Identification and Referral of Impaired Drivers Through Emergency Department Protocols

of Transportation
National Highway
Traffic Safety
Administration

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DOT HS 809 412
March 2002

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 809 412		

4. Title and Subtitle	5. Report Date
Identification and Referral of Impaired Drivers Through Emergency Department Protocols	February 2002
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Runge, J.; Garrison, H,; Hall, W.;Waller, A.; and Shen, G.	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Carolinas HeathCare System	11. Contract or Grant No. DTNH22-97-DH-15072
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration Office of Research and Traffic Records Research and Evaluation Division 400 7th Street, S.W., Washington, D.C. 20590	13. Type of Report and Period Covered Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes
Jon Walker and Amy Berning were the Contracting Officer's Technical Representatives on this project.

16. Abstract
Objectives: Of patients treated in the emergency department (ED) following motor vehicle crash (MVC), 15-20% are at high risk for alcohol abuse or alcohol dependency (AA/AD), and are likely to drive after drinking. In order to intervene with patients at high risk in the ED, a reliable and quick screening procedure and a method of intervention must be available. We investigated whether an ED intervention protocol to identify and refer patients with AA/AD would result in more patients receiving treatment and evaluation for substance abuse.
Methods: The prospective, randomized, controlled study was performed at two EDs with a combined census of 120,000 patients of driving age. Consecutive patients over 17 years of age treated in the ED for MVC injury from 10 AM to 10 PM over a 1 year period were studied. Excluded were patients admitted greater than 24 hours, unconscious or too impaired to cooperate with the questions, and those who could not communicate in English. Patients were screened for AA/AD using a previously validated screening tool (TWEAK). Those at high risk of AA/AD were randomized to a group receiving the intervention protocol or to a control group (no intervention). The intervention protocol was a standard scripted protocol used by all interviewers, ending with a recommendation for definitive evaluation and treatment. Patients were followed up by phone at 3 and 6 months. Groups were compared to determine the likelihood of actually receiving treatment for AA/AD.
Results: Of those receiving the intervention, 25 out of 130 (19.2%) received a formal evaluation, compared to 7 out of 157 (4.5%) in the control group [OR = 5.1, 95%, CI = 2.128 – 12.235]. Of those persons who agreed to an evaluation, 21 out of 43 (48.8%) showed up for the evaluation.
Conclusion: An ED protocol for screening and intervention for patients at high risk of AA/AD increases the likelihood of receiving definitive treatment for AA/AD.

17. Key Words	18. Distribution Statement
Drinking and Driving DWI, DUI Alcohol Screening Brief Interventions	This report is available from the National Technical Information Service in Springfield, Virginia 22161 (703) 605-6000; and free of charge at the National Highway Traffic Safety Administration's website at www.nhtsa.dot.gov

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price

Background and Rationale

The problem of alcohol impairment as a cause of motor vehicle crash (MVC) injury and death is well documented. Approximately 40% of motor vehicle fatalities are related to the use or abuse of alcohol. This problem is a public health emergency mandating aggressive intervention by the health care community. The National Highway Traffic Safety Administration (NHTSA), through its Partners in Progress initiative, has encouraged the health care community to address alcohol use and impaired driving, through its own initiatives and in partnership with law enforcement and other governmental entities.

Physicians, particularly trauma physicians working in the emergency department (ED) and elsewhere within trauma centers, may be in a key position to intervene with patients at high risk for motor vehicle crash injury. Accordingly, patients in the ED for any reason may be identified as being at high risk of driving while impaired by alcohol through the use of established screening tools. Those patients screening positive for alcohol abuse or alcohol dependency (AA/AD) may be referred for definitive evaluation and treatment.

We undertook this project focusing on the population of drivers who abuse alcohol or who are alcohol dependent and presented to the ED following a MVC. Patients who abuse alcohol are more likely to drive after drinking. They are also more likely to have a crash while sober, due to greater risk-taking behavior.[1] This population is well known to escape detection by police if taken to the ED for treatment of crash injury.[2] Approximately 20% of patients treated in the ED following a MVC are at high risk for AA/AD.[3] Since more than 90% of them are discharged home from the emergency departments (ED), it is imperative to determine the usefulness of a process for screening, intervention, and initiating a plan for treatment while the patient is still in the ED. We therefore sought to determine the efficacy of an emergency department based intervention program for identifying and referring persons at high risk of AA/AD to substance abuse treatment programs, and to determine what factor or combination of factors best predicts treatment enrollment. If the intervention is effective, individuals at high risk for further alcohol-impaired driving could be identified and referred in a structured fashion for alcohol dependency treatment through a standardized emergency department protocol that could be reproduced throughout the nation.

Methods

Design

The study was prospective, randomized, and controlled. Patients were randomized 1:1 to the intervention or control. A prospective study is one in which patients are enrolled as they become known to be eligible, in contrast to a retrospective study of records or databases. Randomization is a process for assigning study patients to a group. A 1:1 randomization is similar to flipping a coin. A controlled study is one in

which the group on which the intervention is tested is matched against a group on which the intervention is not tested, to serve as a control.

Setting

Patients were enrolled at two emergency departments, Carolinas Medical Center, located in a urban setting in Charlotte, North Carolina, and Pitt County Memorial Hospital in Greenville, North Carolina, a small city - rural setting. The two EDs have a combined annual census of approximately 150,000. Patients of driving age constitute 75-80% of that total. An analysis prior to the beginning of the study estimated that 9,000 to 12,000 MVC related injuries were likely to be treated in the two EDs during the study period.

Carolinas Medical Center

Carolinas Medical Center (CMC) is an 843-bed academic medical center located in Charlotte, North Carolina's largest city with a metropolitan area of 1.2 million. It is the region's designated trauma center, with over 2,000 admissions yearly to its trauma service. The CMC Department of Emergency Medicine is a department of 23 full-time academic faculty, 30 residents, and 4 fellows in a 50 bed ED facility with an annual census of approximately 100,000. Virtually all severely injured patients from motor vehicle crashes in the region are taken to CMC. A large volume of ambulatory patients is cared for as well. All ED visits are recorded on a computer database with codes to indicate external cause of injury for all injured patients, enabling an accurate measure of the population baseline.

CMC is the central hospital of Carolinas Health Care System (CHS). CHS is a multi-hospital network, including the Center for Behavioral Health, which operates inpatient and outpatient treatment centers for alcohol disorders, other substance abuse disorders, and dual diagnosis. Nurses and counselors staff an emergency phone line 24 hours per day to assist with referral of patients for substance abuse treatment. This phone line was used at the CMC site for this study. Patients were referred to one of two evaluation centers, depending upon their third party payer requirements.

Pitt County Memorial Hospital

Pitt County Memorial Hospital (PCMH) is a 740-bed tertiary academic medical center located in Greenville, North Carolina, in the middle of the most rural part of North Carolina. It is its region's designated Level I trauma center, with 1,200 annual trauma admissions. The PCMH Emergency Department has an annual census of approximately 52,000. The medical center is the only hospital in Pitt County, North Carolina, and the only tertiary medical center for a 100-mile radius. The medical center serves a population base of both semi-urban and rural communities in eastern North Carolina, including all severely injured patients as well as many others transported by emergency medical services (EMS).

Substance abuse services in Pitt County were provided by the county mental health system and by private practitioners.

University of North Carolina at Chapel Hill

The fundamental mission of the UNC Highway Safety Research Center (HSRC) is to conduct basic and applied research that increases knowledge and contributes to reducing death, injury, and the related societal costs. HSRC strives to translate developed knowledge into practical interventions that can be applied at local, state, national and international levels. The expertise of the HSRC was therefore employed to take advantage of research planning experience in the area of highway traffic safety, as well as extensive experience in the management of large research databases from multiple sites. Investigators from the UNC School of Medicine, Department of Emergency Medicine provided the clinical research monitoring function, as well as assistance in data maintenance.

Population

Consecutive patients sustaining motor vehicle injury presenting at the two EDs between the hours of 10 a.m. and 10 p.m. during a 1-year period were studied. Motor vehicle injury was defined as an injury occurring to persons injured as motor vehicle drivers or occupants, including motorcycles and mopeds, as well as pedestrians and bicyclists. Thus, patients enrolled in the study were not necessarily drivers in the crash that just occurred, but because of age, all were potential drivers, and therefore at the same risk of driving after drinking, whether they had been the driver in this particular occurrence. We also did not account for culpability in the crash, since that information was not known to the interviewers and is a matter for the courts.

Excluded were patients who were admitted to the hospital outside of the ED Observation unit, those who were unconscious or too impaired to cooperate with the questions, and those who could not communicate in English sufficiently to comprehend the consent process or the questions being posed by the research assistants.

The hours of 10:00 AM to 10:00 PM were chosen because of the cost limitations of 24-hour staffing for the study with respect to the relatively low volume of eligible patients presenting from 10:00 PM to 10:00 AM. A histogram of presentation times for eligible patients created during the planning phase revealed a small peak in crash frequency during the morning rush hour followed by a steady increase in crash frequency into the evening hours. The data collection schedule was designed to capture the later end of the morning rush hour crashes prior to patients' disposition from the ED, as well as the evening peak. Although it was anticipated that the proportion of alcohol-related crashes would increase as the day progresses, morning crashes should be just as likely to yield high risk patients appropriate for randomization, since a large proportion of patients involved in daytime crashes, sober or not, will be alcohol dependent.[4,5] It would therefore not be useful to concentrate solely on alcohol-related crashes for this study. Rather, the high risk patient who is not currently intoxicated is

more likely to be a candidate for intervention, and should be the subject of systematic prevention efforts.

Patients younger than 18 years of age were not included in the study for two reasons. First, there was the practical limitation imposed by the need for, and difficulty of, obtaining consent from parents prior to entering minors into the study. Second, the investigators believe that any patient under 18 years of age who is injured in a crash with a positive breath alcohol should receive the maximum intervention available to the ED, without being subjected to the control group.

Prior to starting the study, the target sample size was estimated to be approximately 5,000. This sample size was derived through the following rationale: Recent research conducted in Michigan by Maio and colleagues reported that 19% (222) of the 1,161 motor vehicle injury victims screened for AA/AD were positive for current AA/AD.[3] An additional 3% (30) of the patients who screened negative for current AA/AD tested positive for elevated levels of ethanol in blood, breath, or serum (22 mmol/L, 0.10 g/dl). Based on these results, we assumed that 1,000 (20%) of the 5,000 initial screens would be eligible for referral to AA/AD counseling. Under the research protocol, persons eligible for referral to AA/AD counseling were to be randomly assigned to either the treatment group (intervention and referral) or to the control group (no intervention or referral other than that made under existing standard of care, by the court system, or self-referral). Thus, 500 persons each would be assigned to the treatment and control groups. Past research suggests that 12% - 19% of the persons in the control group may seek counseling on their own or be referred by the court system.[6] For purposes of establishing target sample size, we used the figure of 15%. The goal of this demonstration project was to increase the proportion of persons seeking AA/AD counseling by at least 50% (p_0 = .15, p_1 = .225). At the .05 level of significance for a one-sided test, a sample size of 500 in each group would be able to detect this difference at a power of 0.92. We assumed that some portion of the cases would result in incomplete data and would not be available for analysis in both treatment and control groups. Even if 20% of the cases are lost, sample sizes of 400 in each of the groups would be able to detect at difference of 50% (p_0 = .15, p_1 = .225) at a power of 0.86.

Research Interventions

Each site employed dedicated research assistants to screen patients and collect data. The two lead Research assistants were trained in counseling at the Master's or PhD level. The other Research assistants were either experienced counselors at the Bachelor's degree level or were studying for a Master's degree. All Research assistants were trained together in the protocol and the principles of screening and intervention in a training session prior to the study. The principal investigator and a psychiatrist with a sub-specialty in addictions conducted the training. During the study hours, the Research assistants were present in the ED and monitored the ED log and status boards to identify all patients aged 18 and older being treated for a motor vehicle related injury. Once identified, the Research Assistant kept a record of each patient eligible for screening, consisting of name and medical history. The Research Assistant

approached each patient to be screened, made an introduction, and informed the patient verbally about the research project with patients sustaining motor vehicle related injury. Patients were assured of confidentiality, and verbal consent was obtained. Patients were made aware that they could withdraw at any time. Patients were not made aware of the objective of the study, since that knowledge would bias the answers and confound the study.

The Research assistants were responsible for the entire patient interaction and data entry, and their activities were totally independent of the ED nurses and physicians. The findings of screening or the results of interventions were not communicated to the physicians or nurses to avoid altering their interactions with the patients.

The Research Assistant asked the patient a series of questions, lasting less than five minutes, about their future risk of being in a MVC, including standardized questions about speed of driving, seat belt use and alcohol use (Appendix 1). The alcohol questions posed were actually the TWEAK screening tool (Appendix 2). Patients were then informed that the alcohol in the air was being measured. If serum alcohol content was obtained by the treating physician for clinical reasons not related to the study and available to the Research Assistant, it was also recorded in the case report form.

Patients who were A) TWEAK positive (score $\geq$ 2) or B) had a quantitative breath alcohol (BAC) of 0.12 or higher were randomized to intervention or control. Patients randomized to the control were thanked for their cooperation, and were reminded that we would call them in 3 months and 6 months to follow up to see how well they were doing. Patients randomized to the intervention received a brief intervention at that point administered by the Research Assistant using a standard protocol called ED DIRECT (Appendix 3). This intervention approach was created for the study by a psychiatrist specializing in addictions. ED DIRECT is an adaptation of the FRAMES methodology employed in primary care and behavioral heath settings and takes only a few minutes to perform. [7] Concluding the intervention is the recommendation that the patient undergo a formal assessment by a specialist to see if the problem requires treatment.

Following the intervention, patients who agreed to further evaluation were offered an appointment on the spot. Patients who refused the evaluation were regarded as treatment failures. These data were recorded contemporaneous with the patient interaction. Other data were recorded from the medical record, including demographic data and injury diagnoses. All data were entered into the database, and uploaded at convenient intervals to the central site.

Selection of the Screening Tool

The use of screening tools to detect alcohol dependency in a health care setting has been thoroughly described. There are several screening tests for alcohol problems that are used in the general health care setting, including CAGE, AUDIT, Michigan Alcohol Screening Test (MAST), brief MAST, and TWEAK. A minimally trained

individual can perform these rapid screening tools in only a few minutes. If a screening instrument for any medical condition is to be successful in the ED, it must be able to be administered quickly and have high sensitivity, even if specificity must be established over time.

AUDIT was developed for the primary care setting, and was shown to be sensitive for harmful drinking in a six-nation validation study, and has been recognized by the World Health Organization. {Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption. *Addiction* 1993; 88: 791-804 1992} CAGE is favored by many because of its brevity, it is easily remembered, and it can be worked in easily to the medical history. (Ewing JA. Detecting alcoholism: the CAGE questionnaire. JAMA 1984; 252:1905) TWEAK is similar to CAGE, but adds detection of physiologic tolerance, and asks about current usage, as opposed to life experience (Appendix 2). It has been found to be of high sensitivity and specificity in both primary care and general populations.

Each of these tests has its advantages, and comparison studies are few. A recently released report to NHTSA compared some of these tests for sensitivity and specificity, but did not include TWEAK.[8] More recently, Cherpitel assessed the sensitivity and specificity of rapid alcohol screening tools that can be applied in the ED in a study performed in a level 1 trauma center in the southern United States.[9] The screening tools were compared to a lengthy "gold standard" interview for the diagnosis of harmful drinking or alcohol dependence. Two screening tools--the TWEAK and AUDIT-- demonstrated sensitivities of 83% and 81% respectively. Sensitivity was highest in those individuals who were injured, male, and nonwhite, and was much higher than that for breath alcohol analysis and self-reported drinking (sensitivity 20% and 29% respectively).

The TWEAK was therefore chosen for this study in view of its demonstrated high sensitivity in a similar setting to our EDs, its speed and ease of use, and questions that seem less likely to be threatening following involvement in a MVC.

Breath Alcohol Content

Although breath alcohol content (BAC) itself is not sensitive for detecting alcohol dependency, breath levels greater than 0.14 in a patient who is coherent and able to ambulate is an unequivocal indication of tolerance to the drug, and is therefore a specific indicator of chronic intake.[1] Detection of a high BAC in a coherent patient would detect false negative self-reporting of tolerance in the TWEAK. We therefore postulated that the combination of TWEAK screening tool and the physiologic marker of high BAC would be more sensitive and specific for AA/AD than either test alone.

We employed the use of a passive alcohol sensor (PAS Vr. System, Public Service Technologies, Fredricksburg, VA) for the study. This device is a breath analyzer that analyzes a 10 cc sample of ambient air "inhaled" by the machine in the passive

mode, or it can be used in the active mode by having the subject blow into the device. No fixed correlation exists between the active and passive modes due to inconsistency in ambient air characteristics among measurements, but any error in the passive mode would tend to underestimate the BAC relative to the active mode. This particular instrument was graduated in increments of .04 g/dl, so that is was necessary to choose between BAC .12 and .16 as an entry criterion. Because of the likelihood of falsely low readings in the passive mode, we chose to include patients with BAC greater than or equal to .12 who were alert and oriented in an attempt to include all patients with alcohol tolerance.

For the purposes of our study, the manufacturer mounted the PAS into aluminum clipboards that also held the study documents. This enabled the research assistants to collect the air sample easily and efficiently without fumbling with devices and documents. Patients were informed of the purpose of the device, and were allowed to refuse or withdraw from the study at any time.

End Points and Follow Up

The primary end point of the study is whether or not the patient received the recommended evaluation. At one site, the endpoint determination was by self-report at follow up, and at the other, the agencies to which the patient was referred were contacted following the appointment date to determine whether the patient kept the appointment, in addition to self-report.

At three months and six months from the date of ED treatment, all reasonable attempts were made to contact all consenting patients by phone to obtain the following data regarding the period between the ED visit and follow up: If the patient

1. Received treatment for AA/AD,
2. Was involved in a subsequent MVC,
3. Was arrested for an alcohol related incident, including driving while impaired,
4. Received treatment for another injury.

The file for each patient was closed after the six-month follow up. Patients who could not be located were pursued by the Research Assistant until the end of the study. Those who could not be located were designated "lost to follow-up."

Six months after all subjects were entered into the database, HSRC cross-referenced the study records with DMV driver files, court records, North Carolina Hospital Discharge Database, and North Carolina Ambulance Call Report data to validate and augment the self-report data.

Data Analysis

Data were entered locally into a database written in Microsoft Access, and uploaded to the University of North Carolina at Chapel Hill for maintenance and

reporting. In addition, the UNC investigators also served as clinical monitors for the study to ensure consistency in data reporting between the two sites.

At the six-month point in data collection, the UNC investigators made an audit visit to each site to ensure consistency in data collection and study conduct. This coincided with a change in the lead research assistant at PCMH.

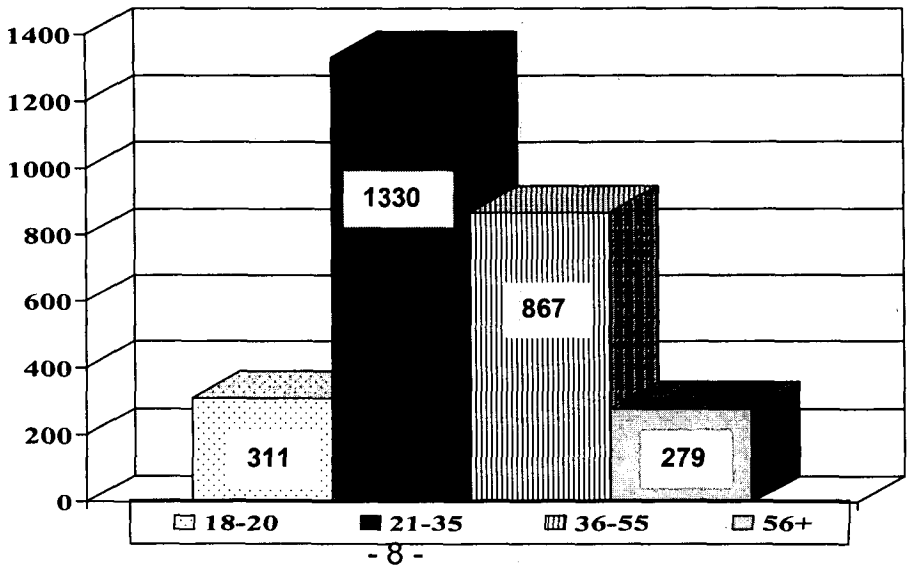
Data were analyzed with the assistance of the Institute for Health Services Research (IHSR) at CMC using standard summary and analytical statistics. The database was transferred to IHSR in December 1999.

Results

During the study period, 5,602 patients at the two centers were recorded as meeting the definition of MV related injury (CMC- 3,638, PCMH- 1,964) according to the screening log maintained by the Research assistants. Of these 4,257 were eligible for enrollment. Reasons for ineligibility were given as admitted to the hospital (574), deceased (23), found upon questioning not to have MV related injury (25), age < 18 years (504), and previous entry into this study (54), and other (165).

Of the 4,257 eligible for screening, consent to participate in the research could not be obtained in 1,470 (26%), leaving 2,844 consenting to the interview. Reasons for not getting consent were refusal by patient, family or attorney (360), severity of injury (322), concerns about confidentiality (197), treatment preventing access (130), language barrier (193), too intoxicated (32), and under arrest (13) or otherwise not available or not completed (166). The age group distribution of those screened is shown in Figure 1.

Figure 1



Of the 2,787 screened with TWEAK, 388 (13.9%) were TWEAK positive, 269 out of 1,752 (15.4%) at CMC and 119 out of 1,035 (11.5%) at PCMH (Table 1). TWEAK positive patients were considered high risk for AA/AD and were eligible for randomization. No patients were eligible to be randomized based on breath alcohol criteria.

Table 1

TWEAK	CMC	PCMH	Total
Negative	1483	916	**2399**
Positive Score of 2 or more	269	119	**388**
TOTAL	**1752**	**1035**	**2787**

Table 2 shows the TWEAK scores by site.

Table 2

TWEAK Score	CMC	ECU	Total
0	1402	856	2258
1	20	11	31
2	179	75	254
3	38	7	45
4	50	59	109
5	27	11	38
6	15	6	21
7	10	6	16
8	4	3	7
9	7	1	8

Table 3 shows the age, gender and race of those who were TWEAK positive. Patients who were older than 56 years were less likely to screen positive for AA/AD. Males were three times as likely to screen positive as females, and African Americans were less likely to screen positive relative to whites. Interracial effects of the

interviewers and the patients on the likelihood of screening positive could not be determined due to sample size.

Table 3

Age	**TWEAK + (%)** Score of 2 or more	**TWEAK – (%)**	**Odds Ratio (95% CI)**
18-20	46 (14.8)	265 (85.2)	3.862 (2.001-7.455)
21-35	225 (16.9)	1105 (83.1)	4.531 (2.497-8.221)
36-55	105 (12.1)	762 (87.9)	3.066 (1.660-5.661)
56+	12 (4.3)	267 (95.7)	--
Gender *			
Female	114 (7.7)	1374 (92.3)	--
Male	268 (21.5)	977 (78.5)	3.306 (2.616-4.178)
Race **			
White	183 (17.6)	858 (82.4)	--
African American	187 (12.0)	1369 (88.0)	0.640 (0.513-0.799)
Hispanic	4 (8.3)	44 (91.7)	0.426 (0.151-1.201)
Other	2 (11.8)	15 (88.2)	0.625 (0.142-2.757)
American Indian	0	9 (100)	NA
Asian	0	14 (100)	NA

* Gender not specified in 54 subjects
** Race not known or not specified in 102 subjects

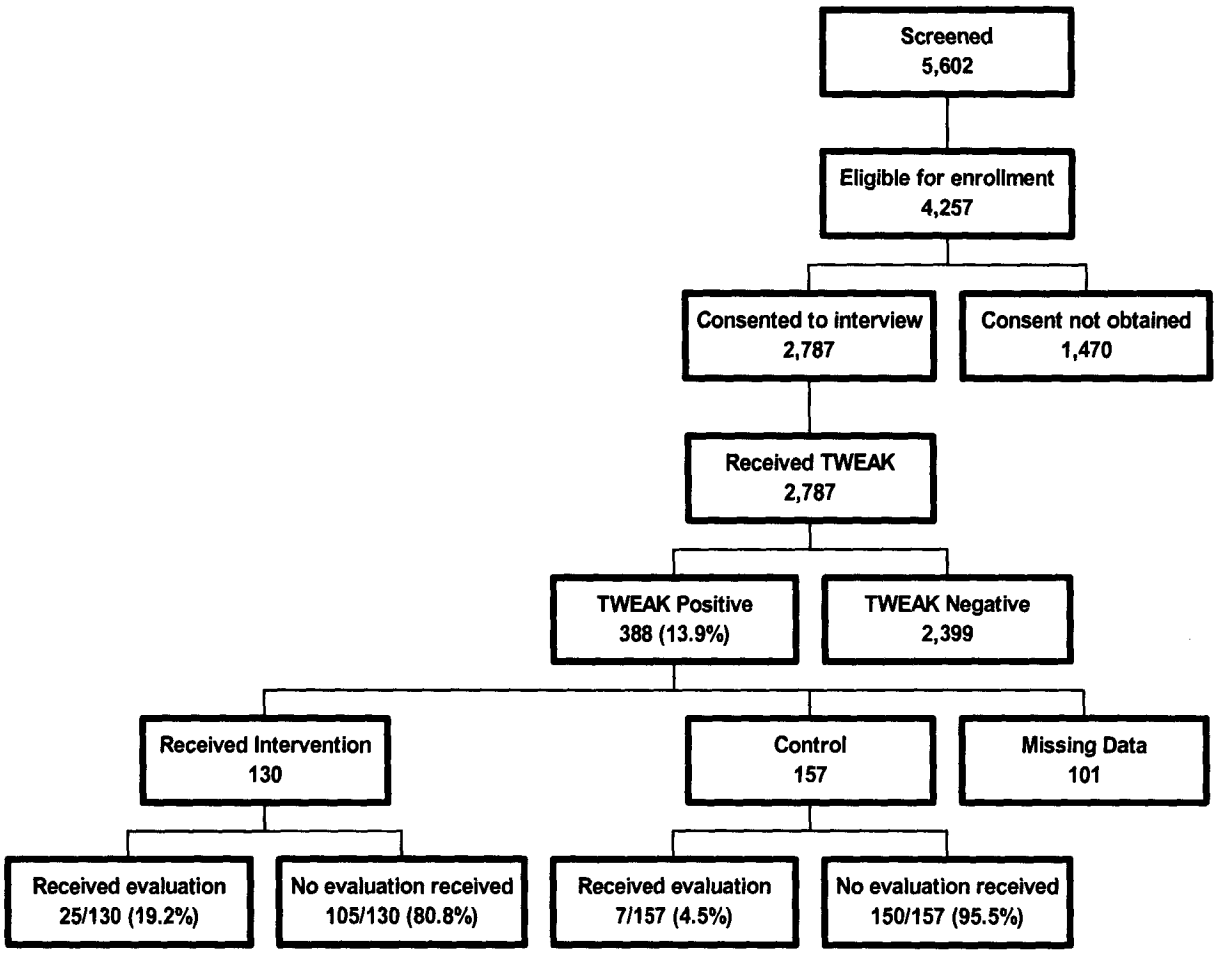
As seen in Figure 2, the 388 patients in the TWEAK Positive group were randomly assigned to the intervention group (n = 130) or to the control group (n= 157). One hundred and one subjects were lost in follow-up efforts and are counted as missing data[1].

Of the patients who screened as TWEAK positive, 97.0% agreed to be called for follow-up. Follow-up data were available from 265 patients at three months, and 243 at six months. Of those receiving the intervention, 25 out of 130 (19.2%) received a formal evaluation, which compares quite favorably to the 7 out of 157 (4.5%) in the control group [OR = 5.1, 95%, CI = 2.128 – 12.235).

Of the group that received the intervention and agreed to a formal evaluation, 21 out of 43 (48.8%) received the evaluation compared to 4 out of 87 (4.6%) who did not agree to a formal evaluation.

[1] For example, subjects with disconnected phones or a disavowing of knowledge of persons' existence by those who answered the phone.

FIGURE 2
DATA SUMMARY



Of those contacted at 3 months, 7 out of 265 reported being involved in a motor vehicle crash during that period (2.6%). We do not know whether they were a driver or a passenger in the subsequent crash. All 7 patients were in either the control group or the group that refused intervention. This is equivalent to an annualized crash rate of 106/1000, compared to the crash rate of 25/1000 nationally.[10] No patient who received the intervention and agreed to an evaluation had a subsequent crash. No patient reached for follow up had a crash between the 3-month and 6-month follow up.

The number of patients who were randomized and accepted the intervention was insufficient to allow for a multivariate analysis to determine specific factors that predict which patients are more likely to comply with referral for evaluation.

We are planning a follow up study to compare subsequent DWI convictions in the groups receiving the intervention and those who did not. We will also attempt to look at the group that refused the intervention to determine whether the group had more previous DWI charges than those who accepted the intervention.

Discussion

We have shown that high risk patients who receive an intervention for alcohol problems in the emergency department following a motor vehicle crash are more likely to seek a formal evaluation for alcohol problems than those patients treated under the current standard of care who receive no ED intervention.

As seen in Figure 2, of those receiving the intervention, 25 out of 130 (19.2%) received a formal evaluation, compared to 7 out of 57 (4.5%) in the control group. In fact, there was 5 times greater chance that they would seek a formal evaluation [OR = 5.1, 95%, CI = 2.128 – 12.235]. It should be noted, that for those persons who agreed to an evaluation, 21 out of 43 (48.8%) actually showed up.

The protocol used in this project is consistent with the role of emergency medicine in the health care system. Emergency medicine is the entry point into the health care system following a traumatic event or medical emergency. It is tasked with disease detection and intervention, and depends on referral for definitive care of chronic medical problems.

There were several components of this protocol that were likely essential to the differences between the groups. The use of a structured screening instrument embedded in questions regarding future risk of injury was non-threatening and provided reliable, validated evidence of alcohol problems. The simplicity and brevity of the "ED DIRECT" intervention was important in that it did not present an impediment to other care rendered in the ED. The availability of a referral destination was also essential, in that it provided a seamless way for patients to receive help, and the barrier of the patient's needing to negotiate the health care maze to receive follow up was removed.

Studies of injured, impaired drivers admitted to the hospital or the ED are numerous. All have come to the unanimous conclusion that alcohol impaired driving in this population is under-reported, patients are infrequently charged and even less frequently convicted, and that opportunity for intervention is lost.[4,5,11-14] This population is likely to drink and drive again and therefore likely to cause further injury or death. The National Commission Against Drunk Driving has recently published a position paper on the issue, with suggested state legislative remedies as well as concerted efforts by medical and law enforcement professionals.[15] The American College of Emergency Physicians has recently developed policy on the issue, calling for greater detection of potentially impaired drivers and greater awareness and provision for treatment of alcohol abuse and alcohol dependency.[16] Recognizing that those who abuse alcohol may also experience crash injury when sober, the net should be widened to detect

alcohol abusers when they interface with the health care system, not only when they exhibit impairment after a crash. In the study of screening tools by Cherpitel, 17% of "current drinkers" seen in the ED met standard criteria for harmful drinking and 19% met criteria for alcohol dependence, whether or not they had been drinking at the time.[9] Maio and colleagues found that 23% of MVC patients at their ED met criteria for AA/AD, although nearly half of those patients had no evidence of alcohol ingestion at the time they were seen in the ED.[3] We expected therefore that screening for AA/AD among patients treated for MVC injury would be a high yield test, worthy of the added time and effort.

Large numbers of patients were required for screening in order to detect those most at risk for harmful drinking. It is a disease with an approximate 15% prevalence in our population, which certainly justifies screening and detection. We chose to test the hypothesis using a 1:1 randomization scheme. In retrospect, a 2:1 or 3:1 randomization of intervention to control would have improved our number of patients getting the intervention and referral. This may have allowed for better discrimination of the factors predicting patients amenable to intervention and referral. Unfortunately, the numbers of patients accepting the intervention and subsequently receiving treatment were too small for a multivariate analysis.

There were differences between the two sites with respect to numbers of patients receiving treatment after having received the intervention. Although the reasons for this are not fully understood, there were inherent differences between the sites that may have implications for implementation of a clinical protocol. First, at CMC, the referral destination and the emergency department are part of the same health care organization. There is a 24-hour call center staffed by mental health nurses or counselors experienced in substance abuse counseling. Follow-up data were therefore much easier to acquire, since many patients were referred within the same hospital system. Patients who needed to be referred outside the system were referred to a single destination that had a protocol to report whether or not a patient kept the referral appointment. At PCMH, the patients were referred into a mental health system not specifically dedicated to substance abuse treatment. In smaller communities where patient volume is insufficient to support dedicated substance abuse centers, the general mental health system would often be the referral destination. Also, patients in that system who were referred to private substance abuse therapists were lost to follow up if they were not available for self reporting at three or six months. Second, the populations of the communities at the research sites differ. CMC is located in a large urban area, with crash injury patients widely distributed among different ages and races. PCMH is located in a small city with a high proportion comprised of students and faculty of East Carolina University. The extent to which site bias was introduced because of college students' different drinking habits and beliefs about drinking is not known. An important feature of this research that may have accounted for some of the difference between centers was the use of a standard intervention instrument by all research staff, irrespective of patient characteristics. It is possible that a more individualized intervention tailored to the needs of the patient and the style and experience of the research assistant may have resulted in greater compliance at PCMH.

Much of the follow-up data were limited by the inability of the research assistants to reach the patient by phone. The inherent limitations of self-reporting are well known and will not be reiterated, except to point out that some patients who agreed to evaluation and treatment may have been hesitant to report non-compliance to the same person that performed the intervention. It should also be noted that we were unable to detect the positive effects the intervention may have had, even if the patient refused to go for alcohol treatment. Many diseases such as hypertension often require multiple attempts to get patients to comply with treatment, and the disease of AA/AD is no exception.

Ideally all interviewers would have been multi-lingual due to an unexpected rise in the number of Spanish-only speaking patients in our emergency departments. There is insufficient data on the ethnology of alcohol-related vehicle injuries, but evidence indicated that drinking patterns are highly influenced by cultural norms, and awareness of driving laws is lacking in this population.[17,18] Our study would have been stronger if we could have been able to detect differences in risk, including ethnicity, but the language barrier precluded the use of the screening instrument by our research technicians.

It should be emphasized that a TWEAK score of three was felt to be insensitive to detect AA/AD in the ED following a crash. After the first three months of data collection, is became obvious to the interviewers that these patients were becoming apprehensive after the first two or three questions about their drinking behavior. The first two questions of the TWEAK test are meant to detect tolerance, which by itself is a good predictor of excessive drinking. Although many patients were forthright in answering the questions subsequent to the tolerance questions, it became clear that having a score of two, rather than three, should be considered a positive TWEAK score. Therefore, after consultation with our addiction psychiatrist consultant and with NHTSA, we decided to re-define a "positive" TWEAK score as two, allowing for the patient to be randomized even if only the tolerance questions were positive. This is internally consistent with the protocol, in that a patient could be randomized based on presence of physiologic tolerance alone using a high breath alcohol and lucidity as evidence.

The interview containing the TWEAK may itself have provided some motivation to change drinking behavior. It should be noted that seven patients randomized to the control group reported receiving help with their drinking subsequent to the ED visit. This suggests that in some people with preexisting insight or readiness to change, simply bringing up the issue of risk behaviors may be helpful.

The study was designed to gather data over a 12-month period. There were personnel issues that occurred during the year at both research sites that mandated a change in protocol. At one site, the lead Research Assistant left the employ of the institution for personal reasons. At the other site, the lead Research Assistant sustained a medical condition necessitating the hiring of a replacement. Because of institutional hiring protocols there was a hiatus in data acquisition. Therefore, in consultation with

the statisticians and with NHTSA, the lost days were replaced with identical days of the week and times of the day at the end of the original twelve-month period. We believe this to be valid and no bias of results occurred.

The passive sensor was not helpful in this study. Of all the patients who agreed to the interview, not one entered the randomization solely because of breath alcohol. The study protocol called for entrance into the randomization if the BAC was 0.12 or greater. Although there were patients who were probably higher than this level, they either could not consent because of heavy intoxication or elected not to do so, and were therefore not randomized. Were this a clinical protocol and not a study protocol, those patients would have been observed in the emergency department until they were competent to receive an intervention and referral. Thus a passive sensor may very well be useful to detect tolerance in harmful drinkers prior to a screening interview.

The ideal outcome measure for a study such as this is the proportion of patients receiving the intervention that reduced their drinking over a year and reported fewer episodes of driving after drinking. Due to the time constraint of the project, one-year outcome data were not measurable in the time allotted. It is particularly obvious that, as a starting point, sobriety or reduced drinking begins with an initial interface with the treatment community. Our intent was to demonstrate that a protocol for screening detection and referral of high-risk patients results in a significant increase in the proportion of patients who receive a formal evaluation. Our results demonstrate that such a protocol indeed dramatically increases the opportunity for people to interface with the treatment community and therefore, they have the opportunity for sobriety, fewer drunk driving episodes, and safer highways.

Physicians, nurses, or administrators who are considering the implementation of a screening and intervention protocol in the emergency department should not be concerned that our percentage yield of patients who agreed to treatment was low. First, due to the nature of the study and the need for a consent, there were over 1,400 patients who would have been screened under a clinical protocol who were not, because of the need for consent to participate in research. We do not know why patients refused to participate, but anecdotally it was noticed that many patients who refused appeared to be high-risk by various indicators, including alcohol on their breath and fear of investigating police officers in the emergency department. Moreover, an experienced interviewer, not operating from a script, may be able to detect AA/AD with higher sensitivity than we were able to do with our standard scripted interview. In fact, some of our more highly trained research associates with experience in alcohol treatment became frustrated with being prohibited by the experimental design from providing needed counseling for those who refused to consent or were randomized to the control.

Emergency physicians and administrators of EDs who are not screening for alcohol use problems should be aware of the large volume of patients who go untreated in emergency departments throughout the country. Although it may not be practical to have every physician and nurse trained in alcohol screening and intervention, the use of

a simple screening tool as part of the history taking has value. In emergency departments with large patient volumes, it may be cost effective to employ an individual, who is not a part of the physician-nurse treatment team, with the primary focus on detecting AA/AD and facilitating referral. Many hospitals with substance abuse and behavioral health services may find that the ED population is an untapped source of patient revenue. For those systems, there is most certainly a break-even point at which a dedicated individual in the emergency department to detect the disease and arrange for treatment would be cost effective.

It is well documented that emergency physicians fail to detect alcohol abuse and refer. The reasons for this are unknown, but they likely have to do with more pressing problems, unrelated diagnoses, difficulty of referral, and a recalcitrant population. Perhaps the likelihood of future injury to self or others is not viewed as a health problem worthy of attention in the emergency setting. When put into the perspective that the ED treatment for injury may be those patients' only interface with the health care system, the importance of screening for the disease among those at highest risk is obvious. Detection and referral of AA/AD patients is not, however, a foreign concept in the ED. Patients with liver disease, gastrointestinal bleeding, poor nutrition and other disorders directly related to alcohol consumption are frequently referred or transferred to a structured situation that incorporates treatment for substance abuse. But because of the widespread lack of recognition of injury as a disease, the same aggressive approach to substance related injury has not traditionally been employed.

We realize that the study was performed under ideal conditions, in that we employed trained dedicated personnel to screen, perform intervention and refer. Whether or not our results can be duplicated in settings where nurses, physicians, or social workers with other duties must perform the intervention is not known. Clearly, if we had shown no difference under ideal conditions, it would have been unlikely to work in any setting. Fortunately, screening, referral and intervention does have benefit, and implementing it in different settings awaits further analysis.

Conclusion

Our study indicates that this indeed is not a futile exercise, but that when operating under a standard, simplified protocol, a reasonable number of patients will respond to the intervention. Physicians and nurses have the unique position in society to turn the lights on for people in the dark about their health risks. We have identified a high-risk population that needs illumination through intervention for a disease that is responsible for huge societal costs. We have identified a viable methodology for intervention that can be adapted in virtually any emergency department. Further longitudinal research will be necessary to verify long term reduction in harmful drinking and driving in this population.

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Appendix 1

A. Obtain information from ED study log and ED records:

1. Site: ❑. Carolinas Medical Center
❑. Pitt County Memorial

ED ID
Label / Stamp

1. ED Log #:

1. Case ID:

1. RESEARCH ASSISTANT ID:

2. ED Rec# :

3. Med Rec#:

4. Date Admt: ___ ___ /___ ___ /___ ___

5. Time Admt: ___ ___ : ___ ___ (24 hr clock)

6. Name: ..... First ..... Middle ..... Last

B. Obtain INFORMED CONSENT and then alcohol/risk information through interview:

VII. A) Hello, I am _____ from emergency medicine research. I understand that you were in a traffic crash today. Our department is doing highway safety research that focuses on patients' risks of being in a traffic crash in the future. Would you mind answering a few questions about your own risk of being in a future crash? ..... ❑ Yes ❑ No

B) We know that the three things that most affect risk are speed, seat belts, and alcohol use. The questions I'm going to ask you will deal with these three areas. Is that okay? ..... ❑ Yes ❑ No

C) Would you mind if we call you at home in three months and six months from now to see how you are doing? ..... ❑ OK to call ❑ Do not call

C. CONTINUE INTERVIEW ONLY IF INFORMED CONSENT OBTAINED:

VIII. First of all, when you drive or ride in a car, would you say you buckle your seatbelt: all the time, most of the time, some of the time, or never? ..... ❑All ❑Most ❑Some ❑Never

IX. When you're driving a car, do you insist that your passengers buckle up: all the time, most of the time, some of the time, or never? ..... ❑All ❑Most ❑Some ❑Never

X. If you had to give one reason why you do not always buckle your seatbelt, what would it be? _____

XI. When you drive, do you drive under the speed limit: all the time, most of the time, some of the time, or never? ❑All ❑Most ❑Some ❑Never

XII. If you had to pick one reason why you drive over the speed limit, what would it be? _____

Continue interview with TWEAK **SCORE**

XIII. a) How many drinks does it take before you begin to feel the first effects of the alcohol? _____

b) *Is the answer to a. three (3) drinks or more?* ❑ Yes [2] ❑ No [0] _____

XIV. a) How many drinks does it take before the alcohol makes you fall asleep or pass out? OR
If you ever drink until you pass out, what is the largest number of drinks you have? _____

b) *Is the answer to a. five (5) drinks or more?* ❑ Yes [2] ❑ No [0] _____

XV. Have your friends or relatives worried or complained about you drinking in the past? ❑ Yes [2] ❑ No [0] _____

XVI. Do you sometimes take a drink in the morning when you first get up? ❑ Yes [1] ❑ No [0] _____

XVII. Are there times when you drink and afterwards you can't remember what you said or did? ❑ Yes [1] ❑ No [0] _____

XVIII. Do you sometimes feel the need to cut down on your drinking? ❑ Yes [1] ❑ No [0] _____

XIX. a) *TOTAL SCORE* _____

b) TWEAK RESULT ❑ TWEAK negative (Score <2) ❑ TWEAK positive (Score ≤2)

D. Obtain breath alcohol information from passive sensor during interview or serum readings from ED records at a later time:

XX. BAC a) Reading: ____ . ____ ____ b) Time: ___ ___ : ___ ___ (24 hr clock)

c) Source: ❑ Breath ❑ Serum

XXI. a) Optional Active BAC ____ . ____ ____ b) Time: ___ ___ : ___ ___ (24 hr clock)

E. Group Assignment:

F. Follow up:

1. Group: ❑ Screen negative ❑ Intervention, accepted referral (Go to Q0)
❑ Control ❑ Intervention, refused referral

2. Referral Agency: .....

3. Appt Date: ___ ___ /___ ___ /___ ___

G. Obtain patient contact information from ED records and verify with or obtain from patient:

IV. Address:

a) ❑ Current ❑ Local Address:

_____ _____

_____ _____

_____ ____ _____ _____ ____ _____

City State Zip City State Zip

b) How long? ____ ____ If <5 yrs **d)** How long? ____ ____

Yr Mo Yr Mo

c) ❑ Previous ❑ Permanent Address:

V. Phones: _____ (____) _____ **b)** Phone 2: (____) _____

a) Home:

c) Name: ❑ Subject, 2nd ph# ❑ Other .....

d) Relation: ❑ Patient work phone ❑ Child
❑ Spouse/Partner ❑ Other .....

VI. Living Status: ❑ Single, living alone ❑ Separated, living alone ❑ Living with partner
❑ Married, living with spouse ❑ Separated, living with family ❑ Other .....

VII. Support at ED: ❑ Accompanied to ED ❑ Met at ED by friend ❑ Other .....
❑ Met at ED by family ❑ No support

H. Obtain and/or verify basic motor vehicle crash information with patient:

VIII. Dr. Lic. #: .....

IX. DL State: ❑ NC ❑ SC ❑ Other __ __

X. Date: ___ ___ /___ ___ /___ ___

XI. Time: ___ ___ : ___ ___ (24 hr clock)

XII. State: ❑ NC ❑ SC ❑ Other___

XIII. County: ❑ Mecklenburg ❑ Pitt ❑ Other.....

XIV. City: **a)** ❑ In ❑ Near **b)** ❑ Charlotte ❑ Greenville ❑ Other.....

XV. Location: .....

.....

I. Obtain additional patient identification information from ED records:

XVI. SS#: ___ ___ ___-___ ___ -___ ___ ___ ___

XVII. DOB: ___ ___ /___ ___ /___ ___

XVIII. Sex: ❑ Male ❑ Female

XIX. Race: ❑ White ❑ Hispanic ❑ Asian ❑ Black ❑ American Indian ❑ Other.....

J. Additional ED and Injury information from ED records:

XX. Arrive ED Via: ❑ Ambulance ❑ Police ❑ Walked or carried ❑ Other..... ❑ Private Veh. ❑ Helicopter ❑ Taxi ❑ Unable to determine

XXI. Leave ED to: ❑ Home ❑ OR ❑ Morgue ❑ Other..... ❑ ICU ❑ Floor ❑ Transfer ❑ Unable to determine

XXII. E Code:

XXIII. NCodes: 1)..... 2)..... 3).....

XXIV. Trauma Score:

XXV. AIS:

K. Additional motor vehicle crash information from investigating officer and/or report:

XXVI. Agency: Investigated by ❑ Municipal Police ❑ Sheriff ❑ None ❑ Highway Patrol ❑ DMV ❑ Other .....

XXVII. Victim Type: ❑ MV driver ❑ Motorcycle driver ❑ Moped driver ❑ Bicyclist ❑ Other ..... ❑ MV passenger ❑ Motorcycle pass. ❑ Moped pass ❑ Pedestrian .....

XXVIII. Violation (if not passenger): a) Violation 1 | b) Violation 2 | c) Violation 3

Violation codes (Circumstances contributing to the collision)

01	No violation indicated	10	Pass stopped school bus	19	Safe movement violation
02	Alcohol Use	11	Passing on hill	20	Following too closely
03	Drug Use	12	Passing on curve	21	Improper backing
04	Yield	13	Other improper passing	22	Improper parking
05	Stop sign	14	Improper lane change	23	Unable to determine
06	Traffic signal	15	Use of improper lane	24	Left of center
07	Exceeding speed limit	16	Improper turn	25	Right turn on red
		17	Improper or no signal	26	Other.....
08	Exceeding safe speed	18	Improper vehicle equipment		.....
09	Failure to reduce speed				

XXIX. Arrests: a) ❑ Subject NOT arrested as result of crash

❑ Subject arrested as result of crash

b) Charge(s).....

.....

Appendix 2

TWEAK Screen for Alcohol Dependency

***T*olerance -**	**Can you drink six drinks in a row and still stay awake?**
***W*orried -**	**Do you have friends or relatives that are worried about your drinking?**
***E*ye Opener -**	**Have you taken a drink first thing in the morning?**
***A*mnesia -**	**Have you ever had blackouts after drinking?**
***K*ut down -**	**Do you ever think you may need to cut down on your drinking?**

Appendix 3

ED DIRECT

- Empathy
- Direct
- Data
- Identify options
- Recommend action
- Elicit response
- Confirm Clarify
- Telephone referral

Empathy
- eye contact
- positive regard
- non-possessive warmth
- serious concern

Direct
- eye contact
- matter of fact
- friendly, not friends

Data
Now, I want to share our findings with you:
1. You are in a group that is high risk for alcohol-related problems:
   Alcoholism, dependence, injury or death

2. Our screen indicates a reason for concern.

Identify options
1.Go for follow up assessment to see if treatment is indicated.
2. Do nothing

Recommend action
"We recommend strongly that you go for an assessment to see if more treatment is indicated.
"We would like to assist you in arranging for that assessment."

Elicit response
"How does that sound to you?"
"What do you think about going for an assessment?"

DOT HS 809 412
February 2002

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