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Comparative analysis of emergency department patients lost to follow-up after computerized alcohol screening and brief intervention

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ABSTRACT

Many studies have evaluated the effectiveness of alcohol screening and brief intervention (SBI) but most of them have reported substantial loss to follow-up without investigating the characteristics of those lost to follow-up. We examined the association between Alcohol Use Disorders Identification Test (AUDIT) scores, readiness-to-change scores and the demographic factors with lost to follow-up. This retrospective study compared demographic characteristics, AUDIT and readiness-to-change scores for 190 lost to follow-up patients to 221 completed follow-up patients who participated in SBI in the Emergency Department between June 2006 and May 2007. Comparing the association between baseline characteristics and completed follow-up rate, those 30–39, 40–49 and 50 years and older had 0.46 (95% CI 0.32–0.91), 0.49 (95% CI 0.29–0.90) and 0.58 (95%CI 0.22–0.79) lower odds of completing follow-up, respectively, in comparison to those 18–29 years of age. The loss to follow-up group reported more negative consequences of alcohol and binge drinking than the completed follow-up group ($p = 0.04$). Using logistic regression, patients who experienced more negative effects of alcohol had 0.87 lower odds of completing follow-up (95% CI 0.79–0.96). The patients lost to follow-up in this study were significantly different in age and alcohol drinking habits compared to those completed follow-ups. It is important to consider differential loss to follow-up in assessing the validity and generalizability of intervention studies. This could help in tailoring methods of approaching patients based on target population characteristics.

Introduction

The prevalence and the negative effects of drug and alcohol misuse have been widely studied. (Center for Disease Control and prevention, 2013; Stahre, Roeber, Kanny, Brewer, & Zhang, 2014) The cost of excessive alcohol consumption in the United States is \$223.5 billion or about \$1.90 per drink from loss in productivity, crime, health care and other expenses. (Bouchery, Harwood, Sacks, Simon, & Brewer, 2011) Each year in the United States, more than 30 million individuals present to acute-care medical settings with traumatic injury. (Zatzick et al., 2014) Since alcohol use problems are endemic among injured trauma patients (Zatzick et al., 2012), alcohol screening and brief intervention became mandatory for all level 1 trauma centers. (American College of Surgeons Committee, 2006)

In addition to designated trauma patients treated in trauma centers, large numbers of patients with minor injuries and non-injury complaints are treated in emergency departments. Alcohol screening has been initiated in some of these emergency departments. (Cunningham et al., 2010) The effectiveness of alcohol screening and brief intervention (SBI) in the emergency department has been investigated through longitudinal studies. Follow-up samples differ from the population from which they were recruited because individuals do not complete screening, refuse to receive brief intervention, withdraw consent, crossed-over, non-adherent or loss of contact or are lost to follow-up. (Karahalios, Baglietto, Carlin, English, & Simpson, 2012) External validity of such studies depends on the completeness of follow-ups. Large number of loss to follow-up will result in skewed data, selection bias, and negative effects on the study's external validity unless data are missing completely at random, and the difference between patients followed and lost to follow-up should be examined. The recommendations related to handling the loss of data have been published in the Strengthening The Reporting of Observational Studies in Epidemiology (STROBE) statement, which emphasizes the importance of reporting loss of data and the way it should be handled. (Von Elm et al., 2007)

Many alcohol intervention studies have found discrepancies in patient characteristics and drinking behavior among loss to follow-up and completed follow-up subjects, necessitating the evaluation of the loss to follow-up issue in such studies. (Richmond, Heather, Wodak, Kehoe, & Webster, 1995; Woodruff, Eisenberg, McCabe, Clapp, & Hohman, 2013) This study analyzes demographic characteristics, AUDIT scores, and readiness-to-change scores among patients who completed follow up and those who were lost to follow up in a previous SBI study conducted in a university Emergency Department (ED). We hypothesize that patients lost to follow up will have higher AUDIT scores and lower readiness-to-change scores.

Materials and methods

Study design

This retrospective study examined baseline demographic characteristics including age, sex, ethnicity and language, AUDIT scores and readiness-to-change scores in a previous SBI study done in the ED between 2006 and 2007. (Vaca, Winn, Anderson, Kim, & Arcila, 2011) ED patients were eligible for the study if they drank more than the National Institute on Alcohol Abuse and Alcoholism (NIAAA) recommended limits. (National Institute on Alcohol Abuse and Alcoholism, 2007) Patients were followed by telephone and re-interviewed at 1 and 6 months after the recruitment. Staff attempted to call subjects multiple times before they were considered lost to follow-up. The study did not have funding for patients incentives.

The data included 411 patients, 221 who completed the follow up and 190 lost to follow up at 6 months. Institutional Review Board approved access to data from the previous study. De-identified data set was accessed through the Department of Emergency Medicine in a version appropriate to SPSS software (version 20, IBM, Armonk, NY). A comprehensive description of the previous study design, study setting, inclusion and exclusion criteria have been explained in detail elsewhere. (Vaca et al., 2011, p. 12)

Variable description

AUDIT scores

Scores range from 0 to 40. Scores 7 and below indicate a lower risk for alcohol use problems. Scores 8–19 indicate harmful and hazardous drinking habits. Scores 20 and higher identify individuals who should be referred for evaluation of alcohol dependence. (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001)

AUDIT domains

The AUDIT questionnaire evaluates subject's drinking patterns in 3 different domains including overall alcohol intake, dependency, and hazardous behavior. The sum of points obtained in question 1 through 3, 4 through 6 and 7 through 10 are calculated to show the score in alcohol intake, dependency and negative consequences of alcohol consecutively. (Babor et al., 2001) Readiness-to-change score (RTC): This score is a patient self-reported score using 1–10 Likert scale (Stott, Rollnick, Rees, & Pill, 1995) determined via a screen ruler ranging from 1 to 10 (1 being “not at all ready” and 10 being “extremely ready”). Patients would be asked for their stage of change only if they report drinking above the NIAAA recommended drinking limit. Scores 1–3 indicates minimal, scores 4–7 moderate and scores 8–10 indicates high readiness to change. (Stott et al., 1995) Based on the original published study (Vaca et al., 2011), age is categorized as: 18–29, 30–39, 40–49, and 50 +. Ethnicity is categorized as: Hispanic/Latino, White/Non-Hispanic, Black/Non-Hispanic, Asian/Pacific Islander, Native American, Other. Sex is defined as male or female. Language: Patients are given the option of taking the test in English and Spanish.

Data analysis

Data were analyzed using SPSS software (version 20, IBM, Armonk, NY). Before starting to analyze data, we plotted a histogram to assess the distribution of data. Independent sample t-test was used to compare means of AUDIT score and readiness-to-change score between patients who completed follow-up versus patients who were lost to follow-up. The chi-square test for independence was used for comparisons of categorical variables between these groups. Separate simple logistic regression models were used to test the association of several predictor variables with the completion of follow-up, reported as “unadjusted odds ratios (OR)”. These predictor variables were demographic characteristics (age, sex, ethnicity, and language), readiness-to-change, and the three AUDIT domain scores (overall alcohol use, dependency, and hazardous behaviors). Then, a single multivariable logistic regression model including all the predictor variables was used to generate estimates for these associations, adjusted for all other entered predictors, reported as “adjusted OR”.

Results

From June 1, 2006, through May 15, 2007, 4375 patients were screened with CASI. Seven hundred and eighty-one (18%) were at-risk based on their AUDIT scores. Brief intervention was completely done for seven hundred forty-two (95%) of the at-risk patients. Of

the available data from 411 patients who were eligible and consented to be followed-up, Table 1 highlights the baseline demographic characteristics of 221 subjects (53.8%) who completed follow-up and 190 (46.2%) lost to follow-up. The mean age of participants was 33.7 years (SD 13.2). Mean age in lost to follow-up and completed follow-up was 35.0 (SD 12.62) and 32.6 (13.58), respectively. The age distribution differs by loss to follow-up. Patients age 18–29 were less likely to be lost to follow-up (38.1%) compared to patients age 30–39 (52.3%), 40–49 (53.5%) and 50 years and older individuals (57.4%). (Table 1) Since the language question was later added to the CASI, only 398 patients answered the question. There was no significant difference between two groups in terms of sex, ethnicity, and language.

AUDIT results of the study population

Table 2 compares the overall AUDIT score, each domain score and readiness-to-change score by loss to follow-up. Among all 411 individuals who were screened using AUDIT, mean AUDIT score was 7.9 (SD 4.1). The mean AUDIT score between two groups was not significantly different. The mean score for domain three, which identifies negative consequences that can lead to the harmful effects, was significantly higher in those lost to follow-up.

Table 1. Baseline demographic characteristics.

Variables	N/Total (%)	Complete follow-up (%)	Lost to follow-up (%)	P-value
Age				
18–29	202 (49.1)	125 (61.8)	77 (38.1)	0.01
30–39	84 (20.4)	40 (47.6)	44 (52.3)	
40–49	71 (17.3)	33 (46.4)	38 (53.5)	
50+	54 (13.1)	23 (42.5)	31 (57.4)	
Sex				
Male	269 (56.4)	144 (53.5)	125 (46.4)	0.89
Female	142 (34.5)	77 (54.2)	65 (45.7)	
Ethnicity				
Hispanic/Latino	172 (41.8)	100 (58.1)	72 (41.8)	0.30
White/not Hispanic	174 (42.3)	87 (50.0)	87 (50.0)	
Black/not Hispanic	21 (5.1)	9 (42.8)	12 (57.1)	
Asian/Pacific Islander	19 (4.6)	12 (63.1)	7 (36.8)	
Native American	3 (0.7)	3 (100)	0 (0)	
Other	22 (5.3)	10 (45.4)	12 (54.5)	
Language				
Spanish	48 (12.1)	23 (47.9)	25 (52.1)	0.38
English	350 (87.9)	191 (54.5)	159 (45.5)	

Table 2. Baseline AUDIT characteristics and readiness for change score.

Variables	Completed follow-up (mean of 221 total)	Lost to follow-up (mean of 190 total)	P-value
AUDIT Score-mean	7.8 (SD 4.00) SE* 0.27	8.1 (SD 4.17) SE 0.30	0.47
Domain 1 (Hazardous use)	5.4 (SD 2.12) SE 0.14	5.2 (SD 2.08) SE 0.15	0.41
Domain 2 (Dependency)	0.82 (SD 1.40) SE 0.09	0.85 (SD 1.44) SE 0.10	0.83
Domain 3 (Harmful Alcohol Drinking)	1.61 (SD 2.04) SE 0.13	2.04 (SD 2.34) SE 0.16	0.04
Readiness to change score	5.6 (SD 3.27) SE0.22	5.6 (SD 3.43) SE0.24	0.99

*Standard error of the mean

Table 3. Demographic factors and AUDIT score associated with completed to follow-up by logistic regression.

Variables	N/completed follow-up	Unadjusted OR (95% CI)		Adjusted OR (95% CI)	
	N from 221(%)	OR	95% CI	OR	95% CI
Age*					
Group 1 (18–29)*	81 (36.6%)	1.0	Ref	1.0	Ref
Group 3 (30–39)	40 (18.1%)	0.56	0.33–0.93	0.54	0.32–0.91
Group 4 (40–49)	33 (14.9%)	0.53	0.31–0.92	0.51	0.29–0.90
Group 5 (50+)	23 (10.4%)	0.45	0.24–0.84	0.42	0.22–0.79
Female	142 (64.2%)	1.02	0.68–1.54	0.99	0.64–1.53
Readiness to change score		1.00	0.94–1.05	1.01	0.95–1.07
Domain 1 (Frequency of use)		1.04	0.94–1.14	1.07	0.97–1.19
Domain 2 (Dependency)		0.98	0.861.13	1.04	0.90–1.21
Domain 3 (Hazardous Behavior)		0.91	0.83–0.99	0.87	0.79–0.96

*Age group 1 and male were set to be the reference groups for comparison.

Demographic and AUDIT scores associated with completed follow-up

Table 3 demonstrates the adjusted association between demographic factors, AUDIT domain scores and readiness-to-change scores between two groups. Age is significantly associated with being lost to follow-up. Those 30 and older have lower odds of completing follow-up than those 18–29 years old ($p = 0.008$ for linear trend by category of age). Individuals with higher domain 3 scores had approximately 13% lower odds of completing follow-up ($p = 0.01$) in the adjusted model.

Discussion

Among SBI studies that compared subjects who completed follow-up with those lost to follow-up, differences have been found. (Babor et al., 1994) Lost subjects differed significantly in terms of having higher initial intakes of alcohol, and being more dependent. (Babor et al., 1994) It has been also proved that those with high alcohol risk level had poor follow-up. (Academic ED SBIRT Research Collaborative, 2007; Babor et al., 1994; Love, Greenberg, Brice, & Weinstock, 2008)

Although our study showed no significant difference in overall AUDIT scores between two groups, individuals with higher domain 3 scores (hazardous behavior) had lower odds of completing follow-up. This is consistent with previous studies that have shown significantly higher alcohol risk level and binge drinking (domain 3) in those lost to follow-up. (Anderson & Scott, 1992; Love et al., 2008; Richmond et al., 1995) However, our results were inconsistent with those of Bendtsen et al., showing higher mean values of weekly consumption (domain 1) among those lost subjects. (Bendtsen et al., 2011) Investigating the predictors of being dropped out from health surveys (Thygesen, Johansen, Keiding, Giovannucci, & Grønbaek, 2008) found that those with medium or high alcohol consumption showed an increased risk of being lost to follow-up. These findings not only suggest that the population with higher alcohol risk level is more likely to be lost to follow-up but also different patterns of alcohol drinking might affect individuals' compliance to follow-up. The effectiveness of SBI could no longer be generalizable

to the whole population if patients with certain pattern and amount of alcohol drinking are lost to follow-up.

We found no difference in lost to follow-up by gender, which is consistent with the findings of De Graaf, Bijl, Smit, Ravelli, and Vollebergh (2000).

Conflicting associations with age and loss to follow-up have been reported. Our results showed that patients are less likely to complete follow-up as age increases. This is consistent with the results of Torvik et al. and among younger women in other studies. (Torvik, Rognmo, & Tambs, 2012; Young, Powers, & Bell, 2006) In contrast, another study showed younger subjects are more difficult to be assessed on time in a high-risk drug injection treatment study. (Messiah, Navaline, Davis-Vogel, Tobin-Fiore, & Metzger, 2003) Loss to follow-up in young adults will, by itself, contribute to bias in studies of substance abuse, which is prevalent in this age. (Bijl, Ravelli, & Van Zessen, 1998) The effect of specific follow-up techniques on responses rates of different age groups has not been examined in these studies.

In order to be able to trust the results of a study, the number of lost to follow-up should be kept less than 5%, and more than 20% of lost to follow-up rate would pose serious threat to the validity of the results (Evidence-Based Medicine Workshop, 2000). Therefore, researchers should apply different methods to control for a high number of lost to follow up. These include data deletion, single imputation, reporting the existing results for the conclusion, complete case analysis, last observation carry-forward, the mean value substitution methods, missing indicator methods, maximum likelihood-based formulation, Bayesian method, and weighting method to minimize the effect of loss to follow-up. (Karahalios et al., 2012) Loss to follow-up can only be ignored if it is completely random and the reason for the loss of data is not related to an observed or unobserved data point. (MacLachlan, 1988)

Akl et al. (2012) have examined 190 high-quality randomized control trials (RCT) published in 5 high impact journals to evaluate the rate of loss to follow-up and how they were handled. Results showed if assuming no event of interest happens in lost to followup, 19% of the results of the studies would no longer be significant. This number would be 17% and 58% if assuming all loss to follow-up had the event or showed the worst-case scenario, respectively.

High lost to follow-up in epidemiological research has the potential to significantly impact the conclusions drawn from study results. The internal validity of a study characterizes the degree for which the researcher draws the correct conclusions about what actually happened in the study. A high rate of patient attrition yields observations and conclusions that are drawn from non-representative samples, thereby leading to biased results. Bias is introduced into a study protocol if outcomes in patients lost to follow-up are different from those patients who remained in the study. Measurement of this bias is not possible because outcomes in patients lost to follow-up are unknown. Identification of characteristics in patients who are lost to follow-up allows for future targeted strategies to minimize dropout rates in this group, which will ultimately yield epidemiological studies with greater external validity. Our study highlights the importance of recognizing the threat to validity in studies where a significant proportion of patients lost to follow-up have different characteristics compared to those remaining in the study.

In order to promote subject retention in the study follow-up techniques should be applied in a tailored way. For instance, there was a tendency toward lower compliance with increasing age, which could be related to technology. On the other hand, there are ways to optimize retention. Collecting accurate contact information, sending reminder cards or informative brochures, offering incentives and dedicated research personnel who make multiple attempts to locate patients can all be helpful.

The most important study limitation is that it is a retrospective analysis of previously gathered data. Additional limitations include small sample size, selection bias, and reporting errors. We were not able to assess the effect of ethnicity and language on the lost to follow up. This study was conducted at a single center and might not be generalizable to different populations.

Conclusion

The patients lost to follow-up in this study were significantly older and reported consequences of alcohol use compared to those completed follow-up. It is important to consider differential loss to follow-up in assessing the validity and generalizability of intervention studies. The reason a subject is lost to follow-up should be unrelated to the study or disease. Researchers should be aware of the characteristics of those screened and those eventually complete follow-up. This could further help in tailoring methods of approaching patients based on target population characteristics as well.

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