-test that then decreased from post-test to follow-up. Based on these study findings, an intervention booster session, sustained messaging in pharmacies, or providing materials to take home may be needed to ensure lasting intervention effects. In addition, a modification of the intervention materials to include more emphasis on the potential benefits and barriers to reducing AMI risk may be useful in creating sustained knowledge and behavior change. While the original intervention materials were grounded in constructs of the Health Belief Model,²⁷ including perceived seriousness and perceived susceptibility, prior research has shown that perceived benefits and barriers are consistently the strongest predictors of behavior.³⁰ Future research should assess the benefits and barriers to engaging in AMI prevention behaviors among older adults and then incorporate these findings into future interventions.

For variables with a lack of change over time, stability may be attributable to high baseline understanding of AMI risk and severity as well as the importance of engaging in medication safety behaviors. At all three time points, participants had extremely high knowledge of almost all AMI messages as well as high perceived importance of AMI messages related to severity. Additionally, on all three assessments, the majority of participants understood that medications and alcohol should rarely be used concurrently and were willing to discuss AMI risk with their friends and family. Given that over half of the sample was non-drinkers, it is promising that participants are willing to share AMI prevention knowledge with those who may be at increased risk for experiencing an AMI.

Only one difference in trends over time by baseline drinking status was found, with willingness to talk to a health professional about AMI risk declining from post-test to follow-up among non-drinkers while remaining stable among drinkers. This finding may be due to non-drinkers feeling that a discussion with their a doctor or pharmacist about medication and alcohol safety was not relevant because they do not consume alcohol. The lack of other intervention effect differences by baseline drinking status is encouraging, as findings suggest that older adults who consume alcohol are just as receptive to information on AMI prevention as those who do not consume alcohol. However, a limitation of this investigation is that motivation behind abstention from alcohol use was not assessed. It is theorized that as people age, they reduce or abstain from alcohol consumption due to declining health.¹³ It is unknown whether participants classified as non-drinkers in this sample abstained from alcohol use due to illness or physician recommendation, and data was not collected on whether these participants were lifetime, long-term, or short-term

abstainers. While preliminary analyses of the sample indicated that drinkers and non-drinkers did not significantly differ based on health status at baseline, future research should examine whether motivation for and length of abstention impact intervention effectiveness.

The results of this study should also be considered in the context of its other limitations. Initial analyses of sample characteristics by completion of the follow-up assessment indicated that completion was statistically significantly related to employment status and past-year household income, suggesting that any missing data may not be missing completely at random. Data were also collected from a single state and may not be generalizable to older adults from other geographic locations, and self-report data, especially on health behaviors such as alcohol consumption, is subject to social desirability bias. Additionally, the study should be replicated with larger, more diverse samples in order to confirm intervention effects.

This brief, pharmacy-based intervention on the prevention of alcohol and medication interactions among older adults showed positive short-term effects on AMI awareness, AMI intentions, and perceived importance of AMI messages, but these short-term effects were only maintained over time for AMI awareness. Future work is needed to revise the intervention to ensure long-term effectiveness as well as evaluate the intervention's effects on behavior change in more diverse samples of older adults.

Translation to Health Education Practice

The results of this study can be used to inform the work of Certified Health Education Specialists (CHES), as they correspond to the CHES areas of responsibility.³¹ In terms of Area I, assessing needs, resources, and capacity for health education and promotion, this study emphasizes the need for health promotion programming related to the prevention of alcohol and medication interactions given prevalent alcohol and medication use in this sample of older adults. The long-term effects of one such AMI prevention intervention were assessed in this study, and findings highlighted necessary revisions, particularly in regards to the preservation of effects over time, to be made to the intervention before wide-scale dissemination.

When planning health education and promotion programs (CHES Area II) for the prevention of AMIs, a partnership with community pharmacists is essential. The intervention in this study was developed with the input of pharmacists because of its intended distribution in the pharmacy setting, and CHES can use this study as a model when including potential stakeholders and partners in the program planning stages. Theoretical models were also used in the planning of this intervention, which proved effective as messages of perceived severity, a construct of the Health Belief Model, were regarded by participants as highly important throughout the study period. Health education specialists in the field of prescription drug safety should continue to use messages that increase awareness of potential health consequences associated with AMI. Revisions and modifications will be made based on study findings, which is a CHES responsibility under Area II and Area III (implementing health education and promotion). The research team and other health specialists can use this information to plan and implement AMI prevention efforts in community pharmacies on a

larger scale in the future, focusing on promoting responsible alcohol and medication use among older adults.

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Table 1.

Sample characteristics, by baseline drinking status.

	Total <i>n</i> = 134	Drinkers <i>n</i> = 58	Non-Drinkers <i>n</i> = 76	<i>p</i> -value
Age (Mean ± SD)	71.6 ± 7.5	71.4 ± 7.7	71.8 ± 7.4	0.774
	n (%)	n (%)	n (%)	
Female	85 (63.4)	34 (58.6)	51 (67.1)	0.312
Non-Hispanic White	127 (94.8)	57 (98.3)	70 (92.1)	0.112
Marital Status *				
Single, never married	7 (5.2)	1 (1.7)	6 (7.9)	0.043
Married	72 (53.7)	28 (48.3)	44 (57.9)	
Widowed	38 (28.4)	17 (29.3)	21 (27.6)	
Divorced	17 (12.7)	12 (20.7)	5 (6.6)	
Education *				
Less than high school	11 (8.2)	1 (1.7)	10 (13.2)	0.001
High school/GED	58 (43.3)	19 (32.8)	39 (51.3)	
Associate degree	23 (17.2)	11 (19.0)	12 (15.8)	
Bachelors degree or higher	42 (31.3)	27 (46.6)	15 (19.7)	
Employment Status				
Employed	31 (23.1)	15 (25.9)	16 (21.1)	0.536
Unemployed	8 (6.0)	3 (5.2)	5 (6.6)	
Homemaker	6 (4.5)	1 (1.7)	5 (6.6)	
Retired	89 (66.4)	39 (67.2)	50 (65.8)	
Income *				
Less than \$25,000	28 (21.1)	6 (10.3)	22 (29.3)	0.006
\$25,000-\$49,999	37 (27.8)	12 (20.7)	25 (33.3)	
\$50,000-\$99,999	37 (27.8)	22 (37.9)	15 (20.0)	
\$100,000 or higher	14 (10.5)	9 (15.5)	5 (6.7)	
Prefer not to answer	17 (12.8)	9 (15.5)	8 (10.7)	
Current medications				
None	6 (4.5)	2 (3.4)	4 (5.3)	0.625
Over the counter (OTC) only	4 (3.0)	1 (1.7)	3 (3.9)	
Prescription only	44 (32.8)	17 (29.3)	27 (35.5)	
Both OTC and prescription	80 (59.7)	38 (65.5)	42 (55.3)	

* Significantly associated with baseline drinking status at the $p < 0.05$ level.

Table 2.

Alcohol and medication interaction (AMI) awareness and intentions over time.

	Pre-Test <i>n</i> = 134	Post-Test <i>n</i> = 134	Follow-Up <i>n</i> = 97	<i>p</i> -value
	n (%)	n (%)	n (%)	
Do you think medications and alcohol can always be used safely together?				
Always	5 (3.7)	2 (1.5)	1 (1.0)	0.308
Occasionally	2 (1.5)	9 (6.7)	8 (8.2)	
Sometimes	39 (29.1)	32 (23.9)	31 (32.0)	
Rarely	29 (21.6)	30 (22.4)	20 (20.6)	
Never	59 (44.0)	61 (45.5)	37 (38.1)	
What do you think is a safe amount of alcohol to consume when taking prescription medications? ^a				
0 drinks- no alcohol is ever safe	78 (58.6)	49 (36.6)	34 (37.0)	0.006
No more than one drink a day	38 (28.6)	78 (58.2)	47 (51.1)	
No more than two drinks a day	13 (9.8)	4 (3.0)	9 (9.8)	
Three drinks a day or more	4 (3.0)	3 (2.2)	2 (2.2)	
In the future, would you be willing to: ^b				
Talk to your doctor or pharmacist about how alcohol can cause harmful prescription drug interactions? ^{c,d}	97 (73.5)	108 (81.2)	53 (54.6)	0.014
Change how much alcohol you consumed in order to prevent harmful prescription drug interactions? ^e	87 (67.4)	96 (73.3)	46 (47.4)	0.001
Talk to friends and family about how alcohol can cause harmful prescription drug interactions?	112 (84.8)	115 (85.8)	87 (89.7)	0.643
Act as a community advocate for safe alcohol and prescription drug use? ^e	94 (70.7)	102 (76.1)	57 (58.8)	<0.001
	Mean ± SD	Mean ± SD	Mean ± SD	
Dangerous medications when taken with alcohol (out of 5) ^f	2.6 ± 1.6	3.1 ± 1.6	3.7 ± 1.6	<0.001
AMI side effects (out of 17) ^f	10.3 ± 5.5	12.5 ± 5.00	15.0 ± 2.5	<0.001

^aSignificantly different ($p < 0.05$) from pre to post-test, but no change from post-test to follow-up.^bIndicates the number of participants who responded “yes” or “maybe” for each item.^cSignificant quadratic trend over time.^dTrend over time varied significantly based on status as a past-month drinker.^eNo change from pre to post-test, but a significant linear decline from post-test to follow-up.^fSignificant linear trend over time.

Table 3.

Knowledge and perceived importance of key AMI intervention messages over time.

	Pre-Test <i>n</i> = 134	Post-Test <i>n</i> = 134	Follow-Up <i>n</i> = 97	<i>p</i>-value
Knowledge^a	n (%)	n (%)	n (%)	
AMI can be potentially dangerous, and even life threatening.	131 (97.8)	133 (100.0)	97 (100.0)	1.000
Alcohol consumption can be dangerous at any level.	106 (79.1)	109 (81.3)	78 (80.4)	0.856
It is important to consume no more than one drink a day. ^b	79 (59.4)	125 (93.3)	79 (81.4)	<0.001
It is important to talk to your doctor or pharmacist about possible AMI.	132 (98.5)	132 (99.2)	95 (97.9)	1.000
AMI can results in negative mental and/or physical health consequences.	129 (97.7)	130 (97.7)	96 (99.0)	1.000
When consuming any level of alcohol, it is important to be aware of potential minor or severe side effects.	134 (100.0)	134 (100.0)	96 (99.0)	1.000
During serious AMI, it is important to visit your local emergency clinic immediately.	134 (100.0)	132 (99.2)	96 (99.0)	1.000
Perceived Importance^c	Mean (SD)	Mean (SD)	Mean (SD)	
AMI can be potentially dangerous, and even life threatening.	1.09 (0.45)	1.08 (0.44)	1.02 (0.14)	0.401
Alcohol consumption can be dangerous at any level. ^b	1.72 (1.07)	1.51 (1.02)	1.86 (1.16)	0.002
It is important to consume no more than one drink a day. ^b	2.14 (1.31)	1.27 (0.81)	2.12 (1.22)	<0.001
It is important to talk to your doctor or pharmacist about possible AMI.	1.20 (0.71)	1.11 (0.55)	1.13 (0.51)	0.051
AMIs can results in negative mental and/or physical health consequences. ^b	1.16 (0.59)	1.08 (0.43)	1.23 (0.70)	0.024
When consuming any level of alcohol, it is important to be aware of potential minor or severe side effects. ^b	1.21 (0.71)	1.10 (0.42)	1.29 (0.71)	0.008
During serious AMIs, it is important to visit your local emergency care clinic immediately.	1.19 (0.75)	1.08 (0.51)	1.06 (0.28)	0.195

^aIndicates the number of participants who responded "true" for each item.^bSignificant ($p < 0.05$) quadratic trend over time.^cMeasured on a scale from 1 (very important) to 5 (not very important).