Alcohol screening and brief intervention in emergency departments: Review of the impact on healthcare costs and utilization

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Abstract:

Purpose: To review the published evidence of the impact of alcohol screening and brief intervention (SBI) delivered in emergency departments (EDs) on healthcare utilization and costs. **Principal results:** This scoping review used existing literature reviews supplemented with an electronic database. We included studies if they assessed SBIs for alcohol delivered in an ED setting and reported healthcare utilization and/or costs. We abstracted methodological approaches and healthcare utilization outcomes from each study and categorized them based on substance of focus (alcohol only vs. alcohol and other substances). We updated cost estimates from each study to 2018 U.S. dollars. We identified seven studies published between 2010 and 2019 that met study inclusion criteria. Two of the seven studies evaluated SBI that targeted both alcohol and other substances. Six studies found a reduction in healthcare utilization or costs, and one found an increase in healthcare utilization. **Major conclusions:** This literature review suggests that SBI delivered in ED settings can be a cost-reducing approach to treating excessive alcohol consumption, a factor that policy-makers and payers might consider in prioritizing interventions.

Keywords: alcohol | emergency department | healthcare costs and utilization | screening and brief intervention

Article:

1. Introduction[1]

Globally, 5.3% of all deaths are attributed to alcohol (World Health Organization, 2018). In the United States, excessive alcohol consumption (Centers for Disease Control and Prevention [CDC], 2018)[2] has caused about 88,000 deaths (9.8% of all U.S. deaths) each year between 2006

[1] ACEP (American College of Emergency Physicians), BI (brief intervention), CDC (Centers for Disease Control and Prevention), ED (emergency department), OECD (Organisation for Economic Co-operation and Development), RCT (randomized controlled trial), SBI (screening and brief intervention), SBIRT (screening, brief intervention, and referral to treatment), USPSTF (U.S. Preventive Services Task Force)

[2] Excessive alcohol use includes binge drinking (defined as consuming 4 or more alcoholic beverages per occasion for women or 5 or more drinks per occasion for men), heavy drinking (defined as consuming 8 or more alcoholic

and 2010 (Stahre et al., 2014) and is associated with considerable morbidity and societal costs (Rehm et al., 2014; Rehm et al., 2017; Sacks et al., 2015). About 55% of U.S. adults reported consuming alcohol in the past month (CDC, 2019), and about 19% drank excessively in 2017 (America's Health Rankings, 2019).

Most adults who drink excessively are not dependent on alcohol (Esser et al., 2014). However, they can benefit from an evidence-based approach, such as screening and brief intervention (SBI), to identify and reduce excessive alcohol consumption (Babor & Higgins-Biddle, 2001). The U.S. Preventive Services Task Force (USPSTF) recommends alcohol screening in primary care settings for adults aged 18 years or older and brief counseling interventions for those who exceed drinking limits (USPSTF, 2018). SBI consists of the administration of a standardized alcohol screen and delivery of brief intervention (BI) or counseling sessions (can be as short as 6–15 min) to those screening positive for excessive alcohol consumption (CDC, 2014). Some models of SBI—screening, brief intervention, and referral to treatment (SBIRT)—include identifying individuals at risk for alcohol dependence (or severe alcohol use disorder) and referring them to formal treatment (Babor et al., 2007). Clinicians are increasingly using these models to address a variety of substance use–related issues beyond alcohol, including drug misuse (prescription and illicit) (Richards et al., 2019; Saitz et al., 2014), despite insufficient evidence of effectiveness for other substances (USPSTF, 2019). SBIRT is similar in concept and approach to the internationally known terminology, SBI. For consistency, SBI throughout this manuscript also refers to the studies that include the referral to treatment (RT) component.

Although interventions for excessive alcohol consumption can improve health and are potentially cost effective (Rehm & Barbosa, 2018), it is less clear whether alcohol SBI results in net cost savings (Latimer et al., 2009). Bray et al. (2011) found little evidence that alcohol SBI had an effect on inpatient or outpatient healthcare utilization, although there was some evidence of a small negative effect on emergency department (ED) utilization.

EDs could play an important role in the delivery of SBI, because ED patients have higher rates of excessive alcohol consumption (Barata et al., 2017; Hawk & D'Onofrio, 2018), and the rate of alcohol-related visits to EDs increased by nearly 50% between 2006 and 2014 (White et al., 2018). Although the USPSTF does not specifically recommend SBI in ED settings, the American College of Emergency Physicians (ACEP) "believes emergency medical professionals are positioned and qualified to mitigate the consequences of alcohol abuse through screening programs, brief intervention, and referral to treatment" (ACEP, 2017). Research has increasingly shown SBI in ED settings to be effective (Barata et al., 2017; Hawk & D'Onofrio, 2018; Landy et al., 2016; Schmidt et al., 2016).

Because of the high prevalence of excessive alcohol consumption among patients who utilize EDs (White et al., 2018), the low cost of SBI delivery (Barbosa et al., 2016; Bray et al., 2012; Bray et al., 2014), and because ED visits and repeat hospital admissions are costly (Steiner et al., 2010), SBI delivery in ED settings could be cost reducing. In this scoping review, we gathered data on the influence of alcohol SBI delivered in EDs on healthcare utilization and costs.

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beverages per week for women or 15 or more alcoholic beverages per week for men), and any drinking by pregnant women or people younger than age 21.

2. Material and methods

We conducted a scoping review (Grant & Booth, 2009; Munn et al., 2018) using a two-stage approach and included studies that met the following eligibility criteria: (1) intervention: SBI for substance use, which includes alcohol use only or alcohol use together with the use of illicit drugs and/or nonmedical use of prescription drugs; (2) delivery setting: EDs (includes any hospital ED or urgent or trauma care facility visit); (3) outcomes: measures of healthcare utilization (e.g., inpatient days, outpatient visits, ED visits) and/or associated costs; and (4) study design: randomized controlled trial (RCT), quasi-experimental, or economic evaluation. We considered only studies that met all four criteria for inclusion.

For the first stage, we reviewed two recent and comprehensive published literature reviews that examined the association between alcohol SBI and healthcare utilization. Bray et al. (2011) conducted a systematic review of the effects of alcohol SBI delivered in primary care, ED, and hospital settings on outpatient, inpatient, and ED utilization in studies published from 1962 through 2010. Clemans-Cope et al. (2018) conducted a rapid review of potential healthcare cost savings associated with alcohol and/or drug SBIRT delivered in the ED in studies published from 2010 to 2017. We reviewed the studies included in the two reviews and determined that two (Barrett et al., 2006; Daeppen et al., 2007) of the twenty-six studies in Bray et al. (2011) and three (Barbosa et al., 2015; Estee et al., 2010; Pringle et al., 2018) of the five in Clemans-Cope et al. (2018) met our eligibility criteria.

For the second stage, we conducted an independent literature search. In September 2019, we searched PubMed.[3] The search retrieved 16 studies, with one meeting our inclusion criteria (Hinde et al., 2015). We also added another study (Gentilello et al., 2005), which was a cost-benefit analysis published before 2010 that had used estimates from a study (Gentilello et al., 1999) that had been included in Bray et al. (2011).

We extracted the following fields from the included studies: ED delivery setting (hospital ED or urgent or trauma care facility visit and geographical location), study type (e.g., quasi-experimental, RCT, economic evaluation [also called cost-effectiveness analysis]), intervention (description of intervention, person delivering), substance of focus (alcohol, alcohol and drugs), healthcare utilization outcomes (e.g., number of outpatient visits, ED visits, readmissions), when outcomes were achieved, and impact on healthcare utilization/costs. When reported in the

[3] #1 ("Alcohol-Related Disorders"[Mesh] OR "Alcohol Drinking"[Mesh] OR "Alcoholic Beverages"[Mesh] OR alcohol*[Text Word] OR alcohol abus*[Text Word] OR alcohol misus*[Text Word]) AND (("Mass Screening"[Mesh] AND "Motivational Interviewing"[Mesh]) OR (screen*[Text Word] AND brief intervention*[Text Word]) OR SBI[Text Word] OR (screen*[Text Word] AND brief advice[Text Word]) OR (screen*[Text Word] AND brief motivational interview*[Text Word]) OR (screen*[Text Word] AND brief motivational intervention*[Text Word])) AND ("Emergency Service, Hospital"[Mesh] OR "Trauma Centers"[Mesh] OR "Emergency Medical Services"[Mesh] OR emergency department*[Text Word] OR emergency room*[Text Word] OR trauma center*[Text Word]) AND ("Costs and Cost Analysis"[Mesh] OR "Cost-Benefit Analysis"[Mesh] OR "Health Care Costs"[Mesh] OR cost[Text Word] OR costs[Text Word] OR cost-effectiveness analysis[Text Word] OR cost-benefit analysis[Text Word] OR healthcare utilization[Text Word] OR health care utilization[Text Word] OR resource utilization[Text Word] OR healthcare cost*[Text Word] OR economic*[Text Word]) Filters: Publication date from 2010/01/01; English 16

original studies, we extracted tests of statistical significance at the 5% level. We categorized studies by substance of focus (i.e., alcohol only or alcohol and drugs).

All costs are presented in 2018 U.S. dollars. We adjusted the dollar values reported in each study for inflation to 2018 using the Gross Domestic Product Price Index (Bureau of Economic Analysis, 2019). One study reported costs in pound sterling (£, GBP); we used the purchasing power parity to calculate equivalent prices across currencies (1.45 U.S. dollars per 1 GBP in 2001–2002) (Organisation for Economic Co-operation and Development [OECD], 2019). We reported this review following relevant PRISMA guidelines for scoping reviews (Tricco et al., 2018).

3. Results

We identified seven studies that assessed the impact of alcohol or alcohol and drug SBI delivered in an ED setting on healthcare utilization and/or costs (Barbosa et al., 2015; Barrett et al., 2006; Daeppen et al., 2007; Estee et al., 2010; Gentilello et al., 2005; Hinde et al., 2015; Pringle et al., 2018). Table 1 summarizes key characteristics and findings of the seven studies. Two of the studies evaluated substance use SBI interventions that targeted both alcohol and drugs. Six studies found some indication of a reduction in at least one measure of healthcare utilization or costs (not necessarily statistically significant at the 0.05 level), and one study found a nonstatistically significant increase in healthcare utilization (Daeppen et al., 2007).

3.1. Studies assessing the impact of screening for alcohol only

Barbosa et al. (2015), in a cross-site evaluation of an SBIRT initiative, used data from a patient survey covering the 6 months before and the 6 months after receipt of an alcohol SBIRT in an ED. This study found that SBIRT in the ED was associated with social cost savings of $598 per patient for 6 months, or $1196 per patient per year (Barbosa et al., 2015). Barbosa et al. (2015) calculated the aggregate reduction in social costs associated with ED and outpatient encounters, criminal justice outcomes (arrests and nights incarcerated), automobile crashes, and lost workdays by multiplying patient reports of number of outcomes by published unit costs and summing up. They did not assess statistical significance.

Hinde et al. (2015) conducted a comparative interrupted time-series analysis using the Arizona State Inpatient Database to estimate the effects of the American College of Surgeons Committee on Trauma SBI mandate on the probability of readmission and cost per readmission in Arizona trauma centers. Hinde et al. (2015) showed that the mandate led to a statistically significant 2.2 percentage point reduction (44%) in the probability of readmission, with no effect on readmission costs. The study was limited because there was no information on the SBI protocol implemented or on whether patients were screened or received a BI.

Daeppen et al. (2007) conducted an RCT to evaluate the effectiveness of alcohol SBI delivered by a trained research assistant to people who drink excessively and who were treated for minor injuries in an ED in Lausanne, Switzerland. The study randomized individuals to SBI, screening and assessment, and screening-only groups. There were no statistically significant differences in number of days hospitalized, and number of medical consultations at 12 months across groups.

Table 1. Primary studies of alcohol screening and brief intervention in emergency department settings.

Study	Delivery setting	Study type	Intervention	Substance	Healthcare utilization outcomes	When achieved	Impact on healthcare utilization/costs
Pringle et al., 2018	ED in the Pittsburgh metropolitan area (United States)	Quasi-experimental Medicaid claims DiD analysis	SBIRT services for alcohol and drugs through Safe Landing, a program delivered by nurses	Alcohol and illegal or prescription drugs	• Total general medical and behavioral healthcare costs • Number of ED visits	12 months	• Total healthcare costs declined by 21%[b] • ED visits declined by 3.3 percentage points[a] • Healthcare savings of $2359[a]
Barbosa et al., 2015	EDs and trauma centers (United States)	CEA comparing ED visits with outpatient visits	SBIRT services for alcohol delivered by substance abuse counselors	Alcohol	• Number of ED visits • Number of outpatient visits	6 months	• Social cost savings of SBI in ED of $598.[a] Social cost savings include cost of SBIRT ($14 per screen positive), criminal justice costs, automobile crashes, and lost income in addition to healthcare utilization.
Hinde et al., 2015	Six trauma centers in Arizona (United States)	Macro-level ITT analysis of SBI using comparative interrupted time series	Effect of American College of Surgeons Committee on Trauma alcohol SBI mandate. Compares 16 months pre-mandate with 16 months post-mandate using hospital administrative data, with no information on SBI protocol.	Alcohol	• Probability of readmission comparing individuals with an alcohol diagnosis code to those without	16 months	• 44% reduction in the probability of readmission (2.2 percentage point reduction; $t = -3.09$)[b] • Total healthcare and readmission costs not affected
Estee et al., 2010	Nine EDs in Washington State (United States)	Quasi-experimental. DiD Medicaid claims analysis.	SBI for alcohol and drugs provided to working-age, disabled Medicaid patients, delivered by substance abuse counselors	Alcohol and illegal or prescription drugs	• Medicaid billed services PMPM • Inpatient: hospital days	12 months	• Medicaid PMPM savings of $462 ($p = 0.05$) • Reduction PMPM of 1.2 hospital days ($p = 0.04$)
Daeppen et al., 2007	Urban academic ED (Switzerland)	RCT	Single 10- to 15-minute session of standardized alcohol SBI conducted by a trained research assistant. The study randomized individuals to SBI, screening and assessment, and screening-only groups.	Alcohol	• Outpatient: consultations • Inpatient: hospital days	12 months	• Outpatient: increase (no significant effects). Number of medical consultations (SD) for SBI group 7.7 (16.8); for screening and assessment group 3.5 (3.4); and for screening-only group 5.3 (0.40) ($p = 0.4$). • Inpatient: increase (no significant effects). Number of days

Study	Delivery setting	Study type	Intervention	Substance	Healthcare utilization outcomes	When achieved	Impact on healthcare utilization/costs
							hospitalized (SD) for SBI group 6.9 (7.2); for screening and assessment group 4.8 (4.8); and for screening-only group 6.6 (10.4) (p = 0.62).
Barrett et al., 2006	ED (London, England)	Pragmatic RCT	Those who screened positive were referred to an alcohol health worker for a BI and compared to those who received only an information leaflet (control). Alcohol health workers were mental health nurses.	Alcohol	• Outpatient visits • ED visits • Inpatient: hospital days	12 months	• Hospital outpatient (mean visits during 12 months)[a]: TG 1.72 (SD 3.40), CG 1.66 (SD 8.87) • ED (mean visits during 12 months)[a]: TG 0.90 (SD 1.84), CG 0.97 (SD 1.91) • Inpatient (mean days during 12 months)[a]: 2.96 (SD 7.25), CG 3.79 (SD 14.15) • Hospital (ED, outpatient, and inpatient) cost decrease of $382 (95% CI −3497 to 2735) over 1 year for patients receiving BI. Primary care cost increase of $117 (95% CI −80 to 312).
Gentilello et al., 2005	ED and hospital inpatient (United States)	Decision modeling study	A decision analysis model was used to determine whether the benefits of alcohol screening for all injured ED patients and providing a BI outweighed the costs of providing the service. BI was delivered by a psychologist.	Alcohol	• Change in medical expenditures from injuries among individuals given an SBI for alcohol	3 years	• Direct medical cost savings over 3 years of $126 per screened patient ($466 per BI patient)[a] • Cost savings include screening costs of $22.61 per person and BI costs of $53.70 per intervention participant

BI (brief intervention), CEA (cost-effectiveness analysis), CG (control group), CI (confidence interval), DiD (difference in differences), ED (emergency department), ITT (intent to treat), PMPM (per member per month), RCT (randomized controlled trial), SBI (screening and brief intervention), SBIRT (screening, brief intervention, and referral to treatment), SD (standard deviation), TG (treatment group). Note: All dollar values are adjusted for inflation from study base year to 2018 using the gross domestic product (GDP) or GDP Price Index (Bureau of Economic Analysis, 2019). Purchasing power parity ratio for 2001–2002 of 1.45 U.S. dollars per 1 GDP was applied to estimates in Barrett et al. (2006).

[a] Significance was not reported.

[b] Significant at the 5% level.

Barrett et al. (2006) conducted a cost-effectiveness analysis of alcohol SBI in a general hospital in London, England, and reported a nonsignificant decrease in hospital (ED, inpatient, and outpatient) cost of $382 over one year for patients receiving BI. The data came from a pragmatic RCT that compared a BI in an ED for alcohol use delivered by a trained health worker to an informational pamphlet only (Crawford et al., 2004). The study reported 0.5 (95% CI −0.02 to −1.1) significantly fewer ED visits in the 12 months after the BI for those who received a BI.

Gentilello et al. (2005) used a decision modeling approach of SBI for injured patients treated in an ED or admitted to a hospital in the United States. The study assumed reductions in subsequent injuries requiring hospital care based on the results of a well-designed RCT in which patients who were admitted to a trauma center and screened positive were offered a brief intervention by a trained psychologist (Gentilello et al., 1999). Using a computerized database of ED records and statewide hospital discharge records, the study reported a significant 47% reduction in annual ED injury recidivism (hazard ratio 0.53; 95% CI 0.26 to 1.07) and a significant 48% reduction in annual injury recidivism requiring hospitalization (hazard ratio 0.52; CI 0.21 to 1.29). Gentilello et al. (2005) estimated healthcare savings of $126 per screened patient, and $466 per BI patient, over three years or $42 per screened patient and $155 per BI patient per year, which translated to an estimated $3.81 saved for every $1 spent on screening and intervention (statistical significance not assessed).

3.2. Studies assessing the impact of screening for alcohol and other substances

Two studies with quasi-experimental designs, both of which used Medicaid claims data, evaluated combined SBI for alcohol and drugs to assess healthcare expenditures or allowable charges for insured people (Estee et al., 2010; Pringle et al., 2018). Pringle et al. (2018) used Medicaid healthcare claims to calculate healthcare utilization and costs (total costs within 1 year and binary measures of any ED visit within a 30-day window or any ED visits; inpatient claims; and behavioral health claims within a 1-year window). The study setting was an ED that offered SBIRT services to individuals who indicated risk of overdose on a validated screener. They compared costs and healthcare utilization between the group receiving SBIRT and three groups of ED patients who did not receive SBIRT services. Using a difference-in-differences approach, Pringle and colleagues calculated a statistically significant 21% single-year reduction in healthcare costs in the cohort who received SBIRT, which translated to a reduction of $2359 per patient per year receiving SBIRT ($N = 2546$; statistical significance not assessed). Pringle and colleagues' study followed an intent-to-treat approach, and the economic benefits estimate applies to all screened ED patients.

Estee et al. (2010) analyzed claims data for working-age Medicaid enrollees with disabilities in Washington State who were screened and received a BI for alcohol and drug use from April 12, 2004, through September 30, 2006, in one of nine hospitals participating in an SBIRT initiative ($N = 1557$). They found a statistically significant reduction of $462 in Medicaid costs per member per month (i.e., $5544 per year) after propensity score matching to subjects living in the same counties who did not receive SBI.

4. Discussion

Understanding the potential healthcare cost savings of alcohol SBI delivered in ED settings can provide crucial information to policy-makers and payers. Five of seven studies that we reviewed found evidence of avoided costs or economic benefits to the healthcare system or to society associated with SBI delivered in ED settings alone or combined with inpatient settings. Healthcare savings per SBI patient per year in those studies ranged from $155 (Gentilello et al., 2005) to $5544 (Estee et al., 2010). The estimate in Gentilello et al. (2005) accounted for only reductions in medical expenditures due to injuries requiring ED/trauma center or hospital admission, whereas the estimate in Estee et al. (2010) accounted for all Medicaid expenses. The studies found these savings to exceed the cost of delivering SBI.

Of the two studies that did not find significant cost reductions, one found significant reductions in the number of readmissions (Hinde et al., 2015) but not total costs or readmission costs, and one found no evidence of a benefit (Daeppen et al., 2007). The latter study was an RCT that was not adequately powered for health effects. RCTs that are adequately powered for health effects are often underpowered to find significant reduction in costs because of the large variance in costs (Briggs, 2000), and given that the study was not powered for clinical effects, the statistical power to detect impacts on costs is even smaller. Master's-level psychologists with limited clinical experience delivered the SBI in the studies in Daeppen et al. (2007). Three studies that found benefits of SBIRT in the ED were specific to injured patients seen at trauma centers (Barbosa et al., 2015; Gentilello et al., 2005; Hinde et al., 2015).

The two studies that used strong analytical approaches to analyze the impact of ED-delivered SBIRT on healthcare utilization did not provide information on how many patients screened positive for alcohol (Estee et al., 2010; Pringle et al., 2018). However, a previous SBIRT study reported that 75% of ED patients who screened positive also screened positive for excessive alcohol consumption (Barbosa et al., 2015). Also, two ED SBI studies included in a previous rapid review (Clemans-Cope et al., 2018) that did not report statistically significant healthcare cost savings targeted drugs only (Busch et al., 2017; Horn et al., 2017). That is in contrast to the two studies of combined alcohol and drug screening that found significant cost reductions (Estee et al., 2010; Pringle et al., 2018). The one study in that review that evaluated alcohol-only SBI reported societal economic benefits and did not report estimates specific to healthcare savings (Barbosa et al., 2015).

Other studies that have examined the implementation cost of SBI programs without examining downstream implications for healthcare utilization suggest that SBI is a low-cost ED intervention. In particular, in four ED-based studies in the literature review of SBI implementation cost by Bray et al. (2012), the cost of SBI per patient ranged between $28 and $201 in 2018 U.S. dollars. Variations in the duration of service and wage of providers drove the large range in cost. Bray et al. (2012) found median SBI costs of $60 per patient, when not restricted to ED settings. Similarly, Bray et al. (2014) reported a cost per patient of $43, and Barbosa et al. (2016) reported a cost of $57 per patient in ED settings. In addition to the incremental cost of one service event for a patient, Barbosa et al. (2016) reported program costs of alcohol SBI in the ED, including training, administrative, and other costs. The annual program average cost to provide SBI per positive screen, for 1 year, was about $441 (Barbosa et al., 2016). Comparing the costs of SBI with avoided costs shows the potential of net healthcare cost savings of SBI in ED settings.

Because this was a scoping review, we may have missed relevant studies (Ganann et al., 2010). However, we believe the review is comprehensive, drawing on a previously published systematic review and expert knowledge. We did not do a quantitative synthesis, such as a meta-analysis, because of the small number of studies that provided estimates of health care costs and an even smaller number with estimates of variance for those costs. The variation in reporting of healthcare utilization and associated costs also hampers a meta-analysis, as acknowledged in the SBI field in general (Shorter et al., 2019). A framework for the standardization of health economic outcomes in SBI is part of the authors' future research agenda. Because we adopted a healthcare perspective, we did not account for (except for estimates in Barbosa et al. (2015) that were not reported separately) social cost savings that could result from SBI, such as reduced crime and traffic accidents, or increased productivity (lower absenteeism, increased employment).

The implementation of alcohol SBI in ED settings has several system-level barriers related to competing priorities and the high-volume, fast-paced characteristics of such settings (Vendetti et al., 2017). We hope that future studies will assess optimal approaches for the implementation of alcohol SBI in ED settings, including for special populations such as pregnant women, for whom a nonalcohol-exposed pregnancy can reduce the risk of fetal alcohol spectrum disorders (May et al., 2013). Further, the use of telehealth for brief counseling and/or medication-assisted treatment with people who screen positive, which might reduce provider time and office costs, warrants further research (Boudreaux et al., 2015).

Given the growing burden of excessive alcohol consumption in patients presenting to EDs, the healthcare savings reported in the studies reviewed, and the proven effectiveness and low cost of alcohol SBI in EDs, decision-makers and payers may want to consider wider implementation of alcohol SBI in ED settings.

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Declaration of competing interest

None.

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