

Annual Alcohol Screening and Brief Alcohol Interventions in the Veterans Health
Administration

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Abstract

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Background: Alcohol screening and brief alcohol interventions (SBI) are ranked the third highest prevention priority for US adults. Although the US Preventive Services Task recommends routine SBI, the optimal screening interval is unknown and brief alcohol interventions (BI) have been challenging to implement.

Objectives: To 1) evaluate the yield of repeat annual alcohol screening for patients who initially screen negative on 1-4 prior negative alcohol screens in the population as a whole and in subgroups of patients; and 2) estimate the prevalence of BI with alcohol misuse before, during, and after implementation of a national performance measure (PM) and dissemination of an electronic clinical reminder (CR) for BI.

Methods: 1) Using VA electronic medical record data for more than 360,000 outpatients (2004-2008) the probability of a positive final screen after 1 -4 prior negative screens was estimated using adjusted logistic transition regression models that included prior negative screen scores as explicit predictors. Results are also presented as the number needed to screen (NNS) for one patient to screen positive on the final screen. 2) Among 6,788 VA outpatients whose medical records were reviewed for quality improvement (7/06-9/08) the adjusted prevalence of documented BI (advice and feedback) across the 4 phases of BI implementation was estimated using a generalized log-linear regression.

Results: Age, gender and prior negative screen scores were the strongest predictors of a positive final screen. As the number of prior negative screens increased from 1-4, the probability of a positive final screen decreased and those who consistently reported no drinking the past year had the lowest probabilities. Depending on prior negative screen scores, age, and gender, the NNS ranged from 3 – 159. Among patients with alcohol misuse, the prevalence of BI increased significantly over successive phases of BI implementation, from 5.5% during the baseline year to 29.0% after CR dissemination.

Conclusions: Extending the screening interval beyond a year may be appropriate for some patient groups with a low likelihood of a positive screen in settings that lack the resources to screen and follow-up on all patients annually. The VA's strategy of implementing BIs with a PM and CR meaningfully increased documentation over a 1-year period.

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Dedication

This dissertation is dedicated to my son Milo Michael Lapham and daughter Theresa Claire Lapham.

Chapter 1

Introduction

Alcohol misuse is associated with over 60 medical conditions and accounts for 4% of the global burden of disease.(1) Alcohol screening and brief alcohol interventions are ranked the third highest prevention priority for US adults based on the alcohol-related burden of disease and cost effectiveness of the interventions (2) and the extensive evidence that brief interventions can decrease drinking in primary patients who screen positive for alcohol misuse.(3-5) The US Preventive Services Task Force recommends routine alcohol screening and brief interventions. (6-8) However, the optimal screening interval remains unknown and brief interventions have been challenging to implement into routine medical care.

In 2004, the Veterans Health Administration (VA) required annual screening for alcohol misuse and most VA's used with the Alcohol Use Disorders Identification Test – Consumption (AUDIT-C), a validated three-item questionnaire for alcohol misuse, and since then more than 90% of patients are screened annually with the AUDIT-C.(9) Yet, screening all patients annually for alcohol misuse is a significant investment. In 2009, the VA is estimated to have screened over 4.5 million patients with less than a quarter screening positive for alcohol misuse. (10, 11) Further, little is known about the value of repeat annual alcohol screening or subgroups of patients who might benefit most from annual screening. To make informed decisions about resource allocation for annual alcohol screening, health care systems like the VA and others considering implementation of annual screening would benefit from information about the yield of repeated annual alcohol screening for identifying alcohol misuse, particularly among patients at least risk for misuse.

Despite clinical recommendations, widespread implementation of brief interventions for screen-positive patients has not occurred. (12-14) In 2006, the VA began monitoring medical record documentation of brief interventions for patients who screened positive for misuse, and in 2008, the VA established a performance measure and disseminated a clinical reminder for brief intervention. Although these implementation strategies have been associated with increased rates of other preventive care (15-17), no previous research had evaluated whether these strategies were associated with increased prevalence of documented brief interventions.

The purpose of this project was two-fold: 1) to evaluate the yield of repeated annual alcohol screening for patients who initially screen negative on 1-4 prior negative alcohol screens in different subgroups of patients and to demonstrate the clinical implications of the findings (Chapters 2 and 3); and 2) evaluate whether VA's strategy of BI implementation was associated with increased rates of documented BI (Chapter 4). Specifically, the study described in Chapter 2 utilized clinical alcohol screening data from over 360,000 VA outpatients to estimate the probability of screening positive for alcohol misuse a year after a negative screen in different subgroups of VA outpatients and the number needed to screen for one patient to screen positive in the year after a negative screen. The study described in Chapter 3 estimated the probability of screening positive for alcohol misuse a year after 1-4 prior consecutive negative screens across patient characteristics found in the first study to be associated with a positive screen. Lastly, the study described in Chapter 4 utilized VA national medical records review data collected for quality improvement to estimate the prevalence of BI among 6,788 outpatients with alcohol misuse before, during, and after implementation of a national performance measure (PM) and dissemination of an electronic clinical reminder (CR) for BI.

Chapter 2

The Yield of Annual Alcohol Screening for Identifying Alcohol Misuse among VA Patients who Initially Screen Negative

INTRODUCTION

The U.S. Preventive Services Task Force (USPTF) recommends routine population-based screening for alcohol misuse in primary care settings based on extensive evidence that brief interventions (BIs) with primary care patients who screen positive can reduce drinking.(6-8) Moreover, alcohol screening followed by BIs was ranked the third highest prevention priority—among all USPSTF recommendations for adults—by the National Commission on Prevention Priorities (NCPP).(2) However, the USPTF recommendations do not define the appropriate interval for routine screening, and the optimal interval for screening remains unknown.(6)

The Veterans Health Administration (VA), Department of Defense (DOD) (18) and Centers for Medicare and Medicaid Services (CMS), recommend annual alcohol screening. The VA has required annual alcohol screening for outpatients since 1997 (11), screening over 90% of patients annually.(9) In 2011, CMS established payment for annual alcohol screening with a validated screen by primary care providers in outpatient settings (19) a decision endorsed by the American Psychiatric Association.(20) However, little is known about the value of repeat annual alcohol screening for patients who initially screen negative.

The objective of this study was to estimate the yield of annual alcohol screening in a cohort of 20,000 female and 300,000 male VA outpatients who had screened negative for alcohol misuse on the previous annual screen. Specifically, this study estimated the probability of screening positive for alcohol misuse a year after a negative screen in different subgroups of VA outpatients. In addition, the number needed to screen for one patient to screen positive in the

year after a negative screen was estimated to demonstrate the clinical implications of these findings.

METHODS

Study Data

This retrospective cohort study included VA outpatients from 5 VA networks who screened negative for alcohol misuse during a 4 year period and had a repeat alcohol screen documented in their VA electronic health record (EHR) a year later. Alcohol screening data, as well as demographic and clinical data, were obtained for eligible VA outpatients from the VA's Corporate Data Warehouse (CDW) and National Patient Care Databases.

Study Population

VA outpatients who were engaged in care at 30 medical centers in 5 VA networks in the north and western region of the US were potentially eligible for this study if they were screened for alcohol misuse on at least two occasions 9-15 months apart between January 1, 2005 and December 31, 2008. Because the interval between outpatient appointments varies, screens 9-15 months apart were included to represent annual alcohol screens. Only the first pair of annual screens available in CDW during the study period was included for each eligible patient. Patients were included in the study if they screened negative for alcohol misuse on their initial screen and had no evidence of alcohol misuse or diagnosis or treatment of an alcohol or substance use disorder (definition below) in the year prior to their initial negative screen (Figure 2.1).

This study received approval and waivers of informed consent and HIPAA authorization from the VA Puget Sound Health Care System Institutional Review Board.

Measures

Alcohol screens. The VA began requiring annual alcohol screening with the 3-item Alcohol Use Disorders Identification Test - Consumption (AUDIT-C) in 2004.(11) The AUDIT-C is a validated screen for alcohol misuse, which includes the spectrum from drinking above recommended limits (21) to alcohol dependence(22). Alcohol screening in the VA during the study period consisted of either 1) EHR documentation that the patient did not drink alcohol or 2) administration of the AUDIT-C. The AUDIT-C asks the frequency and quantity of typical drinking and the frequency of heavy episodic drinking. Each item of the AUDIT-C is scored 0-4 points and the items are summed for a total score of 0-12 points. A positive screen was defined as AUDIT-C scores ≥ 3 points in women and ≥ 4 points in men, thresholds which balance sensitivity and specificity for identifying alcohol misuse.(23, 24) AUDIT-C scores of 0 indicate no past-year alcohol use and a score of 0 was imputed for patients documented as nondrinkers in the EHR as in previous validation studies.(23, 25) Each patient's two AUDIT-C screens 9-15 months apart are referred to as their *initial* and *follow-up* screens hereafter. As above, patients were eligible if their *initial screen* was negative (AUDIT-C score 0-3 for men; 0-2 for women). The *initial negative screen score* was defined by the AUDIT-C score and categorized as 0, 1, 2, or 3 points for men and 0, 1, or 2 points for women. The outcome measure for this study was a *positive screen at follow-up*.

Demographic and clinical characteristics. Covariates were selected based on their known association with alcohol misuse and availability in VA administrative data. (26-28)

Alcohol misuse is more common in male, unmarried and younger patients, those with a history of problem alcohol use and tobacco use, and those with better health status.(29-36) Several clinical measures were derived from inpatient and outpatient International Classification of Diseases, Ninth Revision Clinical Modification (ICD-9-CM) diagnoses and service utilization documented in the year prior to the initial AUDIT-C: a) past-year *tobacco use*; b) past-year *mental health diagnoses* for major depression, other mood disorders, anxiety, and other serious mental health disorders; c) past-year *health care utilization* categorized as the number of days of any outpatient or inpatient care in the past year; d) *Deyo Comorbidity Index* measuring overall physical comorbidity in the past-year (37); and e) past-year *alcohol or other substance use disorder diagnosis or treatment (AUD/SUD)*, used to define the eligible patient sample, where treatment included inpatient and outpatient addictions specialty care. For analysis the measure of health care utilization was categorized as: 1-12 days, 13-24 days, 25-36 days and more than 37 days; and the Deyo Comorbidity Index was dichotomized at an index score of ≥ 3 .

Statistical Analyses

All analyses were performed separately for men and women due to gender differences in AUDIT-C cut-points recommended for identifying alcohol misuse (≥ 4 men and ≥ 3 women).(38-40) Initial analyses described the demographic and clinical characteristics of the cohort.

The unadjusted probability of a positive screen at follow-up was estimated for all patients and subgroups of patients based on demographic and clinical characteristics, and differences within subgroups were compared using chi-square tests of independence. A stepped approach to multivariate modeling was used to identify patient characteristics most strongly associated with the probability of a positive screen at follow-up. Specifically, three logistic regression models

were estimated: model 1 included age only as a covariate; model 2 added race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, and Deyo Comorbidity Index; and model 3 added the initial negative screen score as an explicit predictor of the follow-up screen.(41-43) All models were estimated using generalized estimating equations with robust error variances (44) and were clustered on medical center to account for potential correlation of outcomes within 30 VA medical centers. Results are presented as the average adjusted probability of a positive screen at follow-up, which was estimated by allowing the covariate of interest to vary with all other covariates held constant and taking the average of the probabilities. The number needed to screen for one patient to screen positive at follow-up was estimated for both unadjusted and adjusted analyses by calculating the inverse of the probability of a positive screen at follow-up.(45) Analyses were conducted using Stata MP Parallel Edition, version 12.0 (StataCorp, College Station, TX).

RESULTS

Study Sample and Patient Characteristics

Of the 452,180 Veteran outpatients in 5 VA networks with an initial and follow-up screen between 2005 and 2008, 341,974 (75.6%) screened negative on their initial screen and were eligible for the study (Figure 2.1). Eligible women (n=20,919; 6.5% of study sample) were typically younger, had a greater burden of mental health diagnoses, were less likely to be married and had less physical comorbidity than the 321,055 eligible men (Table 2.1). The mean number of days between the initial and follow-up screens was 371 (SD=45) and 375 (SD=43) for women and men, respectively.

Unadjusted probability of a positive screen at follow-up

Among patients with an initial negative screen, the unadjusted probability of a positive screen at follow-up was 5.2% (95% CI 4.9-5.5) for women and 5.9% (95% CI 5.8-5.9) for men. In both women and men, the probability of a positive screen at follow-up varied across most demographic and clinical subgroups (Table 2.2). For both samples, the probability of a positive screen at follow-up varied most across groups based on age and the initial negative screen score. The youngest patients (29 years of age or less) and those with the highest initial negative screen score (score of 2 for women; 3 for men) were most likely to have a positive screen at follow-up. Specifically, for the oldest to youngest age groups, the probability of a positive screen at follow-up ranged from 4.0%-10.9% for women and 4.7%-16.5% for men. The probability of a positive screen at follow-up for the lowest to highest initial negative screen score ranged from 2.5%-18.4% and 2.3%-25.1% for women and men, respectively. These ranges in probability of a positive screen at follow-up resulted in wide variation across subgroups in the number of patients who would need to be screened for one patient to screen positive at follow-up: from 4 to 45 (Table 2.2).

Adjusted probability of a positive screen at follow-up

Multivariate logistic models confirmed that age and initial negative screen score were the strongest predictors of a positive follow-up AUDIT-C (Table 2.3). For both women and men, the addition of patient characteristics to logistic regression models had little impact on subgroup associations except for the addition of the initial negative screen score in the fully adjusted model (model 3), which decreased the variability in the probability of a positive screen at follow-up across age groups. The adjusted prevalence of a positive screen at follow-up varied from

2.3% to 24.2% across patient subgroups (Table 2.2). Because of the magnitude of the association between initial negative screen score and the probability of a positive screen at follow-up, post-hoc adjusted logistic regression analyses tested the interaction between the initial negative screen score and all other demographic and clinical subgroups. Significant interactions between initial negative screen score were observed for age ($p < 0.001$) and service-connected disability ($p < 0.01$) in women and age, race/ethnicity, marital status, tobacco use, Deyo Comorbidity Index, and health care utilization (p -values < 0.001 except $p < 0.01$ for tobacco use) in men.

To further explore the magnitude of the effect of the initial negative screen score on the association between age and the probability of a positive screen at follow-up, post-hoc adjusted logistic regression analyses stratified by initial negative screen score were used to estimate the probability of a positive screen at follow-up and the number needed to screen for one patient to screen positive at follow-up across age groups (Figure 2.2). For all age and gender subgroups, as initial negative score increased, the probability of a positive screen at follow-up increased. As a result, the number needed to screen for one patient to screen positive at follow-up increased across groups as age increased and as the initial negative screen score decreased (Figure 2.2).

Alcohol misuse severity among patients who had a positive screen at follow-up

To understand the severity of alcohol misuse among patients who screened positive at follow-up, the prevalence of mild (scores of 4; 3-4 for women), moderate (scores 5-7), and severe (scores 8-12) alcohol misuse at follow-up was estimated stratified by initial negative screen score (Table 2.4). Among those who had a positive screen at follow-up, most screened positive for mild misuse (86.0% of women and 65.9% of men) only 2.7% and 8.2% of women and men, respectively, screened positive for severe misuse. However, women and men who had

an initial negative screen score of 0 and had a positive screen at follow-up had a 4.7% and 12.2% prevalence of severe misuse, respectively, whereas only 1.0% of women and 6.2% of men with the highest initial negative screen scores who had a positive screen at follow-up were positive for severe misuse.

To determine whether a positive screen reflected a newly recognized problem with alcohol, the prevalence of recognized AUD/SUD in the year *between* the initial and follow-up screen was also estimated for patients with a positive screen at follow-up, stratified by age and initial negative screen score (Table 2.5). Overall, 6.7% and 7.6% of women and men with a positive screen at follow-up, respectively, had AUD/SUD recognized in the year prior to the follow-up screen but the prevalence of AUD/SUD in the year prior to the follow-up screen varied across age and initial negative screen score. In both samples, patients with an initial negative screen score of 0 were about twice as likely to have had AUD/SUD in the year prior to the follow-up screen, 9.8% and 10.6% of women and men, respectively, compared to those with the highest initial negative screen scores. Further, of patients who screened positive for severe misuse at follow-up, 33.3% of women and 28.8% of men had AUD/SUD recognized in the year prior to the follow-up screen. In addition, of those with an initial negative screen score of 0 and screened positive for severe misuse at follow-up, 43.8% of women and 34.6% of men had AUD/SUD recognized in the year prior to the follow-up screen.

DISCUSSION

In this sample of VA female and male outpatients who screened negative for alcohol misuse, the overall probability of a positive screen at repeat screening a year later was relatively low for both women and men, 5.2% and 5.9% respectively. However, the adjusted probability of

a positive screen at follow-up varied from 2.3% to 24.2% depending on patient characteristics. In particular, younger patients and those with higher scores on their initial negative screens were more likely to screen positive at follow-up. Depending on age and the initial negative screen score, the number needed to screen for one patient to screen positive at follow-up a year after a negative screen varied from 4-44 for women and 3-47 for men.

We are unaware of previous research evaluating the yield of annual alcohol screening, or annual preventive screening for any other mental health or substance use condition (i.e., depression or tobacco), when patients have previously screened negative. Moreover, no prior research to our knowledge has evaluated the yield of annual primary care screening for mental health and substance use conditions nor estimated the number needed to screen that would be acceptable in varying clinical settings and patient populations to identify one previously unrecognized patient with a mental health or substance use condition. Although we are unaware of any previous research addressing optimal screening intervals for substance use and mental health conditions,(46) the interval for screening for cervical cancer was previously increased from 1 to 3 years for women who had less than a 1 in 1,000 probability of developing high grade cervical dysplasia to avoid missing cervical cancer.(47, 48) A comparable threshold for alcohol screening or other mental health and substance use screening has not been identified. Although undiagnosed cervical cancer has different health and cost implications than those related to undetected alcohol misuse, it is important to note that the burden of disease and cost effectiveness of identifying and counseling patients with alcohol misuse led the NCPP to rank it above cervical cancer screening.(2)

Optimal screening intervals may vary based on the health care setting and cost of alcohol screening. Assuming screening with the AUDIT-C requires 2 minutes on average, and that the

number needed to screen for one patient to screen positive at follow-up is 44-47 for those who have the lowest probability of screening positive at follow-up (e.g., the oldest women and men with an initial negative screen score of 0), the costs of identifying one patient with a positive screen at follow-up could range from \$21.30 - \$52.10 depending on the personnel providing the screen.(49) This estimate is lower than the cost of blood pressure screening. Given that alcohol screening and brief interventions are ranked the 3rd highest prevention priority among those recommended by the USPSTF,(2) this is likely a reasonable cost per positive screen in a system like the VA, which has implemented clinical support systems for evidence-based follow-up for screen-positive patients (50), but may be less affordable in systems that have not. However, outpatient practices can now be reimbursed for annual alcohol screening (CMS code G0442; \$15.82 - \$21.56)(19, 51), making annual screening potentially more accessible to some systems. In such systems where screening is affordable, our results suggest annual screening is appropriate (number needed to screen < 50).

As health care systems increasingly implement EHRs with clinical decision support in response to incentives linked to health care reform, (52) many may have access to features that facilitate customization of screening intervals based on a patient's clinical and demographic characteristics including their last screen score and AUD/SUD history. EHR algorithms for longer screening intervals for lower risk patients might encourage implementation of routine alcohol screening by decreasing the burden on primary care practices.

However, the specific algorithm for customizing screening intervals for lower risk patients is unknown. Further, while increasing the screening intervals for the lowest risk patients (e.g., older patients who report no alcohol use in the year prior) may turn out to be advantageous in some settings, terminating screening of these patients altogether is not recommended as a

small percent will screen positive for misuse at repeat screening. Results from this study suggest that although patients who report no alcohol use on an initial screen were less likely to screen positive at follow-up, those that did had a relatively high prevalence of severe alcohol misuse and of those, more than half the women and two-thirds the men went unrecognized in the year prior (e.g., did not have AUD/SUD diagnosed or treated in the year between screens).

This study has several limitations. Unlike research to determine intervals for cancer screening,(48, 53, 54) this study lacked a gold standard for alcohol misuse at follow-up. Some positive screens at follow-up were likely false positives. Previous research has suggested that VA clinical alcohol screening has a relatively high false negative rate,(55) and some initial negative screens may have been false negatives. Because routine alcohol screening has not been widely implemented outside VA, it is unknown whether false negatives will be as common in other settings. In addition, use of administrative diagnostic data for covariates limited the factors that could be evaluated in this study and likely underestimated the prevalence of mental health diagnoses, tobacco use, and AUD/SUD. (56-58). Further, while this study evaluated the yield of annual screening, it did not evaluate alternative screening intervals or the impact of more than one prior negative screen on the probability of a positive screen at follow-up. Moreover, while age and the initial negative screen score will likely be strong predictors of a positive screen at follow-up in other settings, results of this study of VA outpatients may not reflect the yield of annual outpatient screening in other settings due to differences in patients or screening implementation. Additional research is needed to determine optimal alcohol screening intervals, including evaluation of the effect of more than one prior negative screen on the yield of screening and the cost per patient of various screening methods (e.g, visit-based interviews, paper and pencil). Nevertheless, this is the first study to our knowledge to evaluate the yield of

annual alcohol screening in patients who have screened negative a year earlier. Moreover, this study included over 20,000 women and 321,000 men, which allowed for evaluation of the differences in the NNS for one patient to screen positive after an initial negative screen across subgroups based on gender, age and initial negative screen score.

CONCLUSION

For both women and men in this study, the probability of a positive alcohol misuse screen in the year after a negative screen was lowest among older patients and those who scored 0 on their initial negative screen. Based on the differences in the probability of a positive screen at follow-up across patient subgroups, the number needed to screen for one patient to screen positive at follow-up ranged from 4-44 for women and 3-47 for men. Given current recommendations for annual alcohol screening, this yield is likely reasonable for annual screening. However, extending the screening interval beyond a year may be appropriate and cost-effective for older patients who report no alcohol use on a previous screen in some settings that lack the resources to screen and follow-up on all patients annually. Nevertheless, given the severity of alcohol misuse among those who do screen positive for alcohol misuse at follow-up screening, there are clear benefits of routine alcohol screening even in these lowest risk patients.

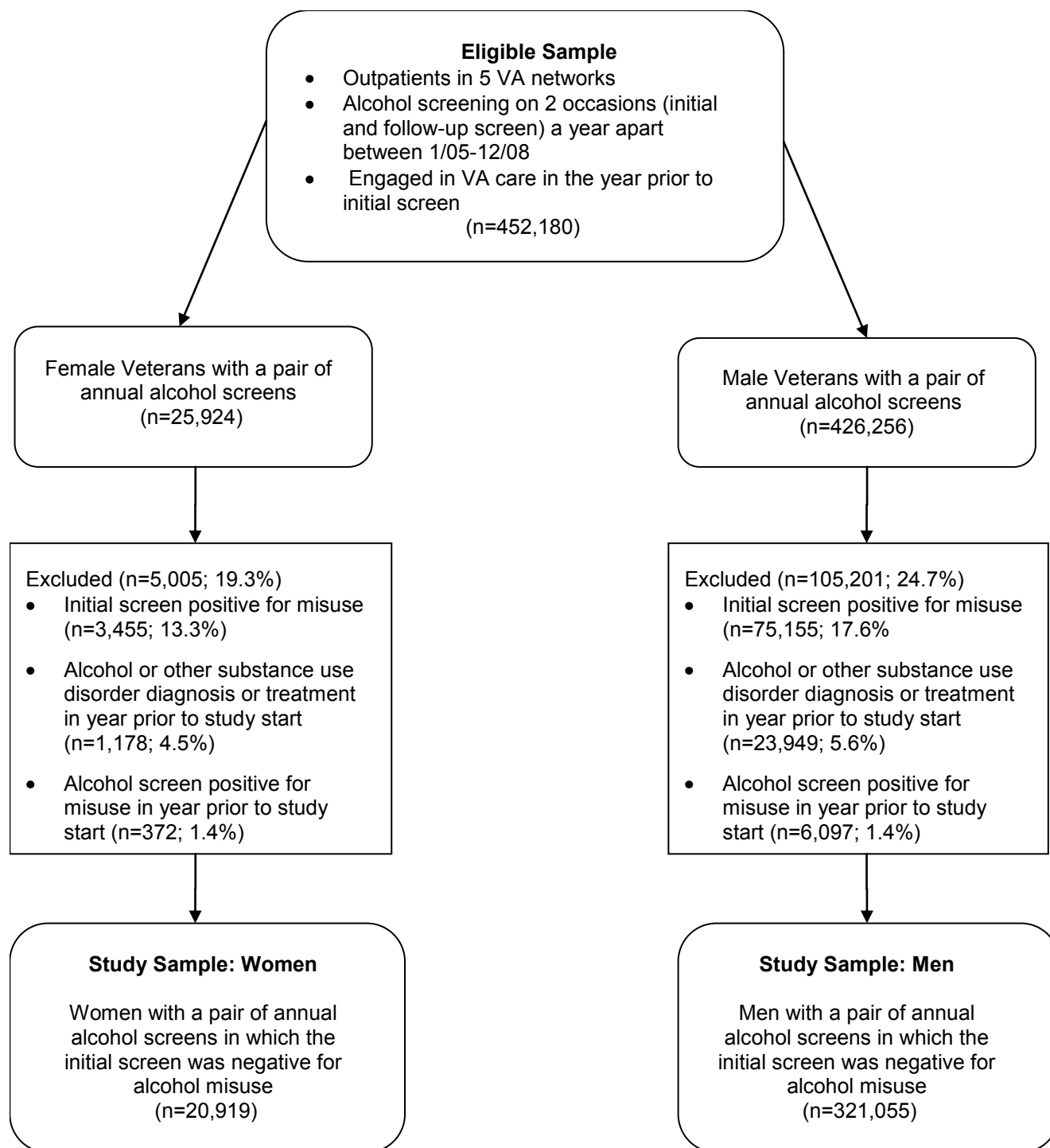


FIGURE 2.1 Sample of VA outpatients with a negative alcohol screen followed by repeat annual screening a year later.

TABLE 2.1. Characteristics of VA outpatients with a pair of annual alcohol screens* in which the initial screen was negative for alcohol misuse

	WOMEN		MEN	
	N=20,919		N=321,055	
	n	(%)	n	(%)
Age				
≤ 29	708	(3.4)	1,557	(0.5)
30-39	2,490	(11.9)	6,146	(1.9)
40-49	3,612	(17.3)	13,535	(4.2)
50-59	5,897	(28.2)	40,249	(12.5)
60-69	3,635	(17.4)	99,065	(30.9)
70-79	1,881	(9.0)	76,621	(23.9)
> 79	2,696	(12.9)	83,882	(26.1)
Race/ethnicity				
White	7,702	(36.8)	115,556	(36.0)
Black	1,226	(5.9)	14,958	(4.7)
Hispanic	438	(2.1)	13,033	(4.1)
Asian/Pacific Islander	222	(1.1)	4,802	(1.5)
American Indian	73	(0.3)	1,077	(0.3)
Missing/unknown	11,258	(53.8)	171,629	(53.5)
Married	7,966	(38.1)	195,133	(60.8)
≥50% service connected disability	5,421	(25.9)	63,923	(19.9)
Tobacco use	1,914	(9.1)	30,835	(9.6)
Mental health diagnosis	7,728	(36.9)	71,703	(22.3)
Deyo Comorbidity Index ≥ 3	1,004	(4.8)	38,643	(12.0)
Health care utilization				
1-12 days	13,892	(66.4)	228,328	(71.1)
13-24 days	4,137	(19.8)	59,147	(18.4)
25-36 days	1,599	(7.6)	19,861	(6.2)
≥ 37 days	1,291	(6.2)	13,719	(4.3)
Initial negative screen score**				
0	13,409	(64.1)	203,650	(63.4)
1	5,326	(25.5)	57,331	(17.9)
2	2,184	(10.4)	33,629	(10.5)
3	--	--	26,445	(8.2)

*Two AUDIT-C screens 9-15 months apart

**Women screened positive for misuse at an AUDIT-C score of 3 or more

TABLE 2.2 Unadjusted and adjusted probability of a positive screen at follow-up and the number needed to screen (NNS) for one patient to screen positive at follow-up among VA outpatients with an initial negative screen

	WOMEN (N=20,919) Positive Screen at Follow-up** (n=1,097)				MEN (N=321,055) Positive Screen at Follow-up** (n=18,773)			
	Unadjusted %	(NNS)	Adjusted* %	(NNS)	Unadjusted %	(NNS)	Adjusted* %	(NNS)
Age	***				***			
≤ 29	10.9	(9)	7.4	(13)	16.5	(6)	9.6	(10)
30-39	8.2	(12)	6.3	(16)	10.6	(9)	7.3	(14)
40-49	5.6	(18)	5.1	(20)	7.1	(14)	5.8	(17)
50-59	4.7	(21)	4.9	(21)	6.4	(16)	6.1	(16)
60-69	4.3	(23)	4.8	(21)	6.2	(16)	6.0	(17)
70-79	3.8	(26)	5.1	(20)	5.5	(18)	5.6	(18)
≥ 80	4.0	(25)	4.6	(22)	4.7	(21)	5.6	(18)
Race	***				***			
White	4.3	(23)	5.0	(20)	5.2	(19)	5.8	(17)
Black	4.1	(24)	4.7	(21)	5.1	(20)	5.7	(18)
Hispanic	4.3	(23)	5.1	(20)	5.6	(18)	6.7	(15)
Asian/Pacific Islander	4.5	(22)	6.1	(17)	4.0	(25)	5.2	(19)
American Indian	2.7	(37)	3.6	(28)	4.6	(22)	6.3	(16)
Missing/unknown	6.1	(16)	5.4	(18)	6.4	(16)	5.8	(17)
Marital status	***				***			
Unmarried/unknown	5.3	(19)	5.4	(19)	6.5	(15)	6.4	(16)
Married	5.1	(20)	5.1	(20)	5.4	(19)	5.5	(18)
% service connected disability	**				***			
< 50%	5.5	(18)	5.4	(18)	6.1	(16)	5.9	(17)
≥ 50%	4.4	(23)	4.7	(21)	4.8	(21)	5.4	(18)
Tobacco use	***				***			
No	5.2	(19)	5.2	(19)	5.8	(17)	5.8	(17)
Yes	5.4	(19)	6.1	(16)	6.5	(15)	6.7	(15)
Mental health diagnosis	*				***			
No	5.5	(18)	5.1	(20)	6.1	(16)	5.9	(17)
Yes	4.8	(21)	5.5	(18)	4.9	(20)	5.7	(17)
Deyo Comorbidity Index	***				***			
0-2	5.4	(19)	5.3	(19)	6.2	(16)	6.0	(17)
≥ 3	2.5	(40)	4.0	(25)	3.4	(29)	4.8	(21)
Health care utilization	***				***			
0-12 days	6.1	(16)	5.6	(18)	6.5	(15)	6.1	(16)
13-24 days	4.1	(24)	4.7	(21)	4.5	(22)	5.3	(19)
25-36 days	3.1	(32)	3.7	(27)	3.6	(28)	4.8	(21)
≥ 37 days	2.6	(38)	3.6	(28)	3.2	(31)	4.6	(22)
Initial negative AUDIT-C score	***				***			
0	2.5	(40)	2.6	(39)	2.2	(45)	2.3	(44)
1	6.7	(15)	6.5	(15)	6.2	(16)	6.0	(17)
2	18.4	(5)	17.2	(6)	12.0	(8)	11.5	(9)
3	--	--	--	--	25.1	(4)	24.2	(4)

Unadjusted chi-square test of independence: * p<0.05; ** p<0.01; *** p<0.001

Adjusted analyses included age race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, and Deyo Comorbidity Index and initial negative AUDIT-C score (model 3)

NNS – number needed to screen for one patient to screen positive at follow-up; the inverse of the probability of a positive screen at follow-up.

Table 2.3. Unadjusted and adjusted probability of a positive screen at follow-up among VA outpatients with an initial negative screen

	WOMEN (N=20,919)				MEN (N=321,055)			
	Positive Screen at Follow-up** (n=1,097)				Positive Screen at Follow-up** (n=18,773)			
	Un- adjusted	Model 1	Model 2	Model 3	Un- adjusted	Model 1	Model 2	Model 3
Age	***				***			
≤ 29	10.9	10.9	9.4	7.4	16.5	16.5	14.2	9.6
30-39	8.2	8.2	7.6	6.3	10.6	10.6	9.6	7.3
40-49	5.6	5.6	5.6	5.1	7.1	7.1	6.9	5.8
50-59	4.7	4.7	4.8	4.9	6.4	6.4	6.3	6.1
60-69	4.3	4.3	4.5	4.8	6.2	6.2	6.2	6.0
70-79	3.8	3.8	4.0	5.1	5.5	5.5	4.8	5.6
≥ 80	4.0	4.0	3.9	4.6	4.7	4.7	5.5	5.6
Race	***				***			
White	4.3	4.7	4.9	5.0	5.2	5.3	5.5	5.8
Black	4.1	4.3	4.5	4.7	5.1	5.1	5.3	5.7
Hispanic	4.3	4.4	4.6	5.1	5.6	5.7	6.1	6.7
Asian/Pacific Islander	4.5	4.6	5.0	6.1	4.0	4.0	4.3	5.2
American Indian	2.7	2.9	3.1	3.6	4.6	4.6	4.9	6.3
Missing/unknown	6.1	5.7	5.5	5.4	6.4	6.3	6.1	5.8
Marital status					***			
Unmarried/unknown	5.3	5.4	5.4	5.4	6.5	6.3	6.4	6.4
Married	5.1	5.0	5.0	5.1	5.4	5.5	5.5	5.5
% service connected disability	**				***			
< 50%	5.5	5.6	5.4	5.4	6.1	6.2	6.0	5.9
≥ 50%	4.4	4.3	4.6	4.7	4.8	4.6	5.3	5.4
Tobacco use					***			
No	5.2	5.2	5.2	5.2	5.8	5.8	5.8	5.8
Yes	5.4	5.7	6.2	6.1	6.5	6.3	6.8	6.7
Mental health diagnosis	*				***			
No	5.5	5.5	5.2	5.1	6.1	6.2	6.0	5.9
Yes	4.8	4.8	5.4	5.5	4.9	4.6	5.2	5.7
Deyo Comorbidity Index	***				***			
0-2	5.4	5.3	5.3	5.3	6.2	6.1	6.0	6.0
≥ 3	2.5	3.0	3.6	4.0	3.4	3.6	4.1	4.8
Health care utilization	***				***			
0-12 days	6.1	5.9	5.8	5.6	6.5	6.5	6.3	6.1
13-24 days	4.1	4.4	4.4	4.7	4.5	4.6	4.9	5.3
25-36 days	3.1	3.3	3.5	3.7	3.6	3.7	4.2	4.8
≥ 37 days	2.6	2.8	3.0	3.6	3.2	3.2	3.8	4.6
Initial negative screen score	***				***			
0	2.5	2.6	--	2.6	2.2	2.3	--	2.3
1	6.7	6.6	--	6.5	6.2	6.1	--	6.0
2	18.4	17.6	--	17.2	12.0	11.8	--	11.5
3	--	--	--	--	25.1	24.9	--	24.2

Unadjusted chi-square test of independence: * p<0.05; ** p<0.01; *** p<0.001

Model 1 included age; model 2 added race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization days, and Deyo Comorbidity Index; model 3 added initial negative screen score; all models clustered on VA medical center

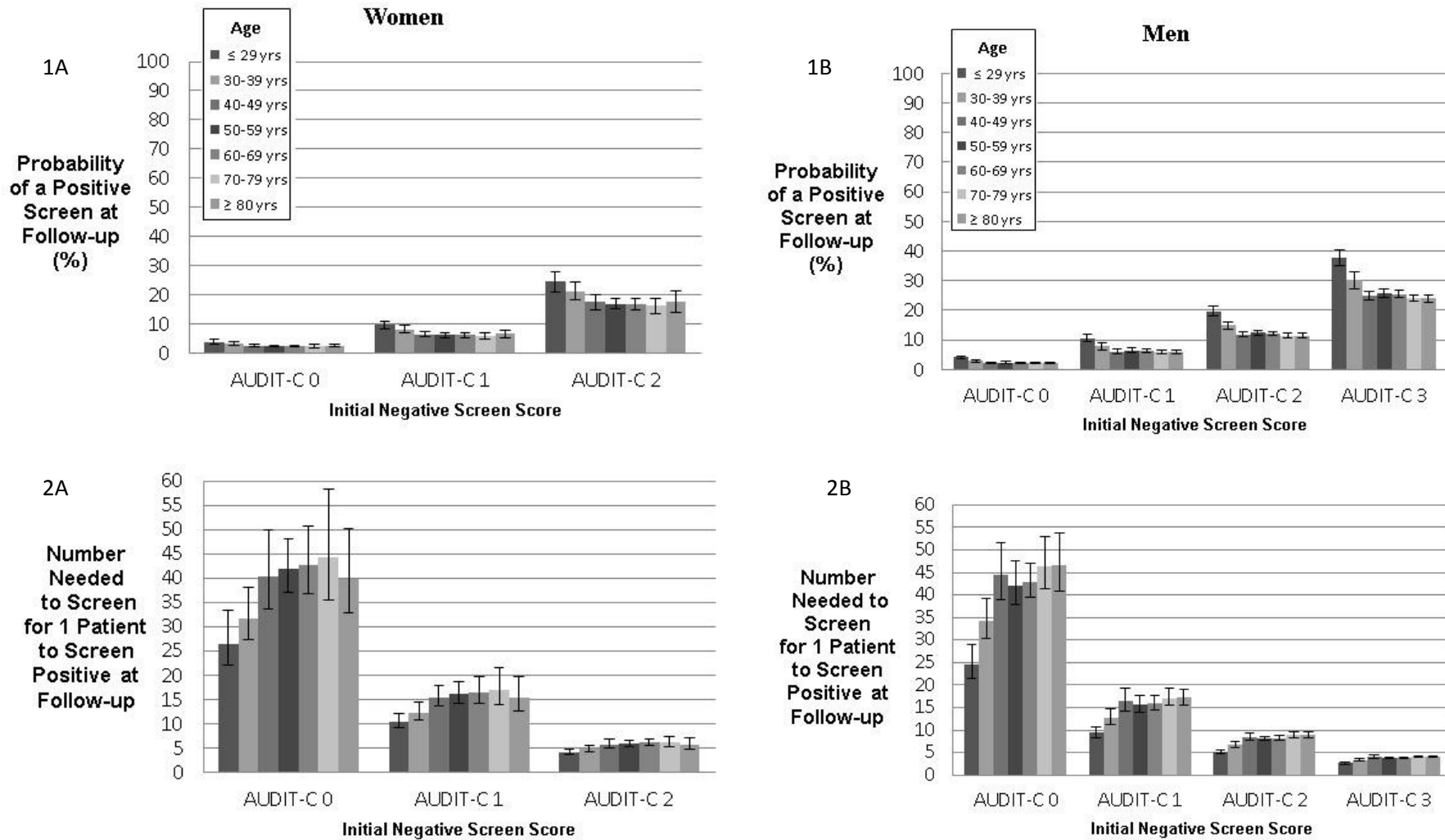


FIGURE 2.2 The adjusted probability of positive screen at follow-up (1A & 1B) and the number needed to screen for one patient to screen positive at follow-up (2A & 2 B) by age and initial negative screen score .

Note. Women screen positive at a score ≥ 3. The probability of a positive screen at follow-up was adjusted for age, race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, Deyo Comorbidity Index, and initial negative screen score. Number needed to screen for one patient to screen positive at follow-up is the inverse of the adjusted probability of a positive screen at follow-up.

Table 2.4 Among patients who screened positive on their follow-up screen, the severity of alcohol misuse on the follow-up screen by initial negative screen score

	WOMEN with a Positive Screen at Follow-up** (N=1,097)						MEN with a Positive Screen at Follow-up (N=18,773)							
	Initial Negative Screen Score						Initial Negative Screen Score							
	AUDIT-C 0 n=337		AUDIT-C 1 n=359		AUDIT-C 2 n=401		AUDIT-C 0 n=4,581		AUDIT-C 1 n=3,532		AUDIT-C 2 n=4,021		AUDIT-C 3 n=6,639	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Severity of Misuse on Positive Follow-up Screen														
Mild (AUDIT-C score 4; 3-4 women)	279	(82.8)	312	(86.9)	352	(87.8)	2800	(61.1)	2364	(66.9)	2610	(64.9)	4594	(69.2)
Moderate (AUDIT-C scores 5-7)	42	(12.5)	37	(10.3)	45	(11.2)	1220	(26.6)	903	(25.6)	1103	(27.4)	1632	(24.6)
Severe (AUDIT-C scores 8-12)	16	(4.7)	10	(2.8)	4	(1.0)	561	(12.2)	265	(7.5)	308	(7.7)	413	(6.2)

* Women screen positive at an AUDIT-C score of 3 or more

Table 2.5. Among patients who screened positive on their follow-up screen, the prevalence of alcohol or other substance use problems in the year prior to the follow-up screen.*

	WOMEN with a Positive Screen at Follow-up** (N=1,097)			MEN with a Positive Screen at Follow-up (N=18,773)			
	Initial Negative Screen Score			Initial Negative Screen Score			
	AUDIT-C 0 n=337 AUD/SUD* (%)	AUDIT-C 1 n=359 AUD/SUD* (%)	AUDIT-C 2 n=401 AUD/SUD* (%)	AUDIT-C 0 n=4581 AUD/SUD* (%)	AUDIT-C 1 n=3532 AUD/SUD* (%)	AUDIT-C 2 n=4021 AUD/SUD* (%)	AUDIT-C 3 n=6639 AUD/SUD* (%)
Age							
≤ 29	4.3	4.8	6.1	4.4	8.5	1.4	9.7
30-39	8.9	7.1	5.2	14.0	13.6	14.7	5.6
40-49	21.1	4.2	10.8	22.9	10.7	9.0	11.0
50-59	9.9	11.1	2.6	23.5	13.4	12.0	11.6
60-69	12.0	5.9	3.5	13.6	10.6	8.5	8.0
70-79	3.6	0.0	0.0	4.3	3.4	3.9	2.9
> 79	0.0	0.0	0.0	2.0	1.1	1.1	1.4
Total	9.8	5.8	4.7	10.6	7.2	7.0	5.9

* AUD/SUD – the prevalence of an alcohol or other substance use disorder diagnosis or treatment documented in the year prior to the follow-up screen

**Women screen positive at an AUDIT-C score of 3 or more

Chapter 3

Do Repeated Negative Annual Alcohol Screens Make Screening Positive Very Unlikely?

INTRODUCTION

Alcohol misuse, which includes the spectrum from risky drinking to alcohol dependence, is common and costly (22, 59). The National Commission on Prevention Priorities ranked alcohol screening and brief intervention for alcohol misuse the third highest prevention priority for US adults due to the burden of disease and cost-effectiveness of the interventions.(2) The U.S. Preventive Services Task Force recommends routine administration of these cost- and life-saving services,(6-8) but the optimal interval for screening remains unknown.(6)

Annual alcohol screening is recommended by the Centers for Medicare and Medicaid Services (CMS), Veterans Health Administration (VA) and Department of Defense (DOD). The VA has required annual alcohol screening for outpatients since 1997 (11), screening over 90% of patients annually (9) and CMS now reimburses for annual alcohol screening in primary care settings.(19)

A recent study evaluated VA outpatients who screened negative on an initial alcohol screen and evaluated factors associated with screening positive on a follow-up screen a year later. The study found that although the overall probability of a positive screen at follow-up was low (5.2% for women; 5.9% for men), the score on the initial negative alcohol screen was the strongest predictor of a positive screen at follow-up; higher negative scores on the initial screen were associated with a greater risk of screening positive at follow-up. Other factors that predicted a positive screen on the next annual screen included male gender and younger age (Lapham et al, submitted).

The present study evaluated the impact of *repeated* negative consecutive alcohol screens on the probability of screening positive for alcohol misuse at the subsequent annual alcohol screen. We hypothesized that the number of prior consecutive negative alcohol screens would be associated with a very low probability of a positive screen at repeat annual alcohol screening and that patients at low risk of a positive screen might have their screening interval extended beyond a year. Specifically, this study estimated the probability of screening positive for alcohol misuse after 1, 2, 3 and 4 prior negative screens and the variability in the probability of screening positive on the final screen across subgroups based on age, gender and the score on the last negative screen. In addition, the number of patients who would have to be screened for one patient to screen positive on the final screen in the different subgroups is presented to show the clinical implications of the findings.

METHODS

Study Data

Study data were obtained from the VA's Corporate Data Warehouse (CDW) and VA National Patient Care Database. Data included alcohol screening as well as demographic and diagnostic data on all outpatients between January 1 2004 and December 31, 2008 from 30 medical centers representing five VA networks in the north and western US. Alcohol screening during the study period in the VA consisted of either 1) electronic health record (EHR) documentation that the patient was asked about and indicated no past year alcohol use; or 2) administration of the AUDIT-C questionnaire (described below). Because the interval between outpatient appointments varies, screens 9-15 months apart were included to represent consecutive annual alcohol screens.

Study Sample

To be included in the study, patients had to have at least two consecutive alcohol screens during the study in which the initial screen was negative. Patients were excluded if they had documented evidence of alcohol misuse or an alcohol or other substance use problem (defined below) in the year prior to their initial screen (Figure 3.1). This study received approval and waivers of informed consent and HIPAA authorization from the VA Puget Sound Health Care System Institutional Review Board.

Four subsamples based on number of prior negative screens

Four nested subsamples of patients based on the number of negative consecutive screens prior to the final screen were used in this study (Figure 3.1). The largest subsample consisted of patients who had at least one pair of consecutive alcohol screens where the first was a negative screen (patients with 1 prior negative screen). At the other extreme, the smallest subsample consisted of patients who had 5 consecutive annual alcohol screens where the first 4 were negative (4 prior negative screens). Further, to maximize power, patients could have multiple records within a subsample. In other words, a patient who had 2 consecutive negative screens before a final (3rd) screen could contribute 2 pairs to analyses of the probability of a positive screen for alcohol misuse after 1 prior negative screen and 1 triplet to the analyses of the probability of a positive screen after 3 prior negative screens (Table 3.1).

Measures

Alcohol screens. In 2004, the VA began requiring annual alcohol screening with the validated 3-item AUDIT-C, which assesses the frequency and quantity of typical drinking and the frequency of heavy episodic drinking.(11) Each item of the AUDIT-C is scored 0-4 and summed for a total score of 0-12. AUDIT-C scores of 0 indicate no past-year alcohol use and a score of 0 was imputed for all documented nondrinking as in previous validation studies.(23, 25) A *positive screen* was defined as AUDIT-C scores ≥ 4 for men and ≥ 3 for women, the thresholds which balance sensitivity and specificity for identifying alcohol misuse.(23, 24) Thus, a *negative screen* was defined as AUDIT-C scores 0-3 for men and 0-2 for women, and all *prior negative screens scores* were categorized based on these scores (0, 1, 2, and 3 for men and 0, 1, and 2 for women). The score on the screen immediately preceding the final screen was referred to the *last negative screen score*.

The **main outcome** measure in all analyses was a positive AUDIT-C score on the *final* screen, referred to as a *positive final screen*.

Covariates. Covariates were selected based on their association with alcohol misuse (26-28) (Lapham et al, in prep). Patient demographics included age (< 50, 50-64, ≥ 65), gender, race/ethnicity (white, black, Hispanic, other, and missing/unknown), marital status, and disability related to military service. Inpatient and outpatient Internal Classification of Diseases, Ninth Revision Clinical Modification (ICD-9) diagnosis codes were used to document *tobacco use* and *mental health diagnoses* for major depression, other mood disorders, anxiety and other serious mental health disorders the year prior to a patients' first screen. Because patients with higher numbers of consecutive screens may have been heavier users of the VA with a greater burden of mental and physical comorbidities than patients with smaller numbers of consecutive screens (60-62), two additional covariates were included to address this potential bias: a) *health care*

utilization was assessed as the number of days of any outpatient or inpatient care in the year prior to the first screen: 0-12 days, 13-24 days, 25-36 days and more than 37 days; and b) *Deyo Comorbidity Index* which measured overall physical comorbidity in the year prior to the first screen and was dichotomized at a score of ≥ 3 (37). Lastly, the exclusion criteria for *alcohol or other substance use disorder diagnosis (SUD) or treatment* was derived from ICD-9 diagnosis codes for alcohol use and other SUD diagnoses as well as inpatient and outpatient specialty addictions treatment in the year prior to the first screen.

Statistical Analyses

Initial analyses described the demographic and clinical characteristics of the four nested subsamples of patients with 1, 2, 3, or 4 prior negative screens preceding a last screen. Main analyses estimated the probability of a positive final screen in each of the four subsamples. The probability of a positive final screen was estimated for patient subgroups, based on age, gender and the last negative screen score, within the 4 subsamples in unadjusted and adjusted analyses. To estimate the adjusted probability of a positive final screen in each subsample, multivariate logistic transition regression models using generalized estimating equations with robust error variances were used. (44) Transition models account for the non-independence of measures (e.g. multiple alcohol screens from a single individual) as all prior negative screens are treated as explicit predictors of the last screen.(41-43, 63) For each subsample, models included the corresponding number of prior negative screens (1-4) categorized by score. In addition, all models were adjusted for covariates (gender, age, race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, Deyo Comorbidity Index and health care utilization) and were clustered on patient to account for potential correlation of outcomes

within subject. Results are presented as the average adjusted prevalence of a positive final screen, which was estimated by allowing the covariate of interest to vary with all other covariates held constant and taking the average of the probabilities.

In order to demonstrate the implications of the findings, the number needed to screen for one patient to have a positive final screen (NNS) was estimated for both unadjusted and adjusted analyses by taking the inverse of the probability of a positive final screen.⁽⁴⁵⁾ Because of patient nesting within subsamples, only descriptive comparisons across subsamples were possible. All analyses were conducted using Stata MP Parallel Edition, version 12.0 (StataCorp, College Station, TX).

Role of the Funding Source

This study was funded by VA Health Services Research and Development's Quality Enhancement Research Initiative rapid response research program. The funding source had no influence on this study's design, data collection, analyses or interpretation and reporting of results.

RESULTS

Study sample and patient characteristics

Of the 461,233 Veteran outpatients with alcohol screening on at least two occasions a year apart between January 1, 2004 and December 31, 2008, 360,384 (78.1%) screened negative on their first screen and did not have alcohol misuse or alcohol or substance use disorder diagnoses or treatment documented in the prior year, making them eligible for the study (Figure 3.1). Ninety-four percent of the total sample were men and more than 60% were at least 65 years

old. The smallest subsample—4 prior negative screens preceding a last screen—included over 34,000 patients including 2,088 were women. Age, the prevalence of mental health diagnoses and physical comorbidities, and health care utilization tended to increase as the number of prior negative screens increased (Table 3.2).

The probability of a positive final screen after 1, 2, 3, and 4 prior negative screens

The unadjusted probability of a positive final screen decreased as the number of prior negative screens increased: 4.8%, 3.6%, 2.6% and 2.0% for patients with 1, 2, 3, and 4 prior negative screens, respectively (Table 3.3). However, the score on the screen immediately prior to the final screen (last negative screen score) was strongly associated with the probability of a positive final screen in both unadjusted and adjusted analyses (Table 3.3), and the difference in probability between patients with 1 and 4 prior negative screens and varied markedly depending on the last negative screen score. For example, for patients with 1 prior negative screen with a score of 3, the adjusted probability of a positive final screen was 22.5%, whereas for those with 4 prior negative screens and a last negative screen score of 3, the adjusted probability of a positive final screen was 6.2%. Comparable adjusted probabilities for patients with 1 and 4 prior negative screens with a score of 0 on the last negative screen were 1.9% and 1.0% respectively.

However, although the probability of a positive final screen varied only slightly between patients with 1 compared to 4 prior negative screens, when the last negative screen score was 0 (e.g. adj. 1.9% to 1.0%), these small differences in the probability of a positive final screen translated into large differences in NNS from 53 vs 99. Conversely, for patients who scored 3 on the last negative screen, the relatively large differences between patients with 1 compared to 4

prior negative screens translated into relatively modest differences in the NNS from 4 to 16 (Figure 3.2).

Similar patterns were evident for gender and age (Table 3.4). Within each subsample, women and older patients had a lower probability of a positive final screen, however, the number of prior negative screens had the strongest impact on the probability of a last positive screen, decreasing within subgroups as the number of prior negative screens increased (Table 3.3).

The range of probabilities for a positive final screen by prior negative screen scores

Additional analyses explored the impact of all prior negative screen scores on the probability of positive final screen. Specifically, to show the range of probabilities for a positive final screen, the adjusted probability of a positive final screen for the patients with lowest possible (all 0's) and the highest possible (all 2's for women, all 3's for men) prior negative screen scores was estimated for each subsample and stratified by age and gender (Table 3.5). The differences in the probabilities of a positive final screen were greatest between the lowest possible and highest possible scores, regardless of gender and age.

For patients who consistently reported no drinking on all prior negative screens, the probability of a positive final screen decreased modestly with each additional prior negative screen. The probability of a last positive screen for those with 1-4 prior negative screen scores of 0 ranged between 1.9% (1 prior) - 0.7% (4 prior) for the total sample and between 2.7% (1 prior) – 0.6% (4 prior) depending on age and gender subgroups (Table 3.5). Yet these small decreases in the probability again resulted in large increases in the NNS: 54-146 for the total sample (Figure 3.3) and 38 – 159 depending on age and gender subgroup.

For patients who consistently reported the highest possible score on all prior negative screens, the probability of a positive final screen was high compared to patients who consistently

reported 0's on all prior negative screens and remained relatively stable with each additional prior negative screen. The probability of a positive final screen for those with the highest possible score on 1-4 prior negative screens ranged between 22.4% (1 prior) - 25.8% (4 prior) for the total sample and between 12.0% (1 prior) - 39.3% (4 prior) depending on age and gender subgroup. The corresponding NNS for these probabilities remained stable at 4 for the total sample (Figure 3.3) and ranged from 3-9 depending on age and gender subgroup (Table 3.5).

DISCUSSION

The optimal interval for alcohol screening remains unknown, but CMS and the VA support annual alcohol screening. However, up to 95% of outpatients screened for alcohol misuse screen negative, and the value of repeated screening of these patients is unclear. A prior study showed that age, gender and the initial negative screen score were important predictors of a positive screen a year later. The purpose of the present study was to evaluate the impact of multiple consecutive prior negative alcohol screens on the probability of a positive final screen with the hypothesis being that patients with multiple consecutive prior negative screens would be unlikely to screen positive. However, this study found that the number of prior consecutive negative screens alone had only a modest impact on the probability of a positive screen on the final screen. Moreover, even after multiple prior negative alcohol screens, some subgroups of patients—based on patient demographics and prior negative screen scores—still had a greater than one in five chance of screening positive for alcohol misuse on the next screen. This suggests that any method to customize the screening intervals will need to account for not only the number of negative screens but also patient demographics and prior negative screen scores.

This is the first study to our knowledge to evaluate the utility of repeated annual screening for any behavioral screening (i.e., depression or tobacco).

In this sample of VA outpatients who screened negative for alcohol misuse on 1-4 consecutive prior negative screens, the probability of a positive final screen ranged from 4.8% to 2.0% for patients with 1 to 4 prior negative screens. The variation in probabilities of a positive final screen were greater across subgroups based on the last negative screen score within each subsample (e.g., 1.0% to 6.2% for patients with 4 prior negative screens). However, when both the number of prior negative screens and the last negative screen score were considered together, the probability of a positive final screen ranged from 1.0% (for those with 4 negative screens and a score of 0 on the last negative screen) to 22.5% (for those with one prior negative and a score of 3 on the last negative screen). If the number of prior negative screens were considered along with all prior negative screens scores, age and gender, the probability of a positive final screen ranged from 0.6 to 39.3%.

However, relatively small absolute differences in the probability of a positive final screen resulted in large differences in NNS to have one patient screen positive at follow-up. For patients who consistently scored 0 on all prior negative screens, the small range in the probability of a positive final screen (2.7% to 0.6% for patients with 1 to 4 prior negatives screens depending on age and gender subgroup) resulted in large changes in the NNS: ranging from 38 to 159. In contrast, among patients who consistently scored the highest on all prior negative screens and had the greatest variation in the probability of a positive final screen, the difference in the probabilities of a positive final screen had only a small impact on the NNS (3-9).

No prior research to our knowledge has estimated the number needed to screen for one patient to screen positive, and it is not known what would be acceptable in primary care to

identify one patient with a behavioral health problem that needs to be addressed. Nor are we aware of any prior research evaluating the optimal interval for alcohol screening or other behavioral health conditions or an acceptable threshold for recommending extended screening intervals. A previous report that estimated the NNS among VA outpatients who screened negative on one prior negative screen found that the NNS ranged from 3-47 (Lapham et al, submitted). The present study found that the number of prior negative screens magnified findings in the previous study with NNS ranging from 3-159, an over 3-fold difference over the previous study.

Whether the largest NNS identified in some subgroups in this study are sufficient to recommend skipping a year of screening will vary depending on the cost per patient of various screening methods (e.g., visit-based interviews, paper and pencil) and the setting. Establishing alcohol screening as a clinical priority and providing the clinical support to ensure evidence-based follow-up for screen-positive patients requires a sizeable resource investment. Extending the screening interval beyond a year for the lowest risk patients may make sense for some systems where annual screening of all patients is less affordable. Algorithms for customizing extended screening intervals for lower risk patients will need to consider a patient's age, gender, the number of prior negative screens and the scores on those screens as well as any recent history of problem alcohol or other substance use and treatment. Although not assessed in this study, the prior study found that although most patients likely screened positive for mild misuse, patients who screened positive for alcohol misuse after having reported not drinking in the past year on a prior screen had higher rates of severe misuse suggesting the need to continue to screen these patients at regular, if extended, intervals (Lapham et al, submitted).

This study has several limitations. This study lacked a gold standard for alcohol misuse. Therefore, the prevalence of false positive final screens is unknown. In addition, VA clinical alcohol screening has a relatively high false negative rate, (55) and some initial negative screens may have been false negatives. Statistical comparisons across subsamples were not possible and descriptive comparisons may have under- or overstated the importance of the findings. In addition, the potential biases due to subsampling patients with increasing numbers of prior negative screens may not have been adequately addressed by adjusting for health care utilization and physical comorbidity covariates. Further, use of administrative diagnostic data for covariates limited the factors that could be evaluated in this study and likely underestimated the prevalence of clinical diagnoses.(56-58). This study did not assess whether patients were recognized to have an alcohol use disorder during the 5-year study period. Inclusion of these patients for whom alcohol screening would serve to monitor rather than detect alcohol misuse likely increased the prevalence of a positive final screen and decreased the NNS. Results of this study of VA outpatients may not reflect the implications of multiple consecutive prior negative screens in other settings due to differences in patients or screening implementation. Additional research is needed to estimate the cost per patient of various screening methods, determine optimal alcohol screening intervals for various resource-driven thresholds, and validate screening results with other methods.

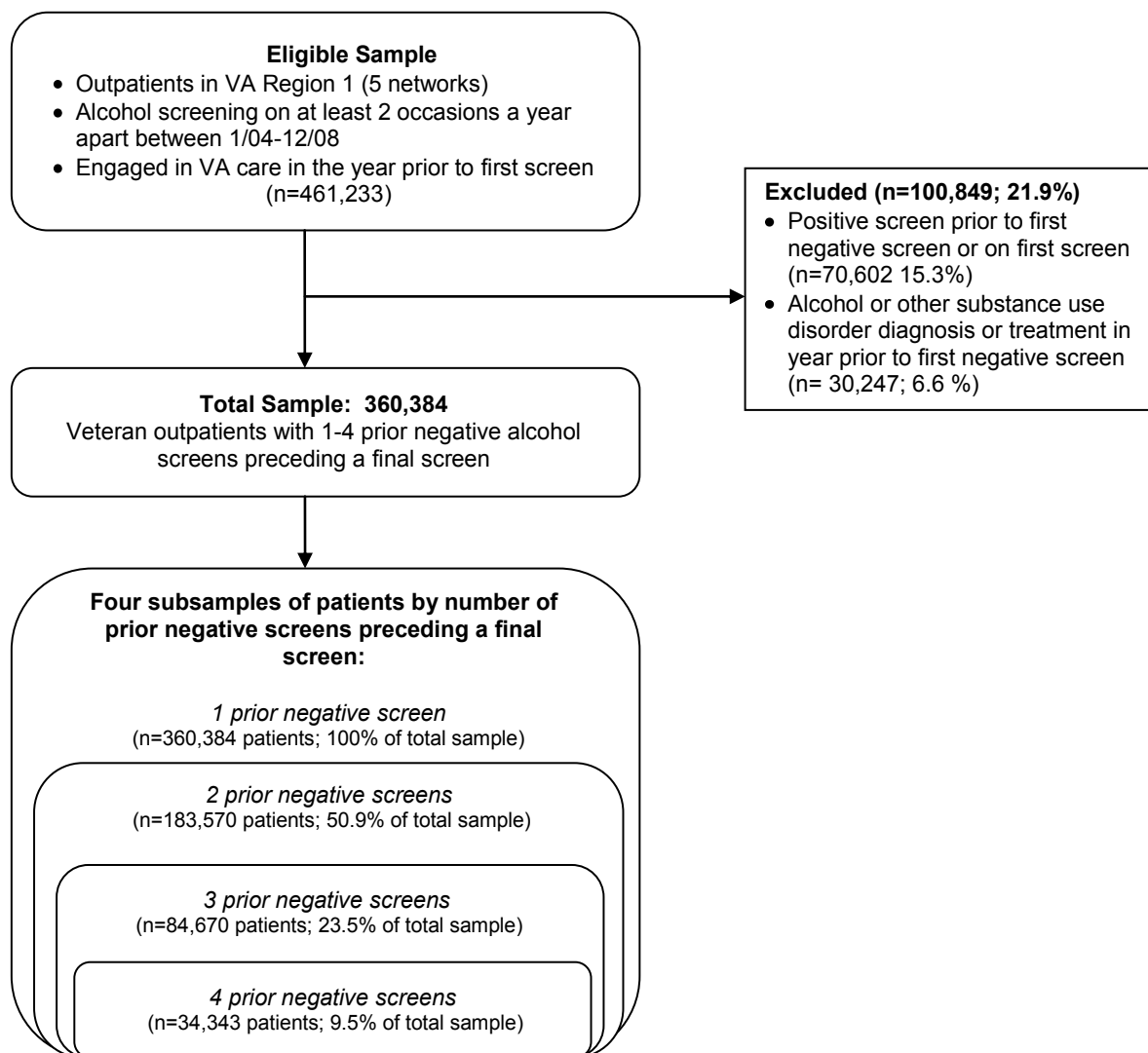
Nevertheless, this study has important strengths. It is the first study to our knowledge to evaluate the value of annual alcohol screening in patients with multiple prior negative screens. Moreover, this study included over 360,000 patients of whom over 21,000 were women and over 34,000 had 4 prior negative screens. This unique and large sample of patients with multiple

consecutive prior negative screens allowed for estimation of the NNS across patients with 1 to 4 prior negative screens as well as across age, gender and prior negative screen scores.

CONCLUSIONS

This study found that the number of prior negative annual alcohol screens alone was associated with relatively minor variation in the probability of a positive final screen and that the greatest variation in the probability of a positive final screen was associated with not only the number of prior negative screens but patient age, gender and the scores on their prior negative screens. Depending on all these factors, the probability of a positive final screen ranged from 0.6 to 39.3% and the number needed to screen for one patient to screen positive on the final screen ranged from 3 – 159. These findings suggest that extending the screening interval beyond a year may be appropriate for some patient groups with a low likelihood of a positive screen in settings that lack the resources to screen and follow-up on all patients annually. Algorithms for customized screening intervals will need to consider additional patient factors aside from the number of prior negative screens.

Figure 3.1. Study sample and four subsamples based on the number of prior negative screens*



Note. *All screens were consecutive annual alcohol screens (9-15 months apart)

Table 3.1. Number of patients and prior negative screens preceding a final screen*

1 prior negative screen†			2 prior negative screens			3 prior negative screens			4 prior negative screens		
<i>Pairs per Patient</i>	Patients (n=360,384)	Pairs‡ (n=712,186)	<i>Triplets per Patient</i>	Patients (n=183,570)	Triplets‡ (n=308,001)	<i>Quadruplets per Patient</i>	Patients (n=84,670)	Quadruplets‡ (n=122,939)	<i>Quintuplets per Patient</i>	Patients (n=34,343)	Quintuplets‡ (n=38,269)
1	152,718	152,718	1	97,509	97,509	1	50,327	50,327	1	30,417	30,417
2	106,059	212,118	2	51,617	103,234	2	30,417	60,834	2	3,926	7,852
3	63,245	189,735	3	30,518	91,554	3	3,926	11,778			
4	34,195	136,780	4	3,926	15,704						
5	4,167	20,835									
Mean days between screens (SD)	371	(45)		368	(36)		363	(33)		355	(31)

* All screens were consecutive annual alcohol screens (9-15 months apart)

‡Pair= 1 prior negative screen plus final screen; triplet= 2 prior negative screens plus final screen; quadruplet= 3 prior negative screens plus final screen; quintuplet= 4 prior negative screens plus final screen

†Patients with 1 prior negative screen represent the total sample

Table 3.2. VA outpatients who had 1-4 prior negative screens preceding a final screen*

	1 prior negative screen† (360,384)		2 prior negative screens (183,570)		3 prior negative screens (84,570)		4 prior negative screens (34,343)	
	n	(%)	n	(%)	n	(%)	n	(%)
Female	21,853	(6.1)	10,798	(5.9)	4,987	(5.9)	2,088	(6.1)
Age								
< 50	29,603	(8.2)	11,277	(6.1)	4,299	(5.1)	1,484	(4.3)
50-64	111,367	(30.9)	55,940	(30.5)	25,586	(30.2)	10,293	(30.0)
≥ 65	219,414	(60.9)	116,353	(63.4)	54,785	(64.7)	22,566	(65.7)
Race/ethnicity								
White	128,582	(35.7)	68,389	(37.3)	32,156	(38.0)	13,528	(39.4)
Black	16,768	(4.7)	9,018	(4.9)	4,308	(5.1)	1,947	(5.7)
Hispanic	14,146	(3.9)	7,442	(4.1)	3,425	(4.0)	1,375	(4.0)
Other	6,463	(1.8)	3,600	(2.0)	1,829	(2.2)	786	(2.3)
Missing/unknown	194,425	(53.9)	95,121	(51.8)	42,952	(50.7)	16,707	(48.6)
Married**	213,949	(59.4)	110,860	(60.4)	51,818	(61.2)	21,001	(61.2)
≥ 50% service connected disability**	72,237	(20.0)	40,017	(21.8)	19,896	(23.5)	8,534	(24.8)
Tobacco use**	36,617	(10.2)	19,942	(10.9)	9,345	(11.0)	3,673	(10.7)
Mental health diagnosis**	86,470	(24.0)	49,110	(26.8)	24,007	(28.4)	10,666	(31.1)
Deyo Comorbidity Index ≥ 3**	45,456	(12.6)	26,108	(14.2)	12,970	(15.3)	5,729	(16.7)
Health care utilization**								
1-12 days	256,392	(71.1)	123,377	(67.2)	54,240	(64.1)	20,615	(60.0)
13-24 days	66,087	(18.3)	37,515	(20.4)	18,652	(22.0)	8,208	(23.9)
25-36 days	22,320	(6.2)	13,176	(7.2)	6,815	(8.0)	3,201	(9.3)
≥ 37 days	15,585	(4.3)	9,502	(5.2)	4,963	(5.9)	2,319	(6.8)

*All screens were consecutive annual alcohol screens (9-15 months apart)

** Assessed in the year prior to the first negative screen

†Patients with 1 prior negative screen represent the total sample

Table 3.3. Unadjusted and adjusted* probability of a positive final screen by number of prior negative screens€ and the number needed to screen (NNS) for one patient to screen positive on the final screen

	1 prior negative screen†			2 prior negative screens			3 prior negative screens			4 prior negative screens		
	Positive final screen (n=34,494)			Positive final screen (n=11,170)			Positive final screen (n=3,240)			Positive final screen (n=772)		
	%	adj. %	(NNS [‡])	%	adj. %	(NNS [‡])	%	adj. %	(NNS [‡])	%	adj. %	(NNS [‡])
Total	4.8	4.8	(21)	3.6	3.6	(28)	2.6	2.6	(38)	2.0	2.0	(49)
Gender												
Women	4.4	4.8	(21)	3.4	3.6	(28)	3.0	2.6	(39)	2.5	2.0	(51)
Men	4.9	5.4	(19)	3.6	4.5	(22)	2.6	3.8	(26)	2.0	3.0	(33)
Age												
< 50	7.4	5.8	(17)	5.7	4.6	(22)	4.6	3.7	(27)	4.4	3.4	(29)
50-64	5.2	5.0	(20)	3.9	3.8	(26)	2.9	2.8	(35)	2.0	2.0	(51)
≥ 65	4.4	4.6	(22)	3.3	3.4	(29)	2.4	2.4	(41)	1.9	1.9	(52)
Last negative screen score**												
0	1.9	1.9	(53)	1.4	1.7	(60)	1.1	1.4	(71)	0.8	1.0	(99)
1	5.3	5.2	(19)	4.2	3.6	(28)	3.3	2.6	(38)	2.8	2.3	(44)
2	11.2	10.8	(9)	9.2	6.3	(16)	7.4	4.3	(23)	5.9	3.6	(28)
3	23.1	22.5	(4)	19.4	11.7	(9)	15.2	7.2	(14)	12.9	6.2	(16)

*Adjusted for gender, age, race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, Deyo Comorbidity Index, and the corresponding number of prior negative screens

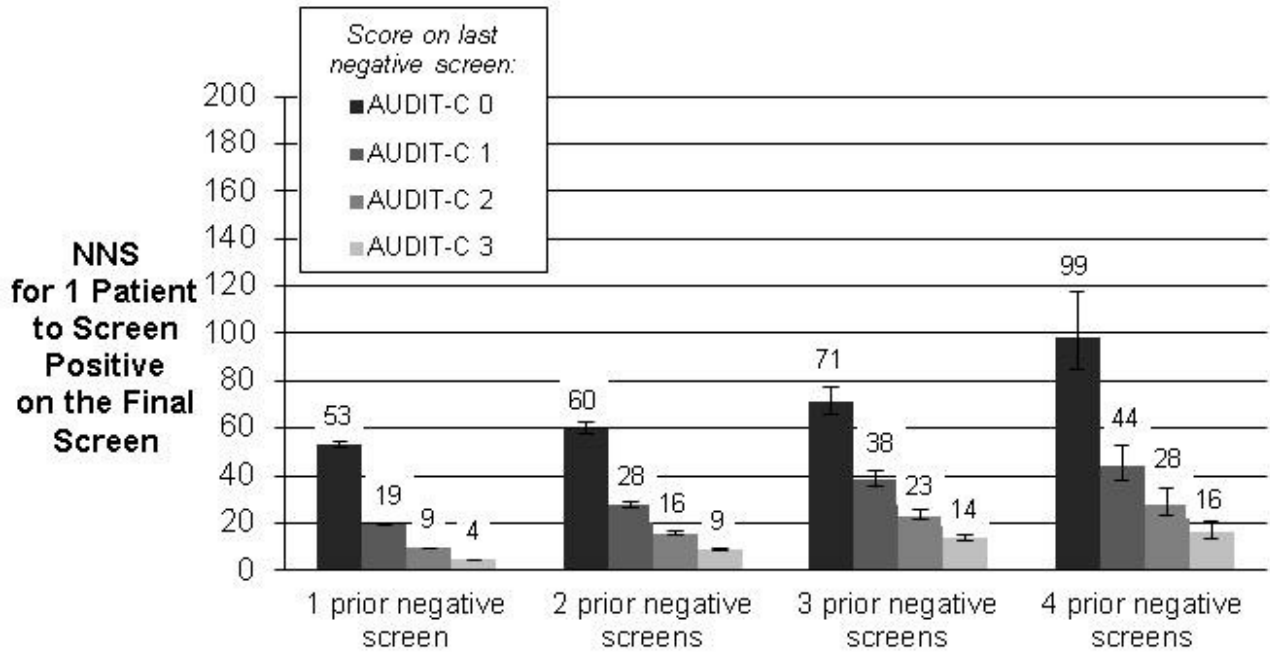
€All screens were consecutive annual screens (9-15 months apart)

†Patients with 1 prior negative screen represent the total sample

‡NNS for one patient to screen positive on the final screen is the inverse of the adjusted probability

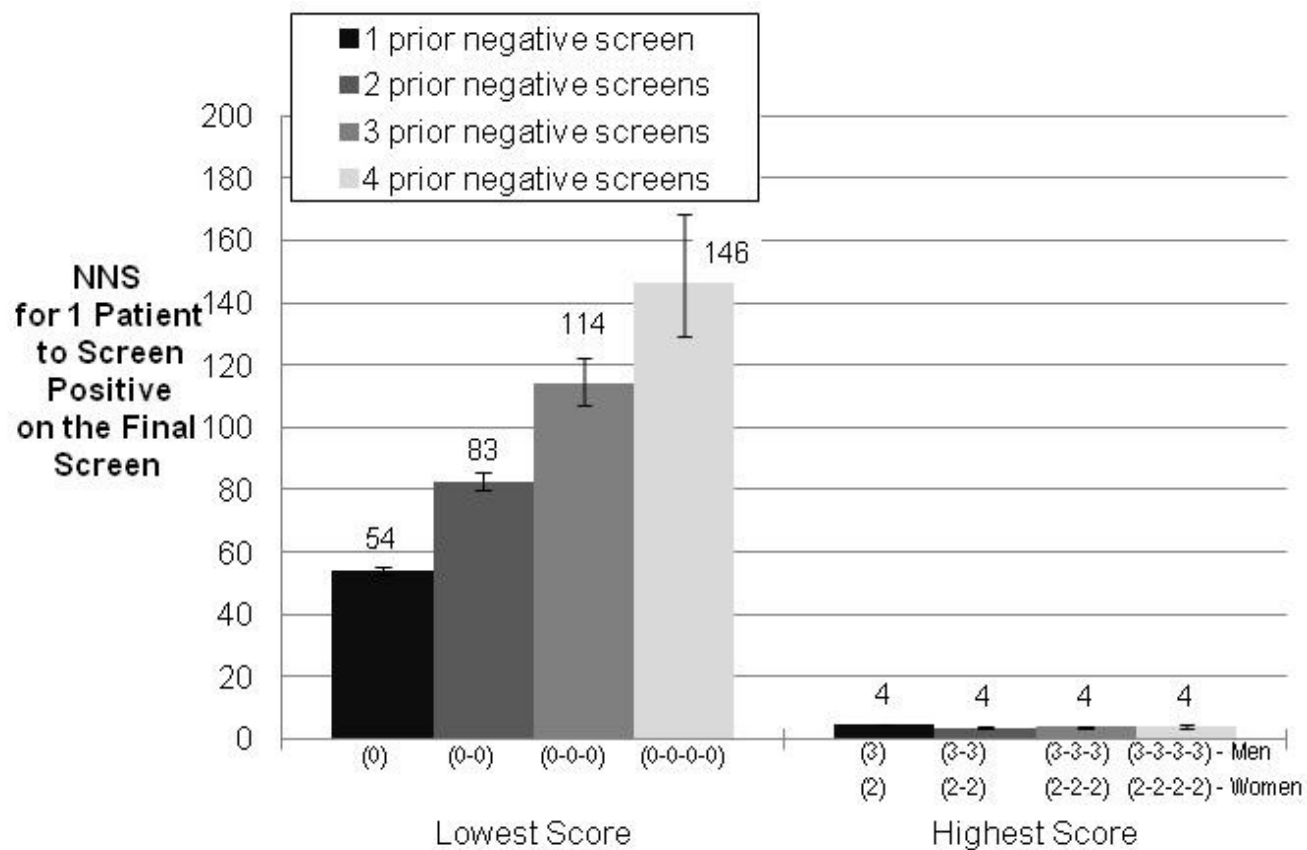
**Score on the last negative screen preceding the final screen

FIGURE 3.2. The association between the number of prior negative screens and the score on the last negative screen with the number needed screen for one patient to screen positive on the final screen



Note. The number needed to screen for one patient to screen positive on the final screen is the inverse of the adjusted probability of a positive final screen.

FIGURE 3.3. The lowest and highest NNS based on the lowest possible scores (all 0's) to the highest possible scores (all 2's women; all 3's men) on 1-4 prior negative screens



Note. The number needed to screen (NNS) for one patient to screen positive on the final screen is the inverse of the adjusted probability of a positive final screen.

Table 3.4. Unadjusted and adjusted* probability of a positive final screen by number of prior negative screens€ and the number needed to screen (NNS) for one patient to screen positive on the final screen

	Probability of Positive Final Screen							
	1 prior negative screen† (n=34,494)		2 prior negative screens (n=11,170)		3 prior negative screens (n=3,240)		4 prior negative screens (n=772)	
	%	adj. %	%	adj. %	%	adj. %	%	adj. %
Total	4.8	4.8	3.6	3.6	2.6	2.6	2.0	2.0
Gender								
Women	4.4	4.8	3.4	3.6	3.0	2.6	2.5	2.0
Men	4.9	5.4	3.6	4.5	2.6	3.8	2.0	3.0
Age								
< 50	7.4	5.8	5.7	4.6	4.6	3.7	4.4	3.4
50-64	5.2	5.0	3.9	3.8	2.9	2.8	2.0	2.0
≥ 65	4.4	4.6	3.3	3.4	2.4	2.4	1.9	1.9
Race/ethnicity								
White	4.2	4.7	3.2	3.5	2.4	2.6	1.7	1.8
Black	4.2	4.7	3.3	3.7	2.6	2.8	2.3	2.4
Hispanic	4.6	5.5	3.5	4.2	2.8	3.4	2.4	2.8
Other	3.3	4.2	2.3	2.9	1.9	2.4	1.8	2.2
Missing/unknown	5.4	4.9	4.1	3.7	2.8	2.6	2.2	2.0
Marital status**								
Unmarried/Unknown	5.3	5.3	3.9	3.9	2.8	2.8	2.1	2.1
Married	4.6	4.6	3.5	3.4	2.5	2.5	2.0	2.0
% service connected disability**								
< 50%	5.1	4.9	3.8	3.7	2.7	2.7	2.0	2.0
≥ 50%	4.0	4.5	3.1	3.4	2.4	2.6	2.0	2.0
Mental health diagnosis**								
No	4.8	4.8	3.6	3.6	2.5	2.5	2.0	2.0
Yes	5.2	5.4	4.2	4.2	3.3	3.4	2.3	2.4
Tobacco use**								
No	5.1	4.9	3.8	3.6	2.7	2.6	2.0	1.9
Yes	4.1	4.7	3.2	3.7	2.4	2.7	2.0	2.3
Deyo Comorbidity Index**								
0-2	5.2	5.0	3.9	3.7	2.8	2.7	2.2	2.1
≥ 3	2.8	3.7	2.2	3.0	1.6	2.2	1.3	1.7
Health care utilization**								
1-12 days	5.5	5.0	4.0	3.6	2.9	2.6	2.2	2.0
13-24 days	3.9	4.5	3.2	3.7	2.4	2.7	1.9	2.1
25-36 days	3.1	4.2	2.6	3.5	1.9	2.4	1.6	1.9
≥ 37 days	2.7	4.0	2.3	3.5	1.9	2.7	1.9	2.4
Last prior screen								
0	1.9	1.9	1.4	1.7	1.1	1.4	0.8	1.0
1	5.3	5.2	4.2	3.6	3.3	2.6	2.8	2.3
2	11.2	10.8	9.2	6.3	7.4	4.3	5.9	3.6
3	23.1	22.5	19.4	11.7	15.2	7.2	12.9	6.2
2nd to last prior screen								
0	--	--	1.6	2.3	1.2	1.8	1.0	1.5
1	--	--	4.1	3.2	3.1	2.3	2.7	1.8
2	--	--	8.3	4.7	6.7	3.2	5.1	2.3
3	--	--	17.4	8.1	14.3	5.4	12.2	4.1
3rd to last prior screen								
0	--	--	--	--	1.2	1.9	1.0	1.7
1	--	--	--	--	3.3	2.6	2.8	2.0
2	--	--	--	--	6.5	3.3	5.5	2.3
3	--	--	--	--	12.1	4.4	9.2	2.6
4th to last prior screen								
0	--	--	--	--	--	--	1.0	1.6
1	--	--	--	--	--	--	2.6	1.9
2	--	--	--	--	--	--	5.0	2.3
3	--	--	--	--	--	--	8.9	3.1

*Adjusted for gender, age, race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, Deyo Comorbidity Index, and the corresponding number of prior negative screens

€All screens were consecutive annual screens (9-15 months apart)

** Assessed in the year prior to the first negative screen

‡Patients with 1 prior negative screen represent the total sample

¥NNS for one patient to screen positive on the final screen is the inverse of the adjusted probability

Table 3.5. Adjusted€ probability of a positive final screen for the lowest and highest prior negative screen score for the total sample and stratified by age and gender

Age	1 prior negative screen						2 prior negative screens						3 prior negative screens						4 prior negative screens					
	Lowest (n=465,997)			Highest (n=52,844)			Lowest (n=177,233)			Highest (n=7,436)			Lowest (n=66,636)			Highest (n=1,108)			Lowest (n=20,034)			Highest (n=125)		
	0	% (95% CI)	NNS	3*	% (95% CI)	NNS	0-0	% (95% CI)	NNS	3-3*	% (95% CI)	NNS	0-0-0	% (95% CI)	NNS	3-3-3*	% (95% CI)	NNS	0-0-0-0	% (95% CI)	NNS	3-3-3-3*	% (95% CI)	NNS
Total Sample (N=721,186)																								
< 50	2.3	(2.2- 2.4)	44	26.1	(25.4- 26.9)	4	1.6	(1.5- 1.7)	62	33.1	(31.3- 34.8)	3	1.3	(1.1- 1.5)	77	35.4	(31.7- 39.0)	3	1.2	(0.9- 1.6)	81	38.6	(30.7- 46.6)	3
50-64	2.0	(1.9- 2.0)	51	23.1	(22.7- 23.6)	4	1.3	(1.2- 1.4)	77	28.6	(27.5- 29.6)	4	1.0	(0.9- 1.0)	105	28.7	(26.4- 30.9)	3	0.7	(0.6- 0.8)	149	25.6	(20.7- 30.4)	4
≥ 65	1.8	(1.7- 1.8)	57	21.4	(21.0- 21.8)	5	1.1	(1.1- 1.2)	88	26.0	(25.1- 26.9)	4	0.8	(0.8- 0.9)	123	25.5	(23.6- 27.3)	4	0.7	(0.6- 0.8)	152	25.1	(20.8- 29.4)	4
Total	1.9	(1.8- 1.9)	54	22.4	(22.0- 22.7)	4	1.2	(1.2- 1.3)	83	27.1	(26.3- 28.0)	4	0.9	(0.8- 0.9)	114	26.7	(24.8- 28.5)	4	0.7	(0.6- 0.8)	146	25.8	(21.6- 30.1)	4
Women (N=42,876)																								
< 50	2.7	(2.5- 2.8)	38	15.1	(14.4- 15.9)	7	2.1	(1.9- 2.3)	47	16.1	(14.6- 17.5)	6	2.0	(1.7- 2.4)	49	18.3	(15.3- 21.4)	5	2.0	(1.3- 2.7)	49	18.2	(11.8- 24.7)	5
50-64	2.3	(2.2- 2.4)	44	13.2	(12.5- 13.8)	8	1.7	(1.6- 1.9)	58	13.4	(12.2- 14.6)	7	1.5	(1.3- 1.7)	66	14.1	(11.8- 16.4)	7	1.1	(0.8- 1.4)	90	10.8	(7.0- 14.6)	9
≥ 65	2.1	(1.9- 2.2)	49	12.0	(11.4- 12.6)	8	1.5	(1.4- 1.7)	66	12.0	(10.9- 13.0)	8	1.3	(1.1- 1.5)	78	12.3	(10.2- 14.3)	8	1.1	(0.8- 1.4)	92	10.6	(6.8- 14.4)	9
Total	2.3	(2.2- 2.4)	44	13.8	(13.2- 14.4)	7	1.7	(1.6- 1.9)	58	14.1	(13.0- 15.3)	7	1.5	(1.3- 1.7)	66	14.8	(12.6- 17.1)	7	1.2	(0.9- 1.6)	81	12.4	(8.2- 16.5)	8
Men (N=669,310)																								
< 50	2.3	(2.2- 2.4)	44	27.0	(26.2- 27.9)	4	1.6	(1.4- 1.7)	64	34.2	(32.4- 36.1)	3	1.3	(1.1- 1.4)	80	36.0	(32.3- 39.8)	3	1.2	(0.8- 1.5)	85	39.3	(31.1- 47.5)	3
50-64	1.9	(1.9- 2.0)	52	24.0	(23.5- 24.5)	4	1.3	(1.2- 1.3)	79	29.6	(28.5- 30.8)	3	0.9	(0.8- 1.0)	109	29.2	(26.9- 31.6)	3	0.6	(0.5- 0.8)	155	26.0	(21.1- 31.0)	4
≥ 65	1.7	(1.7- 1.8)	57	22.1	(21.7- 22.5)	5	1.1	(1.1- 1.2)	90	27.0	(26.0- 27.9)	4	0.8	(0.7- 0.8)	128	26.0	(24.0- 27.9)	4	0.6	(0.5- 0.7)	159	25.6	(21.2- 30.1)	4
Total	1.8	(1.8- 1.9)	55	23.1	(22.7- 23.5)	4	1.2	(1.1- 1.2)	85	28.0	(27.1- 29.0)	4	0.8	(0.8- 0.9)	120	27.2	(25.3- 29.1)	4	0.6	(0.6- 0.7)	154	26.3	(21.9- 30.7)	4

* Women are included in the total sample with a highest negative AUDIT-C score of 2. Highest negative screen score combinations for women were 2, 2-2, 2-2-2, and 2-2-2-2 for 2, 3, 4 and 5 consecutive screens, respectively

€Adjusted for gender, age, race/ethnicity, marital status, service-connected disability, tobacco use, mental health diagnoses, health care utilization, Deyo Comorbidity Index, and the corresponding number of prior negative screens

†All screens were consecutive annual alcohol screens (9-15 months apart)

Chapter 4

Increased Documented Brief Alcohol Interventions with a Performance Measure and Electronic Decision Support

INTRODUCTION

Alcohol misuse is a significant cause of disease and disability(1) accounting for nearly 4% of deaths worldwide.(64) Moreover, brief opportunistic counseling interventions can decrease drinking and improve health for patients who screen positive for alcohol misuse.(3-5, 65, 66) Based on the clinical burden of alcohol-related disease and the cost-effectiveness of brief alcohol interventions,(2, 67) the recent National Commission on Prevention Priorities ranked alcohol screening and brief intervention the 3rd most important preventive service for adults.(6) However, despite the confirmed efficacy of alcohol screening and brief intervention (BI),(3) widespread implementation of these practices as part of routine medical care has not occurred.(13, 14, 68, 69)

The Veterans Affairs (VA) Healthcare System, the largest integrated healthcare system in the US, has transformed the quality of care for Veterans through two key tools: 1) national performance measures and 2) computerized electronic clinical reminders in the VA's state of the art electronic health record (EHR).(15, 70, 71) National VA performance measures reflecting evidence-based practice guidelines are linked to financial incentives for clinical leaders(15) and monitored through quarterly facility-level reports. VA clinical reminders are decision support tools in the EHR designed to prompt, document, and monitor recommended care.(16, 72)

Over the past 5 years, VA has taken a stepped approach to implementing alcohol screening and BI with performance measures and clinical reminders in the EHR. In 2004, the VA implemented a performance measure requiring annual alcohol misuse screening.(11)

However, only a minority of VA patients who screened positive for alcohol misuse nationwide in the same year reported receiving alcohol-related advice.(9) Since July 2006, VA has taken steps to implement BI in four phases. First, VA began using medical record reviews to monitor documentation of BI for patients who screened positive for alcohol misuse. In July 2007, VA announced a new performance measure that would require all patients who screened positive for alcohol misuse to have documented BI. This performance measure for BI was implemented October 1, 2007, although no benchmarks were set for expected rates of BI. In January 2008, a clinical reminder for BI (Figure 4.1) was electronically disseminated into the EHR at each VA facility.(73) The clinical reminder was designed to prompt providers to offer evidence-based BI when a patient screened positive for alcohol misuse and to facilitate documentation of key elements of BI. The purpose of this study was to evaluate whether this strategy to implement BI nationally in the VA was associated with increased prevalence of documented BI among VA patients with alcohol misuse.

METHODS

Study Design

This is a retrospective, natural history study of the implementation of population-based brief intervention for alcohol misuse in the VA between July 1, 2006 and September 30, 2008. Patient-level data were used to evaluate the prevalence of documented BI among patients who screened positive for alcohol misuse during the 4 phases of BI implementation.

Data collection

Data for this study were obtained from the VA Office of Quality and Performance's (OQP) External Peer Review Program (EPRP). EPRP is contracted by VA OQP to conduct comprehensive standardized medical record reviews of a random sample of outpatients seen at each VA medical center each month(74) and is performed by trained reviewers using detailed abstraction rules and computerized algorithms to ensure reliable and accurate data abstraction.(71) Cross-sectional data from medical record reviews are published quarterly for quality improvement and used to monitor national performance. Patients were eligible for the outpatient EPRP sample at the time of this study if they received VA outpatient care 13-24 months before the medical record review, had another outpatient visit in the month before the review, and had not been included in a previous EPRP sample that fiscal year. Approval for the study and waivers of informed consent and HIPAA authorization were granted through both the University of Washington and VA Puget Sound Health Care System Institutional Review Boards.

Study Sample

Outpatients included in EPRP medical record reviews were eligible for this study if they screened positive for alcohol misuse (defined below) between July 1, 2006 and September 30, 2008 and had at least 30 days between documented alcohol screening and medical record review. Because evaluation of the VA performance measure by VA OQP excluded patients who had documented cognitive impairment, were in hospice care, or received VA addictions treatment in the 90 days prior to alcohol screening, these patients were not eligible for this study. Each patient's earliest recorded alcohol screen during the study period was used for this study.

Measures

Phases of BI implementation

Patients were included in one of four successive phases of BI implementation based on the date they completed alcohol screening (Figure 4.2):

- 1) *Baseline year*, in which measures of documented BI were pilot tested;
- 2) *Transition quarter*, the three months between announcement and implementation of the performance measure for BI;
- 3) *Performance measure (PM) implementation*, the first three months of performance measure implementation, before national dissemination of the BI clinical reminder; and
- 4) *Clinical reminder (CR) dissemination*, the three quarters (9 months) after nationwide electronic dissemination of the BI clinical reminder.

Outcome Measures

Advice and feedback are key components of efficacious BI.(4, 65) Therefore, EPRP medical record reviewers abstracted data on the following 4 components of BI: *advice to abstain from drinking, advice to drink within recommended limits, personalized feedback, and general feedback* (defined in detail in Table 4.1). These components were considered sufficiently concrete to be reliably extracted from the medical record unlike components such as expression of concern or an empathetic or motivational approach.(75) Two main outcome measures of BI documented within 30 days after alcohol screening are used in this study (Table 4.1). One is a stringent (restrictive) definition requiring documentation of both advice and feedback. This measure is referred to as the *VA performance measure of BI* because it is consistent with the VA performance measure. The other is an inclusive definition and requires advice and/or feedback

(*any BI*). Both measures were evaluated because there is no clear consensus on required components of BI and the prevalence of BI differed based on the definition. Each of the four individual components of BI in addition to composite measures of *any advice* and *any feedback* were also evaluated as secondary outcomes (Table 4.1).

Referral to addictions treatment is often indicated for patients with alcohol use disorders. Therefore, EPRP also assessed documentation of discussion of referral and referral to addictions treatment. For this study, these measures were combined into a single composite measure of *referral to treatment* due to relatively small numbers of each (Table 4.1). Both referral to treatment and an aggregate measure of any documented component of BI and/or referral, *any BI or referral*, were also evaluated as secondary outcomes (Table 4.1).

Patient Characteristics

Alcohol misuse was defined as Alcohol Use Disorders Identification Test – Consumption (AUDIT-C) scores ≥ 5 points for purposes of study eligibility. The AUDIT-C, is a 3-item alcohol screening questionnaire, validated in veteran and non-veteran primary care patients (**Table 1**), used for annual screening in the VA since 2006.(76) Medical record reviewers recorded the screening date and AUDIT-C score. While AUDIT-C scores ≥ 4 and ≥ 3 balance sensitivity and specificity for men and women respectively, ≥ 5 is an appropriate cut-off for both women and men in certain settings.(77) The VA performance measure for BI requires documentation of BI for all patients with an AUDIT-C score ≥ 5 points to decrease the burden of false positive screens.

Covariates included age, gender, and past-year tobacco use. Patient race was not used due to limitations in VA race data during the study period. Additional covariates, associated

with receipt of BI, (78-80) included binary measures of prior recognition of alcohol use disorders, prior addictions treatment, and prior mental health or substance use disorder diagnoses (defined in detail in Table 1). Patients were also categorized as screening positive for mild, moderate, or severe alcohol misuse based on AUDIT-C scores (5, 6-7, and 8-12 points, respectively).(76, 81, 82)

Statistical Methods

Initial analyses described demographic and clinical characteristics of the study sample. To evaluate differences in the prevalence of documented BI during the 4 phases of implementation, the unadjusted prevalence of BI was estimated for each phase and compared using chi-square test for linear trend. For adjusted analyses, the relative risk of BI was estimated using a generalized log-linear regression with a Poisson working model and robust error variances.(83, 84) Models were fit with medical center as a clustering variable to account for correlation of data within 139 VA medical centers and adjusted for baseline characteristics: gender, age categories, tobacco use, prior alcohol use disorders or addictions treatment, mental health or non-alcohol substance use disorder diagnosis and AUDIT-C categories. The four phases of BI implementation were modeled as a categorical variable with baseline year as the referent group. Results are presented as the adjusted prevalence of each outcome for each phase of BI implementation. For each outcome, post-estimation Wald tests evaluated two types of associations: 1) a linear trend of increasing prevalence across the 4 phases of BI implementation and 2) differences in prevalence between successive phases of BI implementation. Finally, interactions were tested to evaluate whether patient baseline characteristics modified the association between phase of BI implementation and the two main outcome measures of

documentation of BI. Stratified analyses and parallel Wald tests were performed if interactions between baseline characteristics and phase of BI implementation were significant. Analyses were performed using Stata Special Edition, version 10.1 (StataCorp 2008).

RESULTS

Study Sample and Patient Characteristics

Of the 81,997 patients with an eligible AUDIT-C alcohol screen during the study, a total of 6,788 outpatients (8.3%) screened positive for alcohol misuse (AUDIT-C \geq 5) and met inclusion criteria (Figure 4.2): 3,504 in the baseline year, 753 in the transition quarter, 697 in the performance measure (PM) implementation quarter, and 1,834 in the 9 months after clinical reminder (CR) dissemination. The sample was predominantly male and older, reflecting the overall VA patient population. Over half smoked, about a fifth had been previously diagnosed with an alcohol use disorder or received addictions treatment, and 60% had been previously diagnosed with other mental health and/or substance use disorders (Table 4.2).

Changes in the Prevalence of BI and Referral Over Four Phases of Implementation

The prevalence of documented BI—using either main outcome measure—increased across all four phases of BI implementation in both unadjusted (Table 4.3) and adjusted analyses (test for trend p-values <0.001) (Figure 4.3, panel A). The adjusted prevalence of the VA performance measure of BI increased from 5.5% at baseline to 29% after CR dissemination, demonstrating a 5.2-fold increase (95%CI 3.8–7.1) over the course of the study. Although the increase in adjusted prevalence of either main measure was not significant from the baseline year to the transition quarter, the prevalence increased significantly over the next two phases (p-

values <0.001 for all comparisons except p-value <0.01 from transition quarter to PM implementation for any BI).

The prevalence of documented advice and feedback each increased across the four phases of BI implementation in unadjusted (Table 4.3) and adjusted analyses (test for trend p-values <0.001) (Figure 4.3, panel A). In particular, the adjusted prevalence of all measures of advice and feedback increased significantly from transition quarter to PM implementation quarter and from PM implementation to CR dissemination (p-values <0.001 except p-value <0.05 from transition quarter to PM implementation for general feedback and advice to drink within limits). The adjusted prevalence of any advice increased from 19.1% (95%CI 16.4-22.1) to 41.8% (38.0-46.1) and the adjusted prevalence of any feedback increased from 19.9% (95%CI 17.3-22.9) to 37.4% (33.7-41.6) from baseline year to CR dissemination, respectively, with the test for trend significant at p-values <0.001 (Figure 4.4).

The prevalence of referral to treatment did not significantly increase over any phase of BI implementation in unadjusted (Table 4.3) or adjusted analyses (Figure 4.3, panel A), and each component of the referral measure was also stable over time with unadjusted rates ranging from 9.6% to 10.3% for discussion of referral alone and 12.3% to 13.8% for documented referral to treatment. The adjusted prevalence of the aggregate measure of any BI or referral increased across all four phases BI implementation (test for trend p-value <0.001) and, specifically, from the transition quarter to PM implementation quarter (p-value <0.01) and from PM implementation to CR dissemination (p-value <0.001).

Prior Addiction Modified the Effect of BI Implementation

Prior alcohol use disorders or addictions treatment modified the association between phase of BI implementation and the prevalence of BI – using either main measure (p-values < 0.05). Stratified analyses were, therefore, performed for main and secondary outcomes (Figure 4.3, panels B and C). Overall, patients with prior alcohol use disorders or addictions treatment were significantly more likely to have documentation of either main measure of BI (p-values < 0.001) compared to patients without prior alcohol use disorders or addictions treatment. However, patients without prior alcohol use disorders or addictions treatment had a significantly greater proportional increase in either measure of BI after CR dissemination compared to those with prior alcohol use disorders or addictions treatment (p-value < 0.05 VA performance measure of BI, p-value < 0.01 any BI). Significant interactions between prior alcohol use disorders or addictions treatment and phase of BI implementation were also observed for secondary outcomes: personalized feedback, referral to treatment and any BI or referral (p-values < 0.05).

DISCUSSION

This observational study found that the VA's strategy of implementing BI with a performance measure supported by dissemination of an electronic clinical reminder for brief intervention (BI) was associated with statistically and clinically meaningful increases in documentation of evidence-based BI in the first year of the performance measure. After dissemination of the clinical reminder, 29% of patients with alcohol misuse had documentation of BI using the most restrictive measure of BI, alcohol-related advice plus feedback linking alcohol use to health, while 54% had documentation of at least one component of BI and/or referral in adjusted analyses. Additionally, the magnitude of the increase in documented BI over the phases of BI implementation varied depending on whether patients had documentation of

prior alcohol use disorders or addictions treatment. As in previous studies,(79) patients with previously recognized alcohol use disorders or addictions treatment were more likely than those without to have BI documented, however, those without prior alcohol use disorders or addictions treatment had greater proportional increases in documentation of BI after clinical reminder dissemination.

While performance measures and electronic clinical reminders have been associated with increased rates of other preventive care,(15-17) to our knowledge this is the first study to document an association between implementation of a performance measure and electronic decision support for BI with increased prevalence of BI. Previous efforts to implement BI for alcohol misuse in real world settings have produced varying results depending on the intensity of the effort(69) and the number of conditions targeted.(85) Although projects focusing on physician training and support have delivered BI to 22% - 59% of eligible patients,(86-88) most efforts to implement BI along with other routine preventive care in the absence of resources exclusively for BI have been disappointing.(85) One exception is a recent implementation trial that coupled physician training and performance feedback with electronic decision support for alcohol screening and BI in patients with hypertension that resulted in 51% of eligible patients having documented BI.(89) However, it is not known if these rates of BI were sustained after the conclusion of the study. Therefore, health care systems currently lack effective models for integrating BI into routine care alongside other evidence-based preventive care.

In the current study, the prevalence of documented BI increased meaningfully in the first year of PM implementation despite alcohol screening and BI being one of many preventive initiatives underway in VA. Moreover, these increases were in the absence of any explicit target for expected rates of BI. This suggests that this combination of strategies is a powerful approach

for BI implementation. Nevertheless, 47% of patients who screened positive for alcohol misuse in the 9 months after dissemination of the clinical reminder had no documentation of BI, indicating continued need for improvement. We suspect that systematic provider education and national targets for expected rates of BI may be required to maximize implementation of BI.

Previous studies have demonstrated that patients without alcohol-related medical problems, and with less severe alcohol misuse, are less likely to receive BI.(79, 80) Moreover, prior research found that providers predominantly advised patients with alcohol misuse to abstain,(79) further suggesting that providers had not integrated evidence-based BI for risky drinking into their practices. In the present study, after dissemination of the clinical reminder for BI, the prevalence of advice to drink within recommended limits increased significantly, suggesting that clinical reminders might aid providers in taking a more preventive approach toward risky drinking.(73)

About half of screen positive patients with previously diagnosed alcohol use disorders or addictions treatment had any BI documented during the baseline year of monitoring, considerably above the 11% of patients with alcohol use disorder who received evidence-based care in an important study of the quality of US health care.(90) Nevertheless, after the baseline year these patients had large increases in BIs that included both advice and feedback, and the prevalence of documented advice to abstain nearly doubled in this high risk group. Also, more than two thirds of these patients had documented BI or referral in the year after performance measure implementation. However, the proportion of these patient with documented referrals to treatment or discussions of referral alone did not increase, even though the clinical reminder could also facilitate referral. This finding among VA patients with prior alcohol use disorders or addictions treatment could reflect patient-centered care (if patients had previously declined

referral), provider reluctance to refer, lack of local adaptations to facilitate referral in the clinical reminder, or a combination of all three. Further research is needed on the optimal management of patients' with alcohol use disorders who screen positive for alcohol misuse.

This study has important limitations. The length of each phase of BI implementation varied from 3 months to one year and the shorter intervals may not have allowed sufficient time to measure any impact of the implementation phase on the prevalence of documented BI. Alcohol misuse is defined as an AUDIT-C score of ≥ 5 , which was selected to minimize the burden of false positives, but would have reduced sensitivity especially among women.(77) Further, this study lacked power to evaluate other potentially important moderators (e.g., gender or age).

While a previous study at an 8-clinic VA facility demonstrated that BI documented with the clinical reminder was associated with decreased drinking at follow-up alcohol screening,(73) it is unknown whether BIs documented in this study were efficacious. With multiple preventive services recommended for all outpatients, providers may lack the necessary time(91) or clinical skills for addressing alcohol use effectively,(92, 93) and although clinical reminders facilitated documentation of explicit advice and feedback linking alcohol use to health, the actual quality of the BIs is unknown.(93-95) Further, while empathetic, patient-centered advice and feedback are common components of effective BI, and very brief advice appears as effective as long BI's,(3, 96) there is no consensus on the essential components of BI.(22) Therefore, additional research on the quality and the efficacy of BIs integrated into routine clinical care is essential.

A related limitation is that biases in the main outcomes could have contributed to observed increases in documented BI. Prior to implementation of the performance measure for BI in October 1, 2007, documentation of alcohol-related discussions might not have been

perceived as a clinical priority and documentation could have underestimated the true prevalence of BI. Conversely, after the performance measure was implemented, the prevalence of BI could have been overestimated due to the ease of documentation of BI with clinical reminders and local institutional pressure to complete those reminders.(97)

The generalizability of results from this sample of Veterans enrolled in a national health care system with an integrated EHR and standardized performance measurement is unknown. However, major efforts are underway to accelerate adoption of EHRs by most physicians and hospitals by 2019.(52) In addition, incentives and performance measures are increasingly discussed as a potential means of implementing alcohol screening and BI in other health care systems.(22, 68, 98) Health Care Common Procedure Coding System codes developed by the American Medical Association were recently endorsed by the Centers for Medicare & Medicaid Services (CMS) for provider reimbursement for alcohol and/or substance use screening and BI and in 2009, the Physician Quality Reporting Initiative, a voluntary CMS physician financial incentive program, added an alcohol screening measure. Therefore, this study suggests effective strategies for implementation of BI that will be increasingly available.

CONCLUSION

The VA's strategy of implementing brief alcohol interventions with a performance measure and clinical reminder meaningfully increased documentation over a 1 year period. BIs increased among patients without prior alcohol use disorders or addictions treatment, as well as those with recognized drinking problems, with proportionally greater increases among the often neglected former group after clinical reminder dissemination. These strategies are increasingly within reach of other health care systems implementing EHRs and preventive care monitoring

and were successful at increasing the prevalence of documented BI alongside other evidence-based preventive care.

Reminder Resolution: POS AUDIT-C FU: Provider or MH only

DOES THE PATIENT DRINK ABOVE THE RECOMMENDED LIMITS?

Men: <= 14 drinks/wk and maximum of 4 drinks/occasion
 Women: <= 7 drinks/wk and maximum of 3 drinks/occasion

No
 Yes

A brief intervention is indicated. Feedback and Advice are both required. Offer referral as appropriate.

Required Interventions

Feedback

Medical problems associated with alcohol use reviewed with patient...

hypertension CHF liver disease seizures injury medication interactions
 psychiatric disorders depression Other:

Advice - Choose one

Advised patient to abstain. Re-address at next visit.
 Advised patient about recommended limits and to drink below them. Re-address at next visit.

Optional Interventions

Patient's Response to Counseling
 Assess Alcohol Use in more Detail
 Refer to MH/SATP if patient is interested
 Declines referral to MH/SATP

Figure 4.1. Image of the clinical reminder for BI as it appears when opened in the VA electronic health record after advice and feedback are selected. (BI=brief intervention)

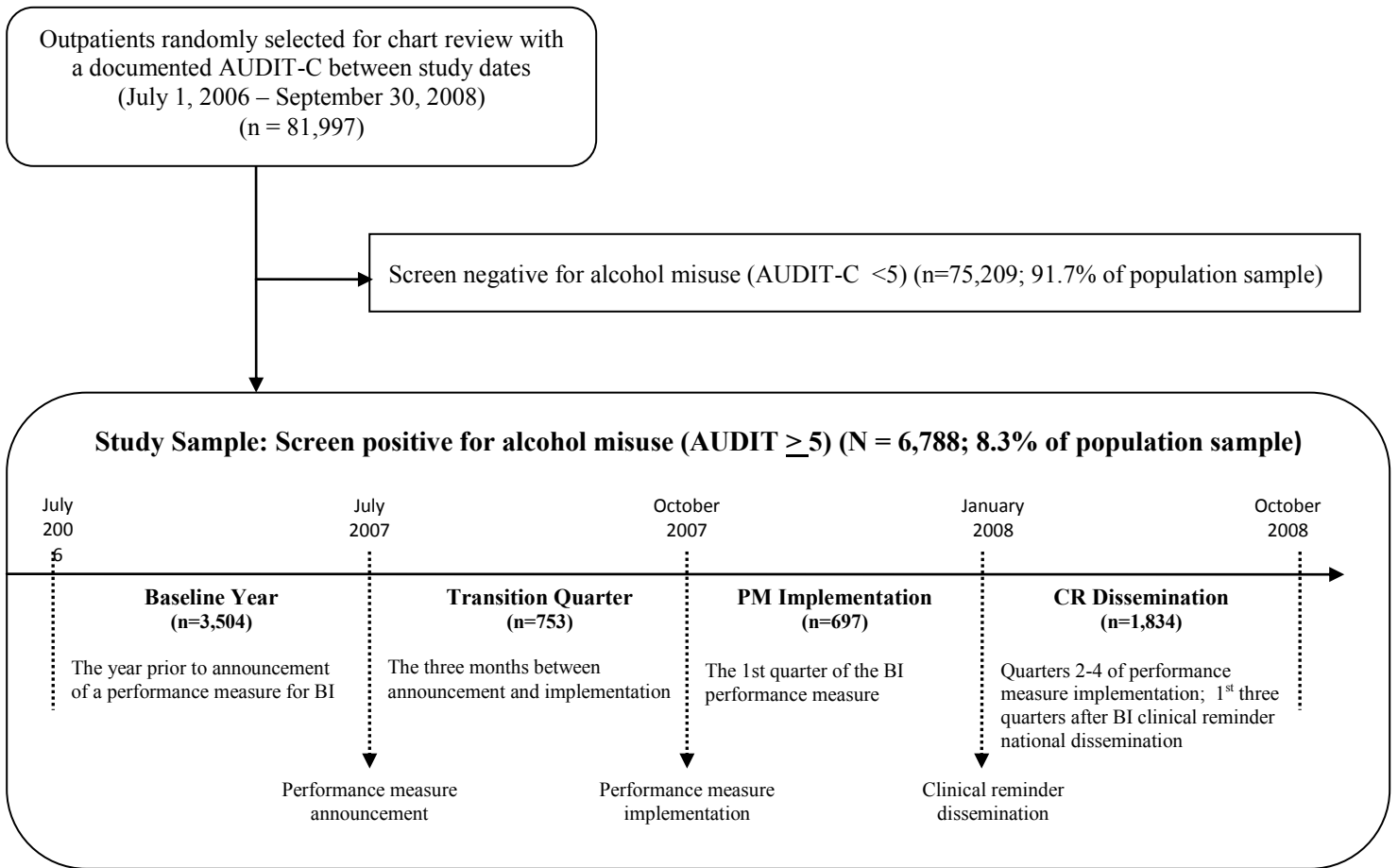


FIGURE 4.2. Study sample and phases of implementation of brief intervention for alcohol misuse in VA (BI=brief intervention, PM=performance measure, CR=clinical reminder)

TABLE 4.1. Definition of Outcome Measures and Patient Characteristics*

Outcome Measures	Definition
Brief Intervention[†]	
Components of BI	
Advice	Medical record documentation of the following:
Advice to abstain	Advice to abstain from drinking
Advice to drink within limits	Advice to drink within recommended limits [‡]
Any advice	Either or both measures of advice
Feedback	Medical record documentation of the following:
Personalized feedback	Personalized counseling linking alcohol use to the patient's specific health issues
General feedback	Counseling linking alcohol to health in general
Any feedback	Either or both measures of feedback
Main outcome measures of BI	Medical record documentation of the following:
VA performance measure of BI	Any advice <u>and</u> any feedback
Any BI	Any advice <u>or</u> feedback
Referral to treatment[†]	Medical record documentation of discussion of or scheduling addictions treatment
Any BI or referral[†]	Medical record documentation of any measure of BI (advice or feedback) or referral
Patient Characteristics	Definition
Alcohol Misuse	Defined as AUDIT-C score ≥ 5 points. The AUDIT-C score (0-12 points) is the sum of the scores for the 3 AUDIT-C questions: 1) How often did you have a drink containing alcohol in the past year? <i>Never (0 points), monthly or less (1), 2-4 times a month (2), 2-3 times per week (3), 4 or more times per week (4)</i> 2) How many drinks containing alcohol did you have on a typical day when you were drinking in the last year? <i>0 drinks (0 points), 1-2 (0), 3-4 (1), 5-6 (2), 7-9 (3), 10 or more (4)</i> 3) How often in the last year have you had 6 or more drinks on one occasion? <i>Never (0 points), < monthly (1), monthly (2), weekly (3), daily or almost daily (4)</i>
Previously recognized AUD	Medical record documentation in the year before alcohol screening of a current or prior diagnosis of alcohol withdrawal (ICD 291), alcohol dependence (303.9), alcohol intoxication (303.0), or alcohol abuse (305.0), based on EPRP reviews
Prior addictions treatment	Medical record documentation in the year before alcohol screening of current or prior VA alcohol or addictions treatment or community-based treatment program, including support groups such as Alcoholics Anonymous, based on EPRP reviews
Prior AUD or addictions treatment	Either or both previously recognized AUD or prior addictions treatment
Mental health or substance use disorder diagnosis	VA administrative data, obtained by EPRP, indicating a diagnoses of psychosis, neurotic disorders, personality disorders, or other non-psychotic disorders, including non-nicotine drug and alcohol abuse and dependence (ICD 295-298.xx, 300-304.xx, 305.0, 305.2, 305.3, 305.4, 305.5, 305.6, 305.7, 305.8, 306.xx, 307.1, 308-309, 311.xx and 312.3x) in the year prior to EPRP review.

* Data comes from EPRP chart reviews of medical record documentation with the exception of mental health or substance use disorders diagnoses

[†] Documented in the medical record within the 30 days following alcohol misuse screen

[‡] Recommended drinking limits: <14 drinks per week and <5 drinks per occasion for men; <7 drinks per week and <4 drinks per occasion for women (BI=brief intervention, AUDIT-C=Alcohol Use Disorders Identification Test – Consumption, EPRP=External Peer Review Program, AUD=alcohol use disorder)

TABLE 4.2. Demographic and Clinical Characteristics of Study Sample: VA Outpatients with Alcohol Misuse (N=6,788)

	Total n (%)
Male	6,594 (97)
Age	
<50	1,679 (25)
50-59	2,369 (35)
60-69	1,925 (28)
≥70	815 (12)
Tobacco use in past year	3,932 (58)
Prior AUD or addictions treatment	1,280 (19)
Previously recognized AUD	1,026 (15)
Prior addictions treatment	515 (8)
Mental health or substance use disorder diagnosis	5,038 (74)
Excluding previously recognized AUD	4,058 (60)
AUDIT-C categories	
Mild (AUDIT-C score 5)	1,907 (28)
Moderate (AUDIT-C scores 6-7)	2,006 (30)
Severe (AUDIT-C scores 8-12)	2,875 (42)

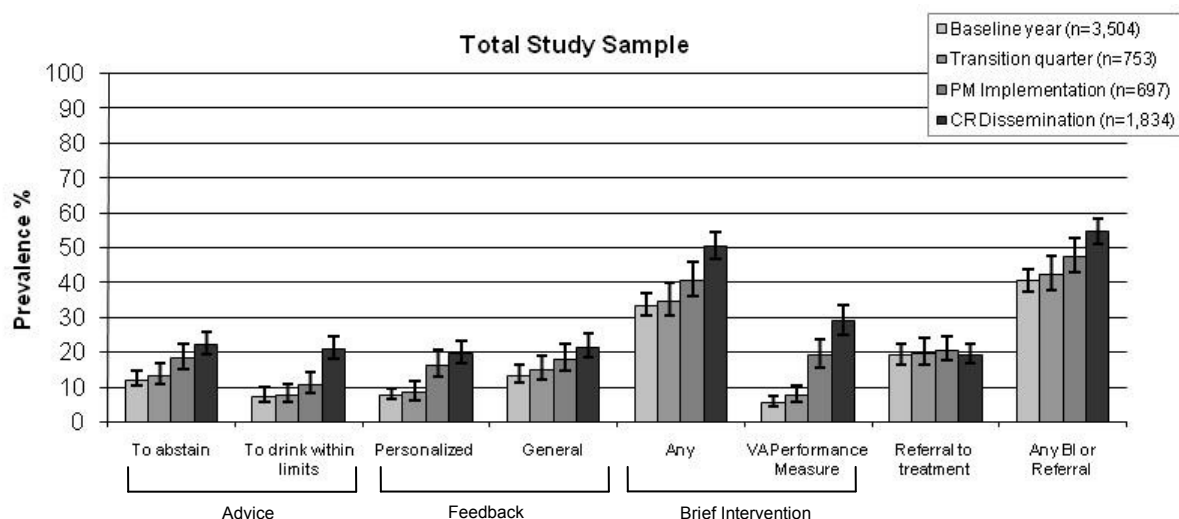
(AUD=alcohol use disorder, AUDIT-C=Alcohol Use Disorder Identification Test-Consumption questionnaire)

TABLE 4.3. Patients with Alcohol Misuse in Each Phase of Brief Intervention (BI) Implementation with Documentation of BI, Referral to Treatment and Any BI or Referral (N=6,788)*

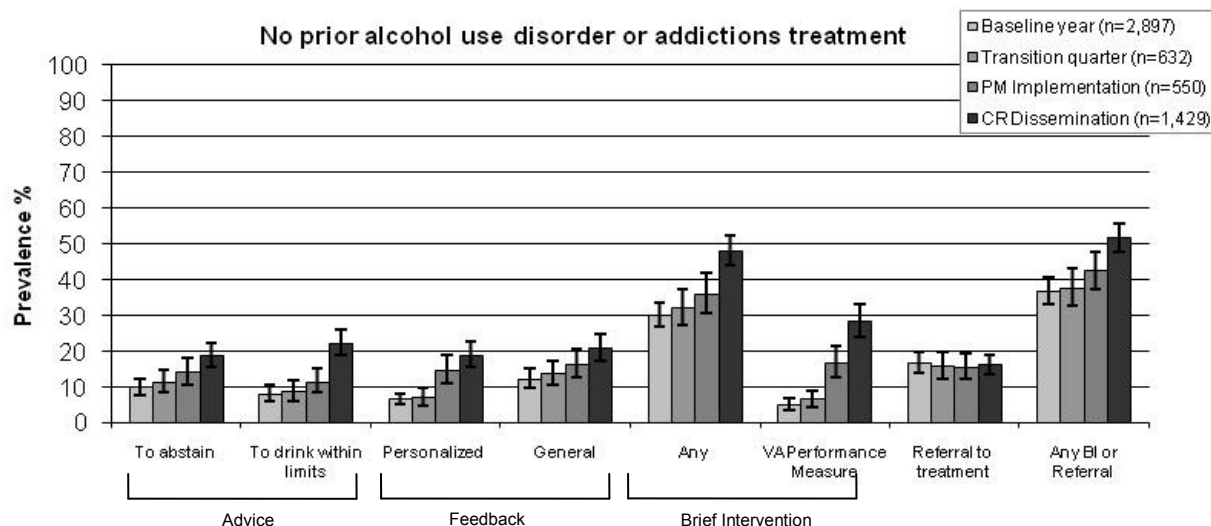
	Baseline Year (n=3,504)		Transition Quarter (n=753)		1 st Year of Performance Measure			
					PM Implementation (n=697)		CR Dissemination (n=1,834)	
	N	(%)	N	(%)	N	(%)	N	(%)
Components of Brief Intervention (BI)								
Advice								
Advice to abstain	477	(14)	111	(15)	148	(21)	481	(26)
Advice to drink within limits	265	(8)	60	(8)	76	(11)	388	(21)
Any advice	687	(20)	159	(21)	214	(31)	807	(44)
Feedback								
Personalized feedback	302	(9)	68	(9)	127	(18)	407	(22)
General feedback	481	(14)	114	(15)	130	(19)	413	(23)
Any feedback	721	(21)	168	(22)	221	(32)	730	(40)
Main Outcome Measures of BI								
VA Performance Measure of BI [‡]	200	(6)	59	(8)	140	(20)	563	(31)
Any BI [†]	1,208	(34)	268	(36)	295	(42)	974	(53)
Referral to treatment	766	(22)	169	(22)	168	(24)	419	(23)
Any BI or Referral	1,464	(42)	326	(43)	347	(50)	1,058	(58)

*All measures, except referral to treatment, significant for chi-square test for linear trend at p<0.001.
[‡]VA Performance Measure of BI: advice plus feedback
[†]Any BI: advice or feedback
(BI=brief intervention, PM=performance measure, CR=clinical reminder)

A



B



C

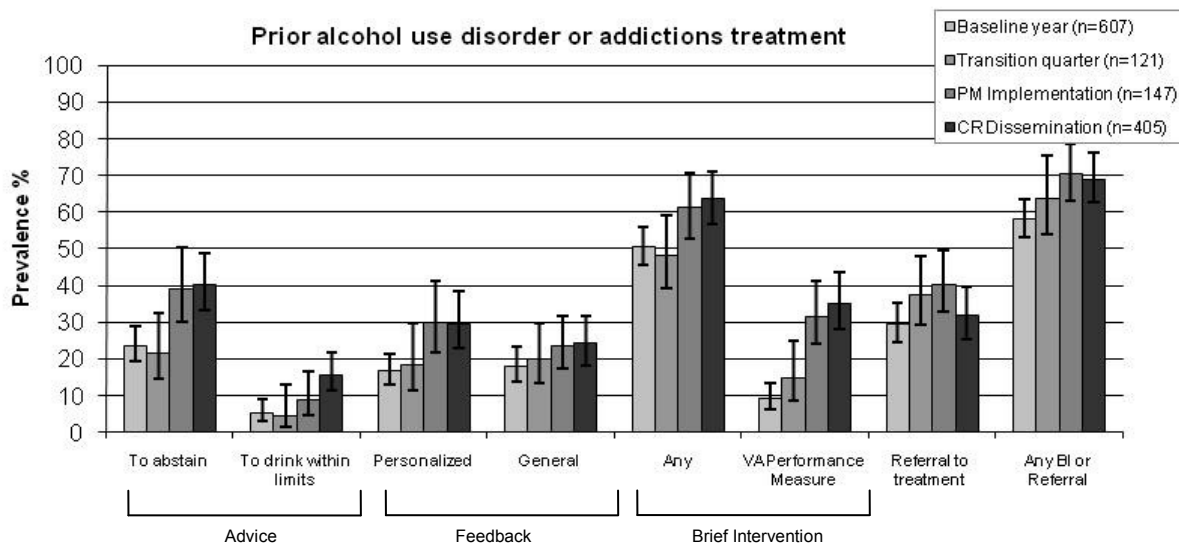


FIGURE 4.3. Adjusted prevalence of brief intervention (BI), referral, and components of BI for each phase during BI implementation: total study sample (Panel A) and stratified by no prior alcohol use disorders or addictions treatment (Panel B) and prior alcohol use disorders or addictions treatment (Panel C). For the total study sample, all outcome measures, except referral to treatment, increased significantly across all BI implementation phases (test for linear trend p -values < 0.001). (BI=brief intervention, PM=performance measure, CR=clinical reminder, AUD=alcohol use disorder)

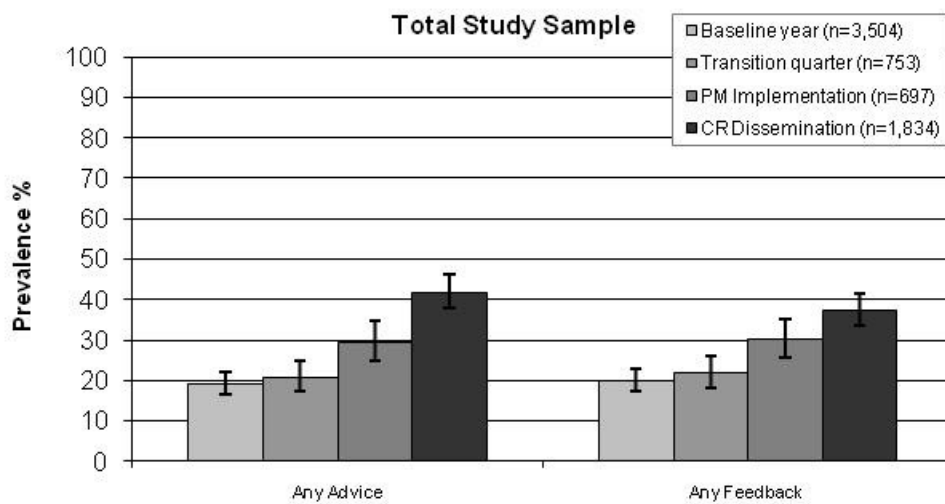


Figure 4.4. Adjusted prevalence of any advice (advice to abstain and/or advice to drink within limits) and any feedback (general or personalized feedback) for the total study sample. Both increased significantly across all BI implementation phases (test for linear trend p -values <0.001). (BI=brief intervention, PM=performance measure, CR=clinical reminder, AUD=alcohol use disorder)

Chapter 5

Conclusion

The VA is one of the first integrated health care systems in the world to successfully implement annual alcohol screening into routine care and attempt sustained implementation of brief intervention for patients who screen positive for alcohol misuse outside of research efforts. Although routine alcohol screening is recommended, the optimal screening interval remains unknown and effective strategies for implementation of brief intervention for into routine care for primary care patients have yet to be described. VA's unique environment and availability of large secondary datasets with documented alcohol-related care offered an opportunity to examine the yield of annual alcohol screening for patients who initially screen negative and VA's strategy to implement BI for patients who screened positive for alcohol misuse.

The overall purpose of this project was to 1) evaluate the yield of 1-4 consecutive negative annual alcohol screens on the probability of a positive final screen; and 2) whether VA's strategy to implement BI nationally in the VA was associated with increased prevalence of documented BI among VA outpatients with misuse. The studies described in Chapters 2 and 3 addressed the first aim and found that the number of prior negative screens, age, gender and prior negative screen scores were the strongest predictors of a positive final screen. As the number of prior negative screens increased from 1-4, the probability of a positive final screen decreased and those who consistently reported no drinking in the past year had the lowest probabilities. Depending on the number of prior negative screens and the negative score, age, and gender, the probability of a positive final screen ranged from 0.6% to 39.3% and the NNS ranged from 3 – 159. These results suggest that extending the screening interval beyond a year may be

appropriate for some patient groups with a low likelihood of a positive screen in settings that lack the resources to screen and follow-up on all patients annually. However, for health care systems to make decisions about customizing extended screening intervals for some patients, additional research is needed to estimate the cost of screening in different settings using different screening formats (e.g, paper and pencil in clinic, mailed patient surveys and visit-based interviews). Models estimating cost will need to consider not only the per-person cost of screening but the costs of additional prior negative screens associated with a particular NNS within any age and gender subgroup. Therefore, further research is needed to determine the potential costs and benefits associated with extended screening intervals.

The study described in Chapter 4 evaluated VA's strategy to implement evidence-based brief alcohol interventions and found that the VA's strategy of implementing BIs with a performance measure and clinical reminder meaningfully increased documentation over a 1-year period. Among patients with alcohol misuse, the prevalence of BI consistent with the VA performance measure increased significantly over successive phases of BI implementation, from 5.5% during the baseline year to 29.0% after clinical reminder dissemination. Further, BI documentation increased more steeply after clinical reminder dissemination for patients without prior alcohol use disorders or addictions treatment relative to patients with prior alcohol use disorders and addictions treatment. Since this study, rates of documented BI for screen-positive patients have reached 76%.⁽⁵⁰⁾ VA's strategies to implement population-based alcohol screening and evidence-based follow-up are increasingly within reach of other health care systems implementing electronic health records and preventive care monitoring. However, research is needed to evaluate whether these strategies will have similar implementation success when they are replicated in other primary care settings. Further, because uptake of these

implementation strategies depend on facility-level factors, future research will want to examine facility-level variation to identify factors associated with successful implementation.

List of References

1. Room R, Babor T, Rehm J. Alcohol and public health. *Lancet* 2005;365(9458):519-30.
2. Solberg LI, Maciosek MV, Edwards NM. Primary care intervention to reduce alcohol misuse ranking its health impact and cost effectiveness. *Am J Prev Med* 2008;34(2):143-152.
3. Kaner E, Beyer F, Dickinson H, Pienaar E, Campbell F, Schlesinger C, et al. Effectiveness of brief alcohol interventions in primary care populations. *Cochrane Database Syst Rev* 2007(2):CD004148.
4. Moyer A, Finney JW, Swearingen CE, Vergun P. Brief interventions for alcohol problems: a meta-analytic review of controlled investigations in treatment-seeking and non-treatment-seeking populations. *Addiction* 2002;97:279-292.
5. Fleming MF, Barry KL, Manwell LB, Johnson K, London R. Brief physician advice for problem alcohol drinkers: a randomized controlled trial in community-based primary care practices. *JAMA* 1997;277(13):1039-1045.
6. U.S. Preventive Services Task Force. Screening and behavioral counseling interventions in primary care to reduce alcohol misuse: Recommendation statement. *Ann Intern Med* 2004;140:554-556.
7. Maciosek MV, Coffield AB, Flottemesch TJ, Edwards NM, Solberg LI. Greater use of preventive services in U.S. health care could save lives at little or no cost. *Health Aff (Millwood)* 2010;29(9):1656-60.
8. Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Brief physician advice for problem drinkers: long-term efficacy and benefit-cost analysis. *Alcohol Clin Exp Res* 2002;26(1):36-43.
9. Bradley KA, Williams EC, Achtmeyer CE, Volpp B, Collins BJ, Kivlahan DR. Implementation of evidence-based alcohol screening in the Veterans Health Administration. *Am J Manag Care* 2006;12(10):597-606.
10. Department of Veterans Affairs. VHA Support Service Center Trip Pack Report II. Available from: <http://reports2.vssc.med.va.gov/ReportServer/Pages/ReportViewer.aspx?%2fMgmtReports%2fTripPack%2fTripPackII&rs:Command=Render>. Accessed March 26, 2012.
11. Hawkins EJ, Kivlahan DR, Williams EC, Wright SM, Craig T, Bradley KA. Examining quality issues in alcohol misuse screening. *Subst Abus* 2007;28(3):53-65.
12. Williams EC, Johnson ML, Lapham GT, Caldeiro RM, Chew L, Fletcher GS, et al. Strategies to implement alcohol screening and brief intervention in primary care settings: a structured literature review. *Psychol Addict Behav* 2011;25(2):206-14.
13. Kaner EF, Wutzke S, Saunders JB, Powell A, Morawski J, Bouix JC. Impact of alcohol education and training on general practitioners' diagnostic and management skills: findings from a World Health Organization collaborative study. *J Stud Alcohol* 2001;62(5):621-7.
14. Kuehn BM. Despite benefit, physicians slow to offer brief advice on harmful alcohol use. *JAMA* 2008;299(7):751-3.
15. Kerr EA, Fleming B. Making performance indicators work: experiences of US Veterans Health Administration. *BMJ* 2007;335(7627):971-973.
16. Hunt DK, Haynes BR, Hanna SE, Smith K. Effects of computer-based clinical decision support systems on physician performance and patient outcomes: A systematic review. *JAMA* 1998;280(15):1339-1346.

17. Jha AK, Wright SM, Perlin JB. Performance measures, vaccinations, and pneumonia rates among high-risk patients in Veterans Administration health care. *Am J Public Health* 2007;97(12):2167-72.
18. Department of Veterans Affairs and Department of Defense. Substance Use Disorders: VA/DoD Clinical Practice Guideline 2009. Available from: <http://www.healthquality.va.gov>. Accessed March 8, 2012.
19. Centers for Medicare and Medicaid Services. Decision Memo for Screening and Behavioral Counseling Interventions in Primary Care to Reduce Alcohol Misuse (CAG-00427N) Available from: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=249#_ftn29. Accessed March 8, 2012.; 2011.
20. Wolfe J. Medicare Approves Screenings for Depression, Alcohol Misuse Available from: <http://psychnews.psychiatryonline.org/newsarticle.aspx?articleid=180837>. Accessed March 8, 2012.: American Psychiatric Association; 2011.
21. National Institute on Alcohol Abuse and Alcoholism, US Department of Health and Human Services, National Institute of Health. Helping Patients Who Drink Too Much: A Clinician's Guide (Update of 2005 Guide); 2007. Report No.: NIH Publication 07-3769. .
22. Whitlock EP, Polen MR, Green CA, Orleans T, Klein J. Behavioral counseling interventions in primary care to reduce risky/harmful alcohol use by adults: A summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med* 2004;140:557-568.
23. Bradley KA, Bush KR, Epler AJ, Dobie DJ, Davis TM, Sporleder JL, et al. Two brief alcohol-screening tests From the Alcohol Use Disorders Identification Test (AUDIT): validation in a female Veterans Affairs patient population. *Arch Intern Med* 2003;163(7):821-9.
24. Bush K, Kivlahan DR, McDonell MB, Fihn SD, Bradley KA. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Arch Intern Med* 1998;158(16):1789-95.
25. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcoholism, Clinical and Experimental Research* 2007;31(7):1208-17.
26. Kinder LS, Bryson CL, Sun H, Williams EC, Bradley KA. Alcohol screening scores and all-cause mortality in male Veterans Affairs patients. *J Stud Alcohol Drugs* 2009;70(2):253-60.
27. Frank D, DeBenedetti AF, Volk RJ, Williams EC, Kivlahan DR, Bradley KA. Effectiveness of the AUDIT-C as a screening test for alcohol misuse in three race/ethnic groups. *J Gen Intern Med* 2008;23(6):781-7.
28. Au DH, Kivlahan DR, Bryson CL, Blough D, Bradley KA. Alcohol Screening Scores and Risk of Hospitalizations for GI Conditions in Men. *Alcohol Clin Exp Res* 2007;31(3):443-51.
29. Rehm J, Irving H, Ye Y, Kerr WC, Bond J, Greenfield TK. Are lifetime abstainers the best control group in alcohol epidemiology? On the stability and validity of reported lifetime abstinence. *Am J Epidemiol* 2008;168(8):866-71.
30. Shaper AG, Wannamethee G, Walker M. Alcohol and mortality in British men: explaining the U-shaped curve. *Lancet* 1988;2(8623):1267-73.
31. Liang W, Chikritzhs T. Reduction in alcohol consumption and health status. *Addiction* 2010.
32. Platt A, Sloan FA, Costanzo P. Alcohol-consumption trajectories and associated characteristics among adults older than age 50. *J Stud Alcohol Drugs* 2010;71(2):169-79.

33. Skogen JC, Mykletun A, Ferri CP, Bebbington P, Brugha T, Coid J, et al. Mental and personality disorders and abstinence from alcohol: results from a national household survey. *Psychol Med* 2010;1-10.
34. Karlamangla A, Zhou K, Reuben D, Greendale G, Moore A. Longitudinal trajectories of heavy drinking in adults in the United States of America. *Addiction* 2006;101(1):91-9.
35. Matzger H, Delucchi K, Weisner C, Ammon L. Does marital status predict long-term drinking? Five-year observations of dependent and problem drinkers. *J Stud Alcohol* 2004;65(2):255-65.
36. Fillmore KM. Women's drinking across the adult life course as compared to men's. *Br J Addiction* 1987;82:801-811.
37. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *J Clin Epidemiol* 1992;45(6):613-9.
38. Harris AH, Bradley KA, Bowe T, Henderson P, Moos R. Associations between AUDIT-C and mortality vary by age and sex. *Popul Health Manag* 2010;13(5):263-8.
39. Harris AH, Bryson CL, Sun H, Blough D, Bradley KA. Alcohol Screening Scores Predict Risk of Subsequent Fractures. *Subst Use Misuse* 2009;44:1055-1069.
40. Rubinsky AD, Kivlahan DR, Volk RJ, Maynard C, Bradley KA. Estimating risk of alcohol dependence using alcohol screening scores. *Drug and Alcohol Dependence* 2010;108(1-2):29-36.
41. Ware JH, Lipsitz S, Speizer FE. Issues in the analysis of repeated categorical outcomes. *Stat Med* 1988;7(1-2):95-107.
42. Chen PL, Wong E, Dominik R, Steiner MJ. A transitional model of barrier methods compliance with unbalanced loss to follow-up. *Stat Med* 2000;19(1):71-82.
43. Heagerty PJ. Marginalized transition models and likelihood inference for longitudinal categorical data. *Biometrics* 2002;58(2):342-51.
44. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 1986;42(1):121-30.
45. Hendrick RE, Helvie MA. Mammography screening: a new estimate of number needed to screen to prevent one breast cancer death. *AJR Am J Roentgenol* 2012;198(3):723-8.
46. O'Connor EA, Whitlock EP, Beil TL, Gaynes BN. Screening for depression in adult patients in primary care settings: a systematic evidence review. *Ann Intern Med* 2009;151(11):793-803.
47. Saslow D, Runowicz CD, Solomon D, Moscicki AB, Smith RA, Eyre HJ, et al. American Cancer Society guideline for the early detection of cervical neoplasia and cancer. *CA Cancer J Clin* 2002;52(6):342-62.
48. US Preventive Services Task Force. Screening for cervical cancer. 2003.
49. United States Department of Labor. Bureau of Labor Statistics, Occupational Employment Statistics May 2011. Available from: <http://www.bls.gov/oes/current/oes291111.htm>. Accessed April 18, 2012.
50. Bradley KA, Johnson ML, Williams EC. Commentary on Nilsen et al. (2011): the importance of asking patients-the potential value of patient report of brief interventions. *Addiction* 2011;106(10):1757-9.
51. Centers for Medicare and Medicaid Services. Medicare Fee Schedule 2012. Available from: <http://www.trailblazerhealth.com/Tools/Fee%20Schedule/medicarefeeschedule.aspx>. Accessed April 18, 2012.

52. Steinbrook R. Health care and the American Recovery and Reinvestment Act. *N Engl J Med* 2009;360(11):1057-60.
53. Humphrey LL, Helfand M, Chan BK, Woolf SH. Breast cancer screening: a summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med* 2002;137(5 Part 1):347-60.
54. Wilkins T, Reynolds PL. Colorectal cancer: a summary of the evidence for screening and prevention. *Am Fam Physician* 2008;78(12):1385-92.
55. Bradley KA, Lapham GT, Hawkins EJ, Achtmeyer CE, Williams EC, Thomas RM, et al. Quality concerns with routine alcohol screening in VA clinical settings. *J Gen Intern Med* 2011;26(3):299-306.
56. Kashner T. Agreement between administrative files and written medical records: a case of the Department of Veterans Affairs. *Medical Care* 1998;36(9):1324-36.
57. Hamlett-Berry K, Davison J, Kivlahan DR, Matthews MH, Hendrickson JE, Almenoff PL. Evidence-based national initiatives to address tobacco use as a public health priority in the Veterans Health Administration. *Mil Med* 2009;174(1):29-34.
58. Tsai J, Edens EL, Rosenheck RA. Nicotine dependence and its risk factors among users of veterans health services, 2008-2009. *Prev Chronic Dis* 2011;8(6):A127.
59. Saitz R. Clinical practice. Unhealthy alcohol use. *N Engl J Med* 2005;352(6):596-607.
60. Agha Z, Lofgren RP, VanRuiswyk JV, Layde PM. Are patients at Veterans Affairs medical centers sicker? A comparative analysis of health status and medical resource use. *Arch Intern Med* 2000;160(21):3252-7.
61. Singh JA, Borowsky SJ, Nugent S, Murdoch M, Zhao Y, Nelson DB, et al. Health-related quality of life, functional impairment, and healthcare utilization by veterans: veterans' quality of life study. *J Am Geriatr Soc* 2005;53(1):108-13.
62. Hynes DM, Koelling K, Stroupe K, Arnold N, Mallin K, Sohn MW, et al. Veterans' access to and use of Medicare and Veterans Affairs health care. *Med Care* 2007;45(3):214-23.
63. Wei LJ, Stram DO. Analysing repeated measurements with possibly missing observations by modelling marginal distributions. *Stat Med* 1988;7(1-2):139-48.
64. Rehm J, Mathers C, Popova S, Thavorncharoensap M, Teerawattananon Y, Patra J. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *Lancet* 2009;373(9682):2223-33.
65. Bertholet N, Daepfen JB, Wietlisbach V, Fleming M, Burnand B. Reduction of alcohol consumption by brief alcohol intervention in primary care: systematic review and meta-analysis. *Arch Intern Med* 2005;165(9):986-95.
66. Fleming MF, Mundt MP, French MT, Manwell LB, Stauffacher EA, Barry KL. Benefit-cost analysis of brief physician advice with problem drinkers in primary care settings. *Med Care* 2000;38(1):7-18.
67. Maciosek MV, Coffield AB, Edwards NM, Flottesmesch TJ, Goodman MJ, Solberg LI. Priorities among effective clinical preventive services results of a systematic review and analysis. *Am J Prev Med* 2006;31(1):52-61 (see erratum page 458 Volume 32, Number 5).
68. Babor TE, Higgins-Biddle J, Dauser D, Higgins P, Burleson JA. Alcohol screening and brief intervention in primary care settings: implementation models and predictors. *J Stud Alcohol* 2005;66(3):361-8.
69. Nilsen P, Aalto M, Bendtsen P, Seppa K. Effectiveness of strategies to implement brief alcohol intervention in primary healthcare. A systematic review. *Scand J Prim Health Care* 2006;24(1):5-15.

70. Kizer KW, Dudley RA. Extreme makeover: Transformation of the Veterans Health Care System. *Annu Rev Public Health* 2009;30:313-39.
71. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *N Engl J Med* 2003;348(22):2218-27.
72. Fung CH, Woods JN, Asch SM, Glassman P, Doebbeling BN. Variation in implementation and use of computerized clinical reminders in an integrated healthcare system. *Am J Manag Care* 2004;10(11 Pt 2):878-85.
73. Williams EC, Lapham G, Achtmeyer CE, Volpp B, Kivlahan DR, Bradley KA. Use of an Electronic Clinical Reminder for Brief Alcohol Counseling is Associated with Resolution of Alcohol Misuse. *J Gen Intern Med* 2010;25(1):11-18.
74. Goulet JL, Erdos J, Kancir S, Levin FL, Wright SM, Daniels SM, et al. Measuring performance directly using the veterans health administration electronic medical record: a comparison with external peer review. *Med Care* 2007;45(1):73-9.
75. Samet JH, Rollnick S, Barnes H. Beyond CAGE. A brief clinical approach after detection of substance abuse. *Arch Intern Med* 1996;156(20):2287-93.
76. Bradley KA, Kivlahan DR, Williams EC. Brief approaches to alcohol screening: practical alternatives for primary care. *J Gen Intern Med* 2009;24(7):881-3.
77. Bradley KA, DeBenedetti AF, Volk RJ, Williams EC, Frank D, Kivlahan DR. AUDIT-C as a brief screen for alcohol misuse in primary care. *Alcohol Clin Exp Res* 2007;31(7):1208-17.
78. Kaner EFS, Heather N, Brodie J, Lock CA, McAvoy BR. Patient and practitioner characteristics predict brief alcohol intervention in primary care. *Br J Gen Pract* 2001;51(471):822-7.
79. Burman ML, Kivlahan DR, Buchbinder MB, Broglio K, Zhou XH, Merrill JO, et al. Alcohol-related advice for VA primary care patients: who gets it, who gives it? *J Stud Alc* 2004;65(5):621-630.
80. Volk RJ, Steinbauer JR, Cantor SB. Patient factors influencing variation in the use of preventive interventions for alcohol abuse by primary care physicians. *J Stud Alcohol* 1996;57(2):203-9.
81. Bryson CL, Au DH, Sun H, Williams EC, Kivlahan DR, Bradley KA. Alcohol Screening Scores and Medication Nonadherence: A Cohort Study. *Annals of Internal Medicine* 2008;149(11):795-803.
82. Rubinsky AD, Kivlahan DR, Volk RJ, Maynard C, Bradley KA. Screening for risk of alcohol dependence using stratum-specific likelihood ratios. *Drug and Alcohol Dependence* 2009;In press.
83. Zou G. A modified poisson regression approach to prospective studies with binary data. *Am J Epidemiol* 2004;159(7):702-6.
84. Greenland S. Model-based estimation of relative risks and other epidemiologic measures in studies of common outcomes and in case-control studies. *Am J Epidemiol* 2004;160(4):301-5.
85. Anderson P, Laurant M, Kaner E, Wensing M, Grol R. Engaging general practitioners in the management of hazardous and harmful alcohol consumption: results of a meta-analysis. *J Stud Alcohol* 2004;65(2):191-9.
86. Gomel MK, Wutzke SE, Hardcastle DM, Lapsley H, Reznik RB. Cost-effectiveness of strategies to market and train primary health care physicians in brief intervention techniques for hazardous alcohol abuse. *Soc Sci Med* 1998;47(2):203-11.

87. Kaner E, Heather N, McAvoy BR, Lock CA, Gilvarry E. Intervention for excessive alcohol consumption in primary health care: Attitudes and practices of English general practitioners. *Alcohol* 1999;34(4):559-566.
88. Seale JP, Shellenberger S, Tillery WK, Boltri JM, Vogel R, Barton B, et al. Implementing alcohol screening and intervention in a family medicine residency clinic. *Subst Abuse* 2005;26(1):23-31.
89. Rose HL, Miller PM, Nemeth LS, Jenkins RG, Nietert PJ, Wessell AM, et al. Alcohol screening and brief counseling in a primary care hypertensive population: a quality improvement intervention. *Addiction* 2008;103(8):1271-80.
90. McGlynn EA, Asch SM, Adams JL, Keesey J, Hicks J, DeCristofaro A, et al. The quality of health care delivered to adults in the United States. *N Engl J Med* 2003;348(26):2635-45.
91. Yarnall KSH, Pollak KI, Ostbye T, Krause KM, Micchener JL. Primary care: Is there enough time for prevention? *Am J Public Health* 2003;93(4):635-641.
92. Aalto M, Hyvonen S, Seppa K. Do primary care physicians' own AUDIT scores predict their use of brief alcohol intervention? A cross-sectional survey. *Drug Alcohol Depend* 2005.
93. McCormick KA, Bradley KA, Cochran NE, Back AL, Merrill JO, Williams EC. How primary care providers talk to patients about alcohol: a qualitative study. In: *Society of General Internal Medicine*; 2004; Chicago, Illinois: submitted; 2004.
94. Bradley KA, Epler A, Bush K, Sporleder JL, Dunn CW, Cochran NE, et al. Alcohol-related discussions during general medicine appointments of patients who screen positive for at-risk drinking. *J Gen Intern Med* 2002;17(5):315-27.
95. Stange KC, Zyzanski SJ, Jaen CR, Callahan EJ, Kelly RB, Gillanders WR, et al. Illuminating the 'black box'. A description of 4454 patient visits to 138 family physicians. *J Fam Pract* 1998;46(5):377-89.
96. WHO Brief Intervention Study Group. A cross-national trial of brief interventions with heavy drinkers. *Am J Public Health* 1996;86(7):948-955.
97. Saleem JJ, Patterson ES, Militello L, Render ML, Orshansky G, Asch SM. Exploring barriers and facilitators to the use of computerized clinical reminders. *J Am Med Inform Assoc* 2005;12(4):438-47.
98. Babor T, Higgins-Biddle J. Alcohol screening and brief intervention: dissemination strategies for medical practice and public health. *Addiction* 2000;95(5):677-86.

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