# Costs of Alcohol Screening and Brief Intervention in Medical Settings: A Review of the Literature

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**ABSTRACT. Objective:** This article summarizes the literature on the implementation costs of alcohol screening and brief intervention (SBI) in medical settings. **Method:** Electronic databases were searched using SBI- and cost-related terms. Methodological approaches and cost estimates were abstracted from each study and categorized based on the cost methodology. Costs were updated to 2009 U.S. dollars. To determine a summary cost measure, we excluded outliers and computed the median of the remaining cost estimates. **Results:** Seventeen studies with cost estimates were identified for further study. Costs ranged from $0.51 to $601.50 per screen and from $3.41 to $243.01 per brief intervention (BI). Cost estimates were lower when an activity-based cost methodology was used, in primary care settings, and when the provider was not a doctor. The median summary cost of a screen is approximately $4, and the median summary cost of a BI is approximately $48. **Conclusions:** Screening cost estimates had more variation than BI cost estimates. Provider type and service delivery time drive the cost variation. Interpretation of cost differences was limited by insufficient reporting of the cost methodology. Cost estimates presented here are similar in size to the Healthcare Common Procedure Coding System and Current Procedural Terminology reimbursement amounts, suggesting that insurance-based service reimbursement may be sufficient to sustain alcohol SBI in practice. (*J. Stud. Alcohol Drugs, 73,* 911–919, 2012)

SCREENING AND BRIEF INTERVENTION (SBI) for hazardous alcohol use is an evidence-based approach to identify and address alcohol use that exceeds recommended guidelines but does not constitute dependence (Saitz et al., 2010). SBI focuses primarily on individuals categorized as hazardous drinkers but can also be used to address alcohol use for individuals who are at risk for alcohol dependence. SBI consists of two defining activities: administration of a standardized alcohol screen and delivery of an evidence-based brief intervention (BI).

The standardized screen is used to identify individuals who are not alcohol dependent but who drink more than the guidelines recommend. A variety of screening instruments are available to identify hazardous drinkers, ranging from short questionnaires (one to three questions) (e.g., Alcohol Use Disorders Identification Test–consumption questions [AUDIT-C]) to longer questionnaires (e.g., AUDIT; Alcohol, Smoking, and Substance Involvement Screening Test) or the use of biomarkers. Prescreens are sometimes used in high-volume settings to quickly identify abstainers and low-risk users not targeted for a BI. Some prescreens are shortened versions of longer screening instruments (e.g., the AUDIT-C used as a prescreen for the full AUDIT), whereas others are stand-alone instruments, usually consisting of one to three questions on quantity and frequency of alcohol use. For example, the National Institute on Alcohol Abuse and Alcoholism (2005) recommends a single-item prescreen, and several other single-item and short questionnaires have been shown to be reliable as a prescreen or screen (Bradley et al., 2007; Canagasaby and Vinson, 2005; Smith et al., 2009; Williams and Vinson, 2001).

The BI encourages hazardous alcohol users to decrease their consumption to reduce their risk of the harmful effects of alcohol consumption. Most BIs are short sessions lasting only a few minutes and may take place during one or more patient visits. Some models of SBI—called screening, brief intervention, and referral to treatment (SBIRT)—include identifying individuals at risk for alcohol dependence and referring them to formal treatment (Babor et al., 2007). SBIRT models are increasingly being used to address a variety of substance-related issues, including risky drug use and dependence.

Alcohol SBI has been shown to be effective at reducing hazardous drinking in numerous efficacy studies (e.g., Babor and Higgins-Biddle, 2001; Babor et al., 2006, 2007; Ballesteros et al., 2004; Bien et al., 1993; D'Onofrio and Degutis, 2002; Moyer et al., 2002; Wallace et al., 1988; Whitlock et al., 2004; WHO Brief Intervention Study Group, 1996; Wilk et al., 1997). The widespread dissemination of SBI and SBIRT has received considerable policy support in the United States. Alcohol SBI is considered a Grade B preventive service by the U.S. Preventive Services Task Force (2004; Whitlock et al., 2004). A Grade B rating indicates that "it is recommended that clinicians provide this service to eligible patients" (U.S. Preventive Services Task Force, 2004, p. 556; Whitlock et al., 2004). The importance of SBI was

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also noted in the Office of National Drug Control Policy's (2011) National Drug Control Strategy.

These dissemination efforts have been hampered, however, by a lack of consensus on how much it costs to implement SBI in medical care settings (Aalto et al., 2003; Moyer and Finney, 2004–2005; Zarkin et al., 2003). Reliable estimates of SBI implementation costs are necessary to understand the financial impact of SBI programs on medical practices. This holds true for both an individual treatment provider and a broader state or federal agency.

Although many health care services have widely accepted cost ranges based on administrative records, new interventions like SBI do not have administrative data available, and costs are often estimated as part of efficacy and effectiveness studies (Smith and Barnett, 2003). Most authors recommend using a micro-costing approach (Drummond et al., 2006; Gold et al., 1996; Johns et al., 2003; Smith and Barnett, 2003). The general concept is to assess the amount of resources (e.g., labor, materials, space) required to provide an intervention and then multiply by the relevant unit cost of each resource. Ideally, a cost analysis will collect detailed information on actual resource use and unit prices at the service level. Resource and cost data can be collected in several ways. Time-and-motion studies, activity logs, and manager surveys are examples of accepted approaches (Smith and Barnett, 2003). In practice, actual resource and cost data might not always be available. In that case, a cost study may be supplemented by using study protocols, expert opinions, estimates from the literature, or regional and national data (e.g., Bureau of Labor Statistics).

This article presents a review of the peer-reviewed literature on the implementation costs of alcohol SBI. We focused on alcohol SBI because few, if any, studies exist on the costs of broader SBIRT programs for the full range of substance use issues. Furthermore, we focused on estimates of the implementation cost of SBI rather than on the full social cost of SBI. Implementation costs include only the costs of the resources used in the delivery of SBI. We focused on this narrower definition of cost to provide policy makers and medical practitioners with crucial information on perhaps the most immediate barrier to widespread adoption: What will SBI cost to implement in a medical setting? Our review presents cost methodologies and cost estimates to assess the current state of knowledge of the implementation costs of alcohol SBI. We also attempted to determine a summary cost estimate for alcohol SBI in medical settings.

## Method

We searched EBSCOhost, PubMed, and Google Scholar to find citations with the following keywords: "cost," "cost-effectiveness," "cost-benefit," "economic evaluation," and "SBI," "screening," "brief intervention," or "alcohol." Searches were limited by year of publication (dates ranged from 1991 to 2011). Only articles available in English were considered for this review. We examined the reference lists in identified articles for additional articles that could provide further detail on the cost calculations used in the identified articles. In total, 20 articles were identified. We then applied two exclusion criteria to this list. We excluded articles that did not provide a cost estimate of a screening and/or BI service and articles describing studies in which SBI was not delivered in a medical setting. Three articles were excluded from the analysis based on these criteria: Shakeshaft et al. (2002) was excluded because the SBI setting was nonmedical, and Chisholm et al. (2004) and Mortimer and Segal (2005) were excluded because they did not include sufficient information to estimate a per-BI-session cost. Information obtained from each included article was then abstracted and coded by one study author and verified by another author. No additional tests for coder reliability were conducted.

The remaining 17 articles were then categorized according to their cost methodology: non-activity-based, activity-based, or a hybrid methodology. On the one hand, a non-activity-based methodology calculates the total annual cost of providing SBIs in a particular setting and then divides this total cost by the number of screens or BIs performed. In this method, the cost of individual SBI components or services is not identified or calculated, but instead the average cost of SBI is estimated. Because individual resource and unit price components are not identified, these cost estimates are less informative for SBI implemented under different clinical protocols or in settings with different unit prices.

On the other hand, an activity-based cost methodology documents each activity related to SBI along with who performs that activity and how long it takes. The sum of the costs of all activities is the cost of providing SBI in that setting. Cost estimates produced through activity-based costing are informative for other clinical protocols or settings because individual components of the intervention can be compared with similar components in another protocol or setting.

Some studies fall into a hybrid category in which elements of both non-activity-based and activity-based costing are used. For example, a study might use insurance reimbursement schedules for similar services to assign a resource value, such as using the reimbursement for a 10-minute primary care physician's visit for the cost of a BI. Although the reimbursement may accurately reflect the value of 10 minutes of a primary care physician's time, it does not capture the actual time spent delivering a BI.

Three other characteristics of each study were recorded to help interpret variations in the cost estimates: setting, resource use estimate, and price (unit cost) estimate. Studies were described as occurring in one of three medical settings: inpatient, emergency department, and primary

care. Resource use estimates refer to the approach used to measure the resources (e.g., labor or space) used to deliver SBI. Resource use estimates are described as actual, protocol-driven, or hypothetical. Actual resource estimates were based on a specific implementation of SBI. Protocol-driven resource estimates were based on the intended implementation protocol for a specific study or clinical trial. Hypothetical resources were obtained from literature reviews, results from decision analytic models, or pooled estimates across several studies.

Price estimates were classified as site-specific, setting average, or national prices. Site-specific prices used actual unit prices for labor and materials at the study site. Setting average prices used the average unit prices for an input in that setting. For example, a study may use the average cost of a hospital nurse in the region. National prices were taken from a national-level data source, such as the Bureau of Labor Statistics.

Timing and cost estimates from each article were recorded and compiled for prescreening, screening, and BI. The provider type for each activity was also documented. Some studies reported multiple provider types for SBI delivery; for example, a study might compare the cost of a nurse-provided BI with that of a primary care physician–provided BI. Many studies conducted outside the United States and many older studies use the term *general practitioner* rather than *primary care physician;* however, we use the term *primary care physician* exclusively. Cost estimates are presented here for each provider type within a given study, resulting in more than 17 estimates for some services. For studies using a multiple-session BI protocol, an average cost per BI session is presented to make it comparable to studies that provide only one BI session. Information on the total cost for multiple-session models is available in the Table 1 footnotes. All cost estimates were converted to 2009 U.S. dollars. If the time of data collection was not explicitly stated, the authors approximated the data collection period based on publication date and contextual information.

As noted in Cowell et al. (2010), the current SBI cost literature may not be useful in supporting future SBI implementation strategies because of the substantial variability across estimates. We therefore attempted to narrow the range of the cost per screen and BI by excluding outlier estimates. We present the range, mean, and median of cost estimates pre- and post-exclusion to summarize the findings of the literature. Unlike studies of clinical efficacy in which the results presented are themselves summary statistics based on varying sample sizes and with associated variances, cost study results typically represent a single observation on a given SBI program and therefore do not have an associated variance. For this reason, and given the limited number of studies available, meta-analytic techniques and other quantitative analysis approaches were not considered for this review.

## Results

Columns 2–5 of Table 1 present information on the cost methodologies for each study. The majority of studies ($n$ = 11 of 17) used a hybrid cost methodology; 2 studies used a non-activity-based methodology, and 4 studies used activity-based costing. Most studies were conducted in primary care settings ($n$ = 11), with 4 in emergency departments and 2 in inpatient hospital wards. Ten studies used actual resource estimates, 2 studies used hypothetical resource estimates, 3 studies used protocol-based resource estimates, and 2 studies used both hypothetical and protocol-based resource estimates. The types of price estimates were more evenly distributed: 4 used setting averages, 6 used site-specific estimates, and 7 used national estimates.

Although 6 studies used a prescreen, only 3 studies present cost estimates for prescreening (not presented in Table 1): Lindholm (1998), Fleming et al. (2000), and Zarkin et al. (2003). Dillie et al. (2005), Mundt et al. (2005), and Quanbeck et al. (2010) follow the protocol used by Fleming et al., which uses a prescreen, but the studies do not report a separate cost estimate for prescreening. Comparing the three studies with a prescreen cost estimate, Fleming et al. and Lindholm used a hybrid costing approach, whereas Zarkin et al. used activity-based costing. Fleming et al. estimated a 15-minute nurse- or receptionist-provided prescreen that cost $5.09 per prescreen, and Zarkin et al. estimated a 1.75-minute receptionist-provided prescreen that cost $0.30 per prescreen. Zarkin et al.'s prescreen is self-administered, whereas Fleming et al. used an interview-style prescreen. Lindholm does not describe who completes the prescreen or how long it takes to complete. Although Lindholm's $2 per prescreen estimate falls in between the cost estimates in Fleming et al. and Zarkin et al., there is not sufficient detail to compare it with Fleming et al. and Zarkin et al.

The remaining columns of Table 1 present information on the provider, time estimate, and cost estimate for screening and BI. Columns 6–8 of Table 1 present information on screening. Across studies, a number of different service providers are used for screening, including primary care physicians, nurses, receptionists, health promotion advocates, alcohol health workers (Barrett et al., 2006), social workers, and psychologists. All 17 studies screened patients as a part of their protocol, but only 7 studies provided a time estimate for the screen. Screening times ranged from 1 minute (Kaner et al., 2003; Solberg et al., 2008) to 30 minutes (Mundt et al., 2005). Cost estimates ranged from $0.51 per screen in Zarkin et al. (2003) to $601.50 per screen in Kunz et al. (2004).

Columns 9–11 of Table 1 present information on BI. The majority of BIs are delivered by a primary care physician, although some studies used a nurse or health worker. No studies set in an emergency department used a physician for the BI; most used either a nurse or a health worker. The time

TABLE 1. Screening and BI time and cost estimates

| | Methodology | | | | Screen | | | BI | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Author | Cost estimation method | Setting | Resource use estimate | Price estimate | Service provider | Time estimate | Cost estimate | Service provider | Time estimate per session | Cost estimate per session |
| Ryder and Edwards, 2000 | Non-activity-based | IP | Hypothetical/ protocol | Setting average | [a] | [b] | [b] | [a] | [a] | $39.31 |
| Kunz et al., 2004 | Non-activity-based | ED | Actual | Site-specific | HPA | [a] | $601.50 | HPA | 15–20 min. | $81.98[c] |
| Tolley and Rowland, 1991 | Hybrid | IP | Actual | Setting average | HD | [a] | $3.62 | | | |
| | | | | | AHW | [a] | $3.72 | | | |
| | | | | | N | [a] | $4.00 | | | |
| Barrett et al., 2006 | Hybrid | ED | Actual | Setting average | AHW | [b] | [b] | AHW | 45-min. BI, 10-min. doc. | $34.00 |
| Navarro et al., 2011 | Hybrid | PC | Actual | National estimate | PCP | [a] | $23.99 | PCP | [a] | $63.73 |
| Quanbeck et al., 2010 | Hybrid | PC | Protocol | Site specific | PCP | [b] | [b] | PCP | [a] | $243.01 |
| Solberg et al., 2008 | Hybrid | PC | Hypothetical | National estimate | PCP | 1 min. | $10.71 | PCP | 4.55 min. | $48.73 |
| Dillie et al., 2005 | Hybrid | PC | Protocol | Site specific | N, rec. | [a] | $146.00 | PCP | 15 min. | $90.07[d] |
| Mundt et al., 2005 | Hybrid | PC | Actual | Site specific | N, rec. | 30 min. | $180.49 | PCP | 10–15 min. | $71.10[e] |
| Wutzke et al., 2001 | Hybrid | PC | Actual | National estimate | PCP | [b] | [b] | PCP | 5 min. | $18.31 |
| Fleming et al., 2000 | Hybrid | PC | Actual | Site specific | N, rec. | 10 min. | $3.86 | PCP | 15 min. | $81.48 |
| Freemantle et al., 1993 | Hybrid | PC | Hypothetical/ protocol | Setting average | N | 2 min. | $1.78 | N | 15 min. | $13.00 |
| | | | | | PCP | 2 min. | $5.34 | PCP | 15 min. | $40.00 |
| Lindholm, 1998 | Hybrid | PC | Protocol | National estimate | [a] | [a] | $181.25 | N | [a] | $60.42[f] |
| | | | | | [a] | [a] | $181.25 | PCP | [a] | $196.35[g] |
| Neighbors et al., 2010 | Activity-based | ED | Actual | National estimate | N | 5 min. | $75.51 | N | 5 min. | $3.80 |
| | | | | | SW | 6.5 min. | $78.91 | SW | 30-min. BI, 15-min. superv., 60-min. waiting, 17-min. doc. | $93.62 |
| Gentilello et al., 2005 | Activity-based | ED | Hypothetical | National estimate | Psy. | [a] | $20.00 | Psy. | 30-min. BI, 54-min. doc. | $47.00 |
| Kaner et al., 2003 | Activity-based | PC | Actual | National estimate | N | 1 min. | $0.91 | N | 8.6 min. | $7.88 |
| | | | | | PCP | 1 min. | $3.73 | PCP | 8.6 min. | $32.08 |
| Zarkin et al., 2003 | Activity-based | PC | Actual | Site specific | Rec. | 2 min. | $0.51 | N/HE | 4 min. | $3.14 |
| | | | | | Rec. | 2 min. | $0.51 | PCP, PA, NP | 4 min. | $4.16 |

*Notes:* AHW = alcohol health worker; BI = brief intervention; doc. = documentation; ED = emergency department; HD = hospital doctor; HE = health educator; HPA = health promotion advocate; IP = inpatient; min. = minute; N = nurse; NP = nurse practitioner; PA = physician's assistant; PC = primary care; PCP = primary care physician; psy. = psychologist; rec. = receptionist, superv. = supervisory; SW = social worker. [a]The estimate or provider is not explicitly described; [b]screening time and cost estimates are included in BI estimates; [c]two-session model, total BI costs are $163.96; [d]two-session model, total BI costs are $180.15; [e]two-session model, total BI costs are $142.20; [f]five-session model, total BI costs are $302.10; [g]five-session model, total BI costs are $981.80.

to deliver a BI varies greatly: Several studies included BIs of no more than 5 minutes (Neighbors et al., 2010; Solberg et al., 2008; Wutzke et al., 2001; Zarkin et al., 2003), and some included BIs of more than 1 hour (Gentilello et al., 2005; Neighbors et al., 2010). Costs of BI also vary widely, from a low of $3.14 per BI in Zarkin et al. (2003) to a high of $243.01 per BI in Quanbeck et al. (2010).

To facilitate the identification of patterns, Table 2 presents the costs of screening and BI separately, sorted in ascending cost order. The following studies that did not provide separate screening and BI costs were excluded from Table 2: Barrett et al. (2006), Quanbeck et al. (2010), Ryder and Edwards (2000), and Wutzke et al. (2001). Screening has a greater range of costs than BI, with the $601.50 per screen estimate from Kunz et al. (2004) being a notable outlier. Kunz et al.'s screening cost is more than $400 greater than the next highest screening cost; it is also the only screening study that uses non-activity-based costing.

Four other studies (Dillie et al., 2005; Lindholm, 1998; Mundt et al., 2005; Neighbors et al., 2010) have screening costs greater than $75. Three of these use a hybrid costing approach, and screening occurs in a primary care setting

Table 2. Screening and BI cost estimates

| Author | Cost estimation method | Setting | Resource use estimate | Price estimate | Service provider | Time estimate | Cost estimate |
|---|---|---|---|---|---|---|---|
| Screening | | | | | | | |
| Zarkin et al., 2003 | Activity-based | PC | Actual | Site-specific | Rec. | 2 min. | $0.51 |
| Kaner et al., 2003 | Activity-based | PC | Actual | National estimate | N | 1 min. | $0.91 |
| Freemantle et al., 1993 | Hybrid | PC | Hypothetical/protocol | Setting average | N | 2 min. | $1.78 |
| Tolley and Rowland, 1991 | Hybrid | IP | Actual | Setting average | HD | [a] | $3.62 |
| Tolley and Rowland, 1991 | Hybrid | IP | Actual | Setting average | AHW | [a] | $3.72 |
| Kaner et al., 2003 | Activity-based | PC | Actual | National estimate | PCP | 1 min. | $3.73 |
| Fleming et al., 2000 | Hybrid | PC | Actual | Site-specific | N, rec. | 10 min. | $3.86 |
| Tolley and Rowland, 1991 | Hybrid | IP | Actual | Setting average | N | [a] | $4.00 |
| Freemantle et al., 1993 | Hybrid | PC | Hypothetical/protocol | Setting average | PCP | 2 min. | $5.34 |
| Solberg et al., 2008 | Hybrid | PC | Hypothetical | National estimate | PCP | 1 min. | $10.71 |
| Gentilello et al., 2005 | Activity-based | ED | Hypothetical | National estimate | Psy | [a] | $20.00 |
| Navarro et al., 2011 | Hybrid | PC | Actual | National estimate | PCP | [a] | $23.99 |
| Neighbors et al., 2010 | Activity-based | ED | Actual | National estimate | N | 5 min. | $75.51 |
| Neighbors et al., 2010 | Activity-based | ED | Actual | National estimate | SW | 6.5 min. | $78.91 |
| Dillie et al., 2005 | Hybrid | PC | Protocol | Site-specific | N, rec. | [a] | $146.00 |
| Mundt et al., 2005 | Hybrid | PC | Actual | Site-specific | N, rec. | 30 min. | $180.49 |
| Lindholm, 1998 | Hybrid | PC | Protocol | National estimate | [b] | [a] | $181.25 |
| Kunz et al., 2004 | Non-activity-based | ED | Actual | Site-specific | HPA | [a] | $601.50 |
| Brief intervention | | | | | | | |
| Zarkin et al., 2003 | Activity-based | PC | Actual | Site-specific | N/HE | 4 min. | $3.14 |
| Neighbors et al., 2010 | Activity-based | ED | Actual | National estimate | N | 5 min. | $3.80 |
| Zarkin et al., 2003 | Activity-based | PC | Actual | Site-specific | PCP, PA, NP | 4 min. | $4.16 |
| Kaner et al., 2003 | Activity-based | PC | Actual | National estimate | N | 8.6 min. | $7.88 |
| Freemantle et al., 1993 | Hybrid | PC | Hypothetical/protocol | Setting average | N | 15 min. | $13.00 |
| Kaner et al., 2003 | Activity-based | PC | Actual | National estimate | PCP | 8.6 min. | $32.08 |
| Freemantle et al., 1993 | Hybrid | PC | Hypothetical/protocol | Setting average | PCP | 15 min. | $40.00 |
| Gentilello et al., 2005 | Activity-based | ED | Hypothetical | National estimate | Psy. | 30-min. BI, 54-min. doc. | $47.00 |
| Solberg et al., 2008 | Hybrid | PC | Hypothetical | National estimate | PCP | 4.55 min. | $48.73 |
| Lindholm, 1998 | Hybrid | PC | Protocol | National estimate | N | [a] | $60.42 |
| Navarro et al., 2011 | Hybrid | PC | Actual | National estimate | PCP | [a] | $63.73 |
| Mundt et al., 2005 | Hybrid | PC | Actual | Site-specific | PCP | 10–15 min. | $71.00 |
| Fleming et al., 2000 | Hybrid | PC | Actual | Site-specific | PCP | 15 min. | $81.48 |
| Kunz et al., 2004 | Non-activity-based | ED | Actual | Site-specific | HPA | 15–20 min. | $82.00 |
| Dillie et al., 2005 | Hybrid | PC | Protocol | Site-specific | PCP | 15 min. | $90.07 |
| Neighbors et al., 2010 | Activity-based | ED | Actual | National estimate | SW | 30-min. BI, 15-min. superv., 60-min. waiting, 17-min. doc. | $93.62 |
| Lindholm, 1998 | Hybrid | PC | Protocol | National estimate | PCP | [a] | $196.35 |

*Notes:* Cost estimates were adjusted from the original study's data collection period. If the period of data collection was not explicitly stated, the authors approximated the data collection period based on publication date and contextual information. AHW = alcohol health worker; BI = brief intervention; doc. = documentation; ED = emergency department; HD = hospital doctor; HE = health educator; HPA = health promotion advocate; IP = inpatient; min. = minute; N = nurse; NP = nurse practitioner; PA = physician's assistant; PC = primary care; PCP = primary care physician; psy = psychologist; rec. = receptionist; superv. = supervisory; SW = social worker. [a]The time estimate is not explicitly described; [b]the service provider is not explicitly described.

(Dillie et al., 2005; Lindholm, 1998; Mundt et al., 2005), whereas the remaining estimate uses activity-based costing, and screening occurs in the emergency department (Neighbors et al., 2010). Dillie et al. (2005) and Mundt et al. (2005) use resource estimates based on Project TrEAT (Trial for Early Alcohol Treatment; Fleming et al., 2000); however, their screening estimate is much higher than the $3.86 per screen in Fleming et al. (2000). The screening time estimate differs by 20 minutes between Mundt et al. and Fleming et al.; information on the reason for the time difference is not available. Although the time difference would certainly account for some of the cost difference, it does not explain the approximately $150 cost difference. Lindholm (1998) provides no explicit information in the article other than a unit cost of $181.25 to deliver a Cut Down, Annoyed, Guilty, and Eye Opener (CAGE) screening test. Neighbors et al. (2010) used actual resource estimates and national price estimates and provided detailed information on their service provider and time estimates.

On the lower end of the cost spectrum, 9 of the 18 cost estimates for screening are less than $5.50. Of these studies, screening times are short (approximately 1–2 minutes), and screens are generally completed by a nurse/receptionist. Studies in this range use hybrid and activity-based costing

approaches. The 3 estimates in the middle of the cost range have costs between $10 and $25. One occurs in the emergency department (Gentilello et al., 2005), and the remaining 2 occur in a primary care setting and use a primary care physician as the service provider.

Across studies with a BI cost estimate in Table 2, there were 17 estimates ranging from $3.14 per BI (Zarkin et al., 2003) to $196.35 per BI (Lindholm, 1998). Lindholm's (1998) estimate is more than double the next highest estimate of $93.62 from Neighbors et al. (2010). Lindholm does not provide specific information on the BI protocol; the BI cost is presented simply as the reimbursement rate for a primary care physician visit.

Five BI cost estimates are below $20. Of these, 4 use activity-based costing, 4 are set in primary care, 4 have a BI provided by a nurse/health worker, and 3 have a service time of 5 minutes or less. Because of these similarities, the cost range is very narrow for these BI estimates.

The remaining 11 estimates in the middle of the cost range are between $30 and $95. The costing approaches in the middle range tend to be either non-activity-based or hybrid. Resource use and price estimates are roughly evenly distributed among these studies. Two studies use activity-based costing but have an approximately $60 difference (Kaner et al., 2003; Neighbors et al., 2010). One study (Kunz et al., 2004) uses a non-activity-based costing; the rest use a hybrid approach. The mid-cost range studies have BI session times that are generally longer than the low-cost BI studies (15–30 minutes), and these BIs are more likely to be provided by a primary care physician. Gentilello et al. (2005) and Neighbors et al. (2010) include waiting time and documentation and administration activities that extend the BI up to 84 minutes. The cost variation in the mid-cost range studies appears to be associated with higher wage providers and longer service delivery times.

Generally speaking, SBI cost estimates are lower when activity-based costing is used, when SBI is conducted in a primary care setting, when the provider is not a doctor, and when the screen time is 2 minutes or less and the BI time is 5 minutes or less. Across all estimates in Table 2, the median cost of screening was $8.03, and the median cost of BI was $48.73. For screening, 9 of the 18 estimates are less than $5.50, 3 estimates are between $10 and $25, and the remaining 3 estimates are greater than $75, suggesting that there are tiers of screening cost estimates. For BI, we also identified three tiers of costs: less than $20, $30–$95, and more than $190.

To develop a summary cost estimate from the literature, we narrowed the range of screening and BI cost estimates by excluding articles at the top tier of the screening and BI distributions. Screening costs from the remaining studies range from $0.51 per screen (Zarkin et al., 2003) to $23.99 per screen (Navarro et al., 2011); the average screening cost for this subset is $6.85 per screen (*SD* = 7.58), and the median cost is $3.80 per screen. The median screening cost estimate was associated with a median time estimate of 2 minutes per screen. BI cost estimates for the remaining studies range from $3.14 per BI (Zarkin et al., 2003) to $93.62 (Neighbors et al., 2010); the average BI cost for this subset is $46.39 per BI (*SD* = 32.72), and the median cost is $47.87 per BI. The median BI cost estimate was associated with a median time estimate of 13.75 minutes per BI. Using the median as the measure of central tendency, we conclude that a screen costs approximately $4, and a BI costs approximately $48.

## Discussion

Understanding the implementation costs of SBI can provide crucial information to policy makers and practitioners looking to adopt an SBI program. Although efficacy and effectiveness of SBI in medical settings have been well established, there is little consensus on what it costs to implement SBI programs. A lack of knowledge about the implementation costs of SBI may be one of several barriers to widespread adoption of SBI in medical settings. This review provides a synthesis of the current SBI cost literature and provides summary cost estimates for SBI.

Variation in screening and BI costs was primarily driven by the wage of the provider and the service delivery time. Differences in provider and service delivery create variation within a medical setting; this seems natural given the various ways in which SBI can be implemented. Studies that used a primary care physician generally had higher cost estimates than studies that used a nurse or health promotion advocate as the provider. Studies with longer BI sessions or that included other activities, such as waiting time or documentation time, also tended to have higher implementation costs. The estimates also suggest that costs differ between primary care and emergency department settings; estimates from emergency department studies tended to be higher.

One major challenge in evaluating SBI cost estimates is insufficient reporting of the cost methodology. For example, there are several instances in which a study that utilizes resource use and unit price estimates from another clinical protocol has a large cost difference from the source study, but the reasons for the cost difference are not described. There are also multiple studies in which provider types and time estimates are not described or where prescreening, screening, or BI estimates are bundled together, and information on the individual service components is not presented. These methodological omissions greatly limit the ability to interpret differences in cost estimates and to understand what drives the cost differences.

This article highlights differences in cost estimation approaches. Activity-based costing defines a taxonomy of activities required to deliver an intervention; the taxonomy identifies the specific activities and unit prices that are included in a cost estimate. Non-activity-based costing collects

information on the total costs required to provide a service at the program level and then divides the cost by the number of persons served. It is difficult to compare non-activity-based cost estimates with other cost estimates because individual activities are not identified. Thus, it is not clear whether equivalent SBI models are being compared.

Excluding the upper tier of the cost estimates yielded summary cost estimates for SBI: Median screen costs of the remaining estimates are approximately $4, and median BI costs are approximately $48. These values are within the range of the Healthcare Common Procedure Coding System (HCPCS) and Current Procedural Terminology (CPT) codes for SBI. Medicaid has separate reimbursement codes for SBI: Screening is reimbursed at $24, and BI is reimbursed at $48 per 15 minutes. CPT codes allow $33.41 for both SBI services between 15 and 30 minutes and $65.51 for more than 30 minutes. Medicare allows similar reimbursement rates of $29.42 and $57.69 for 15 to 30 minutes and more than 30 minutes, respectively (Substance Abuse and Mental Health Services Administration, 2011). To our knowledge, no study has examined the extent to which SBI HCPCS or CPT codes are actually used.

Although the median summary cost estimates suggest that the reimbursement values could sustain SBI, the summary time estimates do not align with the time thresholds of the reimbursement codes. The median summary cost estimates are associated with the median summary time estimates of 2 minutes per screen and 13.75 minutes per BI. However, the CPT and HCPCS-Medicare reimbursement rates do not cover the costs of SBI in the 15- to 30-minute service range; they only cover costs when the service is 30 minutes or longer. Furthermore, depending on the state or agency, these reimbursement codes can be interpreted as requiring an absolute minimum service time: Service delivery time must be at least 15 or 30 minutes to be reimbursed at a given rate. Therefore, several cost estimates in this review would be ineligible for reimbursement because their delivery times are less than the minimum service time, but increasing delivery times could increase the cost of SBI to a value greater than the reimbursement rate. Likewise, studies with cost estimates above current reimbursement values may not be able to reduce delivery time to meet the reimbursement level. This suggests that the minimum service times of the current reimbursement rates are too high relative to the reimbursement levels.

The summary time estimates for SBI may also present a logistical challenge to most health care providers because a 15.75-minute SBI session is not practical. Konrad et al. (2010) reported that the average American physician had 18 minutes to spend with a patient on a routine visit. Even if the cost of SBI is covered by the reimbursement rate, if a health care provider perceives that it takes too long to perform a BI relative to the total time a health care provider spends with a patient, SBI may not be adopted in clinical practice. Therefore, the current time allocation required for SBI reimbursement may not align with clinical time constraints.

Other potential issues that need to be addressed for the widespread adoption of SBI include state Medicaid policy, reimbursement procedures, and perceived costs. Medicaid reimbursement codes are only activated on a state-by-state basis; therefore, they may not be available to practitioners seeing certain patients. Health care providers who perform SBI regularly may be unaware that such reimbursement codes exist, or they may struggle to integrate billing procedures into their practice. Perceived costs may also act as a barrier if providers do not feel reimbursement rates are sustainable for their practice.

A limitation of our review is that none of these studies actually collects costs as incurred in a sustainable, everyday implementation of SBI. The costs reviewed here are derived from the costs of implementing SBI in a clinical trial or research study. Some studies exclude those costs incurred as part of a research study, and others try to approximate real-world settings, but they may not capture the inefficiencies and lost time or service support time necessary for real-world implementation. Although some studies appeared to capture these costs (e.g., Gentilello et al., 2005; Neighbors et al., 2010), most of the other studies did not.

This review presents a first step in establishing a business case for SBI, but additional research is needed. Not only are more alcohol SBI cost studies needed to improve the existing estimates, but also more transparency is required in the cost methodologies. To fully inform policy and implementation decisions around SBI programs, crucial cost differences need to be identified. Additional information on start-up costs, service-support time, and other real-world implementation costs is also needed to overcome barriers.

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