Cost of screening, brief intervention, and referral to treatment in health care settings

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Abstract:

Aims: This study analyzed service unit and annual costs of substance abuse screening, brief intervention, and referral to treatment (SBIRT) programs implemented in emergency department (ED), inpatient, and outpatient medical settings in three U.S. states and one tribal organization. **Methods:** Unit costs and annual costs were estimated from the perspective of service providers. Data for unit costs came from 26 performance sites, and data for annual costs came from 10 programs. A bottom-up approach was used to derive unit costs and included labor, space, and materials used in each SBIRT activity. Activities included direct SBIRT services and activities that support direct service delivery. Labor time spent in each activity was collected by trained observers using a time-and-motion approach. A top-down approach used cost questionnaires completed by program administrators to calculate annual costs and included labor, space, contracted services, overhead, training, travel, equipment, and supplies and materials. Costs were estimated in 2012 U.S. dollars. **Results:** Average unit costs for prescreening, screening, brief intervention, brief treatment, and referral to treatment were $0.61, $6.59, $10.48, $22.63, and $12.06 in ED; $0.86, $6.33, $9.07, $27.61, and $8.03 in inpatient; and $0.84, $3.98, $7.81, $27.94, and $9.23 in outpatient settings, respectively; over half of the costs were attributable to support activities. Across all settings, the average cost to provide SBIRT per positive screen, for 1 year, was about $400. **Conclusions:** Support activities comprise a large proportion of costs. Health administrators can use the results to budget and compare how much sites are reimbursed for SBIRT to how much services actually cost.

Keywords: screening | brief intervention | SBIRT | substance abuse | cost | implementation

Article:

1. Introduction

Substance abuse and dependence are widely recognized as serious and costly societal problems affecting an estimated 22.2 million people in 2012, or 8.5% of the U.S. population aged 12 or older (American Psychiatric Association, 1994, Substance Abuse and Mental Health Services Administration, 2013). Just as significant are the estimated 22.5 million people who used illicit drugs or drank heavily (five or more drinks on the same occasion) over the past month but did

not meet the clinical guidelines for either abuse or dependence (authors' calculations, SAMHDA calculating tool [ICPSR, 2012]). Some of these individuals will develop substance use disorders, but even those who do not may incur societal costs through increased medical care use, increased rates of accident and injury, and lost work productivity (Miller & Hendrie, 2009).

In 2003, the Substance Abuse and Mental Health Services Administration (SAMHSA) launched a major initiative – Screening, Brief Intervention, and Referral to Treatment (SBIRT) – with the aim of integrating services to address unhealthy substance use into medical settings. SBIRT is similar in concept and approach to the internationally known terminology "screening and brief intervention" (SBI), but refers to SAMHSA's SBI program. SBIRT programs use a public health approach to identify people who engage in unhealthy substance use behaviors and then provide an appropriate level of care to those who need it. By screening for unhealthy substance use in addition to dependence, SBIRT services are designed to prevent more severe consequences from occurring (Agerwala and McCance-Katz, 2012, Babor et al., 2007).

In addition to SAMHSA, other national and professional regulatory bodies in the United States (e.g., Surgeon General's Call to Action to Prevent and Reduce Underage Drinking, American College of Surgeons Committee on Trauma, American Academy of Pediatrics, National Quality Forum) have recommended SBI in medical, educational, and criminal justice settings (Padwa et al., 2012). The U.S. Preventive Services Task Force recommends that clinicians provide alcohol SBI to adult patients in primary care settings (Moyer, 2013).

SBI has been implemented in a variety of medical settings, including emergency departments (EDs) (Desy and Perhats, 2008, D'Onofrio and Degutis, 2010, Parker et al., 2012, Sommers et al., 2013), inpatient wards (Broyles et al., 2013, Cruz, 2013, McQueen et al., 2009), and primary care settings (Chick et al., 1988, Fleming, 2004, Fleming et al., 2007, Kaner et al., 2007). The efficacy and effectiveness of alcohol SBI in primary care settings have been well established; however, recent studies have shown a lack of effectiveness of SBI targeting drug misuse in primary care settings (Ries et al., 2014, Saitz et al., 2014). Despite the range of literature on the implementation and effectiveness of SBIRT, little evidence is available on the costs of providing SBIRT in different medical settings (Bray et al., 2014). As integration of substance abuse services such as SBIRT into general medical care becomes more common in the United States (Buck, 2011), understanding the costs of SBIRT is important for policy makers and treatment providers to allocate scarce resources among various treatment services (Moyer and Finney, 2004, Zarkin et al., 2004).

A lack of knowledge about the costs of providing SBIRT may pose a barrier to its widespread adoption. A recent review of 47 published qualitative studies assessing numerous potential barriers to adopting and sustaining SBI concluded that the lack of financial resources for SBI is one of the three most important barriers to implementation (Johnson, Jackson, Guillaume, Meier, & Goyder, 2011). For decision makers to know whether financial resources for SBI are sufficient, they first need detailed estimates on the costs of providing SBI. In addition, a necessary step before conducting a full economic evaluation of SBI, which jointly accounts for both costs and effects, is to accurately estimate the cost of SBI.

A review of the costs of alcohol SBI in medical settings showed that the costs of SBI vary widely in 17 studies and that most studies presented little to no information on the cost methodology (Bray, Zarkin, Hinde, & Mills, 2012). With few exceptions (Bray et al., 2014), studies that calculated the cost of SBI usually present one of three types of cost estimates: the cost of individual SBI services, also known as the unit cost; the average cost of SBI; and the annual cost of SBI (Bray et al., 2012). The average cost and the annual cost of SBI are closely related: the average cost is the annual cost of SBI divided by the number of patients served in a year.

Both the unit cost of individual SBI services and the average/annual cost of SBI are relevant to decision makers. An understanding of the unit costs of individual SBI services, such as the cost of providing one screen, is vital for performance site administrators when budgeting for labor, space, and material resource needs. Unit costs also provide insight to insurers and reimbursement administrators responsible for setting service reimbursement rates. Unit costs can also be used to convert health care utilization into costs and to compare costs across studies. One advantage of using a unit cost rather than an average or annual cost is that it can be used by decision makers to forecast the impact on budgets if they hypothetically change the service mix of bundles of services. However, unit costs have two major limitations that average or annual cost estimates do not have. First, estimating unit costs requires many study resources. Second, unit costs may fail to account for activities that cannot be attributed to an individual patient, such as general administrative activities. If these costs are to be included, they must be apportioned between different services that share those resources (Drummond et al., 2005, Gold et al., 1996). Annual costs provide financial information for funding and performance measurement. They can usually provide the costs of individual expense categories – such as labor, materials, and overhead – and of running SBI as a whole. The advantages of annual costs are that they can be computed more readily than unit costs and they include all of the costs necessary to deliver services. Because annual costs are typically estimated using a less detailed approach, they cannot be used to disentangle the cost of SBI implemented under different clinical protocols or in settings with different unit prices (Bray et al., 2012).

The current study provides estimates of the cost to implement SBIRT, both from the point of view of an individual unit of service and in terms of annual operating costs. Unit costs are separated into service and support labor, materials, and space, and can be used to inform additional analyses of cost-effectiveness and financial sustainability. Annual operating costs are valuable for policy makers and other stakeholders to plan SBIRT implementation.

1.1. SAMHSA SBIRT programs

Five-year grants were awarded to four grantees, which represent three states and one tribal organization and were located in the Southeast, Midwest, and Northwest regions of the United States. The four grantees contained 11 SBIRT programs that functioned as umbrella organizations to administer SBIRT delivery in 192 performance sites. Performance sites nested within programs were sometimes affiliated with one another, but this was not necessarily the case. In some cases, SBIRT programs were administered by hospital systems and comprised only sites within that hospital system. In other cases, SBIRT programs were administered by behavioral health providers whose staff went to other, non-affiliated sites in the community to

conduct SBIRT. In this context, programs are defined by a common SBIRT administrative structure.

Performance sites were emergency departments and trauma centers (EDs); medical, surgical, and psychiatric inpatient hospital settings (inpatient); and outpatient hospitals and ambulatory clinics (outpatient). At those sites, all individuals presenting for care, but not specifically seeking treatment for substance use, were screened and received appropriate feedback, intervention, or treatment. Although implementation varied across programs, typical procedures were as follows. Patients were screened for a range of unhealthy substance use behaviors. Most sites used a short, one-to-four question prescreen on substance use to assess whether a patient should be screened more thoroughly with a full screen. The two common full screens used were the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST) for adults (Ali et al., 2002, Humeniuk et al., 2010) and the car, relax, alone, forget, friends, trouble test (CRAFFT) for adolescents (Knight et al., 2003, Knight et al., 2002). Two of the four grantees screened only adult patients (age 18 +), while the other two screened adolescents (12 + and 14 +, respectively), in addition to adults. Patients screening negative were usually offered brief advice and/or a pamphlet on the dangers of unhealthy substance use.

Almost all patients who screened positive received a time-limited brief intervention (15 min or less) delivered using a motivational interviewing approach (Miller & Rollnick, 2002) or other recognized method to increase awareness regarding substance use and motivation toward behavioral change. For patients needing more intensive services, some sites also offered brief treatment, which consisted of multiple, structured, cognitive–behavioral or motivational enhancement therapy sessions that could take up to one hour. In the most severe cases, or if the site did not offer brief treatment, patients were referred to specialty treatment at an external provider. Depending on the performance site, prescreens were administered by SBIRT practitioners and general medical staff such as nurses or medical assistants, or self-administered as part of the intake paperwork. All SBIRT activities subsequent to prescreen were generally performed by an SBIRT practitioner. SBIRT practitioners were generally Master's level or higher, and about half were certified or licensed in addiction treatment. Most or all of their time was devoted to SBIRT activities.

This study draws on all components of SBIRT delivery, from prescreen to referral to treatment, to calculate unit costs of SBIRT delivery in ED, inpatient, and outpatient settings, and the annual cost of running an SBIRT program.

2. Methods

2.1. Overview

Costs were computed from the perspective of service providers. To maximize the degree to which findings can be generalized, the approach estimates economic rather than accounting costs. Thus, all resources to support SBIRT were valued, regardless of whether the resources are billed or require a transfer of funds. For example, although rental costs for physical space in which SBIRT services were delivered may not be charged by the host institution, the current study estimated the cost of that space.

This study used different methods to estimate unit costs and annual costs. Service unit costs were estimated using a bottom-up or micro-costing approach where the quantity of each component of resource use is estimated and a dollar value is placed on each component (Drummond et al., 2005, Gold et al., 1996). The costs calculated under this approach were the costs of an additional unit of a service (e.g., a screen) and only included patient-specific variable costs, or costs that varied with the number of individuals to whom services were provided (e.g., the cost of delivering brief intervention). Annual costs were estimated using a top-down approach, where data on a broad and comprehensive set of cost categories were obtained. One year was chosen because it represents a reasonable period to reflect a pattern of resource use (French, Dunlap, Zarkin, McGeary, & Thomas McLellan, 1997). The unit of data collection and analysis was the individual program (i.e., SBIRT) rather than the patient. Annual cost estimates included all costs necessary to deliver SBIRT throughout 1 year. In addition to patient-specific costs, the estimates included fixed costs, incurred once during a study period (e.g., administrative costs); and quasi-fixed costs, incurred on a per staff member basis (e.g., training).

All cost estimates are presented in 2012 U.S. dollars. The research plan, protocols, data collection instruments, and consent forms were reviewed and approved by institutional review boards at the authors' institution and at the sites selected for observational data collection.

2.2. Data collection

2.2.1. Unit costs

To compute unit costs, data were collected on labor costs and non-labor costs. Labor costs require data on the time to conduct service activities and the value of that time. Data on the time spent in activities came from direct observation. Because these data were quite detailed and required considerable project resources to collect, they were collected from a sample of sites. Timing data for unit cost data came from 26 performance sites spanning all four grantees and 10 programs. One program was not included in the analysis because it was not operational during the period studied (fiscal year 2012). This program was unusually small in terms of staff and the number of patients served. For two grantees, observations covered all active performance sites. For the other two, sites were sampled using a number of criteria that could best represent the two grantees, including patient flow, type of setting, staffing arrangements, and patient population characteristics.

A time-and-motion approach was used to estimate the time practitioners took to deliver SBIRT services to adult patients. This approach avoided the disadvantages of self-reported data and relied on trained observers to follow a single practitioner during his or her workday and measure the duration of each activity using a stopwatch and standardized observation forms. The advantage of the time-and-motion approach is that activity duration is accurately measured for all activities observed. As a guide for observational data collection, the research team developed a taxonomy of activities that included categories such as SBIRT direct services, SBIRT patient-specific support, SBIRT general support, Government Performance Results Act (GPRA) administration, and evaluation support. The category of SBIRT direct services comprised the actual delivery of each SBIRT component and included five direct SBIRT services: prescreen,

full screen, brief intervention, brief treatment, and referral to treatment. SBIRT patient-specific support included activities necessary to deliver each of the five SBIRT services to one particular patient, such as locating a patient in an ED and writing and reading case notes. SBIRT direct services and patient-specific support were the two activities used to estimate SBIRT unit costs. SBIRT general support captured activities focusing on several patients at the same time, such as reviewing lists of patients to screen. Differences in patient-specific and general support activities across sites were predominantly a function of site protocols and not the type of medical setting. An exception to this rule is that practitioners in EDs spent more time searching for patients that they had identified as needing a screen than practitioners in other settings. GPRA administration was related to the collection of data to meet grant reporting requirements, and evaluation support captured practitioners' interaction with grant evaluators. The last three categories were used to ensure that every activity performed by practitioners during the observation period was captured, even if not directly related to SBIRT.

Data on the dollar value of the labor time for unit costs came from a standardized, structured cost questionnaire completed for each program and grantee by administrators, who typically were the project director or program coordinator. The questionnaire was adapted from the Substance Abuse Services Cost Analysis Program (Zarkin et al., 2004). It recorded the expenses incurred and resources for fiscal year 2012 according to the following expense categories: labor costs (salary, level of effort, and fringe rates for all SBIRT-affiliated personnel, including contracted personnel and personnel who were not directly funded by the grant) and non-labor costs associated with contracted services (e.g., IT and technical assistance), overhead, training, travel, equipment, and supplies and materials. Data collected using the cost questionnaire were reviewed by the study team, and any questions or issues were resolved through follow-up discussions with respondents. The calculation of unit costs used information from the cost questionnaire on the salary and fringe rate of each practitioner to place a dollar value on the labor component of unit costs.

Non-labor costs included material and space costs. Material costs were for pamphlets and brochures distributed to patients, personalized feedback reports, and paper forms used to screen or collect information. The cost questionnaires provided data on the number of copies used of each item for each component of SBIRT. The cost per item was the bulk price obtained either from a key informant at the grantee or from a national online retailer. Space costs were for the room in which services were delivered. The size of the room was measured during observational site visits. Regional rent estimates were obtained from an online commercial real estate marketplace (LoopNet.com), and utility prices were obtained from a national facilities management company (FMLink Group).

2.2.2. Annual costs

Annual costs were obtained from all 10 SBIRT programs and four grantees. Most data for annual costs came from the cost questionnaire. The only data that did not come from the cost questionnaire were for space costs, which were imputed because site-specific estimates on the amount of space used to deliver services were only available for the sample of sites that were visited. A standard 10 × 10 office was assumed for each program administrator, and a standard

7 × 7 office was assumed for each practitioner. Table 1 describes the data sources for service unit and annual costs.

Table 1. Resource use and prices data sources.

Cost component	Quantity of resources	Price
Unit costs		
Labor: service delivery and service delivery support	Service delivery and support time: observational data	Salary and fringe rates: administrative data
Non labor materials: pamphlets, paper and instruments	Number of copies: cost questionnaires	Price per copy: administrative and retailer data
Non labor space: service delivery office space	Room sizes: Observational data	Price per square foot: rent from online commercial real estate marketplace and utilities from a national facilities management group
Annual program costs		
Labor: staff types including service delivery, clinical supervision, program administration, training, information technology and clerical	Level of effort: administrative data	Salary and fringe rates: administrative data
Non-labor: overhead, contracted services, equipment, supplies and materials, training, travel, other	Number of units: program-level questionnaires	Unit cost: program-level questionnaires
Non-labor space: program office space	Assumed a 10 × 10 ft^2 office for each program administrator and a 7 × 7 ft^2 office for each practitioner.	Price per square foot: rent from online commercial real estate marketplace and utilities from a national facilities management group

2.3. Analysis

2.3.1. Unit costs

To calculate unit costs, the investigators first identified the resources used for delivering SBIRT. The resources were identified focusing on the patient as the unit of data collection and analysis. This analysis estimated the cost of SBIRT as it would be delivered in standard practice rather than as part of a grant program. The broad spectrum of activities allowed the investigative team to identify all activities performed by providers so that those not relevant to patient-specific SBIRT delivery could be excluded from the unit cost estimates. These excluded activities were GPRA administration; evaluation activities, including communicating with the study team; and general support activities. General support activities, such as staff meetings and clinical supervision, were excluded because they could not be linked to a particular patient. Hence, only direct services and patient-specific support activities were included in the unit cost estimates.

Unit costs were the sum of labor, materials, and space costs. Cost estimates were derived by multiplying the quantity of a resource by its unit cost and summing over all relevant resources. To estimate the dollar value of the labor component of unit costs, i.e., of practioners time in SBIRT activities, a salary cost per minute for each individual practitioner was calculated assuming a 2080-h work year. The minute rate adjusted for the program's fringe benefit rate and then multiplied by the duration of service and support activities, in minutes. The duration of service activities was directly observed, but because service support time could not be uniquely

attributed to a particular direct service, total service support time was allocated across direct services. The allocation relied on a regression model where the sum of patient-specific support time was regressed on binary indicators of the direct service activities. Gamma regression with a log link was used to account for the duration data being non-negative, having a modal value of zero, and being right skewed (Manning & Mullahy, 2001). In this model, it was assumed that prescreens had no support time because prescreens were typically either fully integrated into a site's intake procedures (e.g., done at triage in an ED) or self-administered by a patient (e.g., in an outpatient waiting room).

2.3.2. Annual costs

Annual costs were the sum of the following cost categories: labor, space, contracted services (e.g., IT and technical assistance), overhead, training, travel, equipment, and supplies and materials. To account for variation in the workload of the programs, annual costs were divided by the number of positive screens in fiscal year 2012 (Agerwala & McCance-Katz, 2012) to yield an average annual cost, representing the cost of treating one patient continuously for 1 year. Average cost estimates are useful because data are normalized so that programs that vary widely in size can be directly compared. The number of positive screens and not the total number of intakes was used because it best represented the typical patient flow and associated annual costs.

3. Results

3.1. Unit costs

A total of 501 patient–practitioner interactions were observed (over 213 h) of which 294 included the delivery of at least one SBIRT service component. Observers timed 210 prescreens, 97 full screens, 66 brief interventions, 6 episodes of brief treatment, and 22 referrals to treatment.

Table 2 shows the unit costs of prescreening, full screening, brief intervention, brief treatment, and referral to treatment, by setting and across all settings. The primary cost component was support of direct service delivery (e.g., writing case notes, collecting information for the patient). More than half of the total service cost was attributable to support costs in all settings for all services but prescreening and brief treatment.

Non-labor costs comprised a relatively small portion of the unit costs. Across all settings and services, space costs added no more than $0.05 to the unit cost. Material costs were relatively minor for prescreens and full screens, but brief interventions and brief treatment had relatively higher material costs due to the higher quantity and price of educational or motivational materials that were offered to patients.

Table 2. Unit cost of SBIRT services by setting.

	Emergency department					Inpatient					Outpatient					All settings				
	PS	**FS**	**BI**	**BT**	**RT[a]**	**PS**	**FS**	**BI**	**BT**	**RT[a]**	**PS**	**FS**	**BI**	**BT**	**RT[a]**	**PS**	**FS**	**BI**	**BT**	**RT[a]**
	N = 136	**N = 56**	**N = 35**	**N = 2**	**N = 14**	**N = 10**	**N = 12**	**N = 11**	**N = 2**	**N = 5**	**N = 64**	**N = 29**	**N = 20**	**N = 2**	**N = 3**	**N = 210**	**N = 97**	**N = 66**	**N = 6**	**N = 22**
Service delivery																				
Time (min)	1:18	4:30	5:56	36:26	4:09	2:14	5:43	9:50	55:13	3:26	1:12	3:53	6:49	45:48	8:42	1:19	4:28	6:51	45:49	4:37
	(0:07)	(0:32)	(0:43)	(18:23)	(1:14)	(0:23)	(0:58)	(1:55)	(3:32)	(0:50)	(0:10)	(0:43)	(1:14)	(2:12)	(5:02)	(0:06)	(0:24)	(0:38)	(5:57)	(1:03)
Hourly wage applied to time	$26.49	$21.70	$22.05	$23.98	21.74	$18.43	$21.20	$18.82	$20.52	$20.59	$27.63	$21.59	$27.19	$32.12	$28.93	$26.45	$21.60	$23.07	$25.54	$22.46
	($0.90)	($0.59)	($0.68)	($0.00)	($1.99)	($1.39)	($0.46)	($1.32)	($0.58)	($0.84)	($1.74)	($1.16)	($1.39)	($3.45)	($3.52)	($0.78)	($0.47)	($0.58)	($2.36)	($0.79)
Service cost per unit($)	$0.51	$1.68	$2.20	$14.56	$1.57	$0.63	$2.04	$3.30	$18.92	$1.20	$0.64	$1.49	$3.08	$24.65	$4.10	$0.55	$1.66	$2.65	$19.38	$1.83
	($0.05)	($0.21)	($0.27)	($7.34)	($0.49)	($0.09)	($0.35)	($0.78)	($1.74)	($0.32)	($0.10)	($0.33)	($0.53)	($3.81)	($2.28)	($0.04)	($0.16)	($0.25)	($2.86)	($0.45)
Support of direct service delivery																				
Time (min) (regression-based estimate)	–	12:22	16:19	11:46	28:09	–	10:43	11:49	18:24	16:10	–	5:42	7:10	5:36	10:34	–	9:30	10:08	13:02	14:59
		(2:06)	(7:06)	(7:09)	(17:48)		(3:10)	(3:15)	(8:47)	(9:03)		(1:13)	(2:30)	(2:40)	(5:25)		(1:11)	(2:03)	(5:58)	(5:22)
Hourly wage applied to time	$26.49	$21.70	$22.05	$23.98	21.74	$18.43	$21.20	$18.82	$20.52	$20.59	$27.63	$21.59	$27.19	$32.12	$28.93	$26.45	$21.60	$23.07	$25.54	$22.46
	($0.90)	($0.59)	($0.68)	($0.00)	($1.99)	($1.39)	($0.46)	($1.32)	($0.58)	($0.84)	($1.74)	($1.16)	($1.39)	($3.45)	($3.52)	($0.78)	($0.47)	($0.58)	($2.36)	($0.79)
Support cost per unit ($)[b]	–	$4.47	$6.00	$4.70	$10.35	–	$3.79	$3.71	$6.29	$5.55	–	$2.05	$3.25	$3.00	$5.09	–	$3.42	$3.90	$4.66	$5.61
Materials																				
Quantity (number of pages)[c]	2.3	10.5	12.1	8.0	2.4	5.5	12.2	12.1	13.9	8.6	4.8	10.8	6.9	1.5	0	3.2	10.8	10.5	7.8	3.4
	(3.4)	(3.1)	(6.2)	(0.0)	(5.4)	(4.7)	(2.1)	(5.9)	(8.6)	(11.8)	(4.5)	(3.2)	(5.3)	(0.0)	(0)	(4.0)	(3.1)	(6.3)	(6.8)	(7.3)
Price per page[d]	$0.04	$0.04	$0.19	$0.25	$0.02	$0.04	$0.04	$0.17	$0.12	$0.05	$0.04	$0.04	$0.21	$0.25	–	$0.04	$0.04	$0.19	$0.21	$0.02
Material cost per unit ($)[e]	$0.09	$0.42	$2.26	$3.21	$0.13	$0.22	$0.49	$2.02	$2.13	$1.26	$0.19	$0.43	$1.45	$0.05	$0.00	$0.13	$0.43	$1.98	$1.80	$0.37
Space																				
Space (ft^2)[c]	119	112	117	173	117	134	127	147	150	189	103	87	96	110	85	115	106	116	144	129
	(30)	(53)	(67)	(74)	(45)	(73)	(90)	(90)	(42)	(103)	(24)	(31)	(37)	(57)	(22)	(32)	(55)	(66)	(54)	(68)
Price per ft^2 per year	$14.15	$14.26	$14.21	$13.20	$14.13	$14.82	$14.40	$15.22	$15.20	$14.56	$19.34	$14.28	$17.85	$23.40	$20.37	$15.77	$14.28	$15.48	$17.27	$15.08
Space cost per unit ($)[e]	$0.01	$0.02	$0.02	$0.16	$0.01	$0.01	$0.02	$0.05	$0.27	$0.02	$0.00	$0.01	$0.03	$0.24	$0.04	$0.01	$0.02	$0.03	$0.22	$0.02
Unit cost	**$0.61**	**$6.59**	**$10.48**	**$22.63**	**$12.06**	**$0.86**	**$6.33**	**$9.07**	**$27.61**	**$8.03**	**$0.84**	**$3.98**	**$7.81**	**$27.94**	**$9.23**	**$0.69**	**$5.53**	**$8.56**	**$26.06**	**$7.83**

Notes: PS, prescreen; FS, full screen; BI, brief intervention; BT, brief treatment; RT, referral to treatment.
Standard error in parentheses except where noted.
Costs in 2012 dollars; all values are averages; the unit cost is the sum of direct service delivery, patient-specific support, materials, and space costs. Costs do not necessarily correspond to the product of resource use and unit cost as only averages are presented here.
[a] RT encompasses referral to specialty and brief treatments.
[b] Because support time estimates were model based and not directly observed, we could not calculate a standard error around support costs per unit.
[c] In these rows, the numbers in parentheses are standard deviations rather than standard errors.
[d] Standard deviation could not be calculated for price per page because it was estimated at the program level rather than the observation level.
[e] Standard errors could not be calculated for material cost per unit and space cost per unit due to price and quantity being estimated at different levels (program level and observation level).

Prescreen average unit costs were $0.61 in ED settings, $0.86 in inpatient settings, and $0.84 in outpatient settings. Inpatient prescreens were exclusively delivered by SBIRT specialists, who generally took longer to deliver prescreens. Full screen unit costs were on average $6.59 in ED settings, $6.33 in inpatient settings, and $3.98 in outpatient settings. These differences are primarily due to statistically significant differences (P-value from joint test of significance of setting < 0.01) in the apportioned support time across settings. Support activities took considerably less time in outpatient settings than in either ED or inpatient settings. Brief intervention unit costs were on average $10.48 in ED settings, $9.07 in inpatient settings, and $7.81 in outpatient settings. The support duration estimate was considerably higher in EDs than in other settings, although the difference was not statistically significant. On average, practitioners in EDs spent almost three times longer supporting brief intervention than actually delivering it (16:19 compared to 5:56 min). Brief treatment unit costs were on average $22.63 in ED settings, $27.61 in inpatient settings, and $27.94 in outpatient settings. Referral to treatment unit costs were on average $12.06 in ED settings, $8.03 in inpatient settings, and $9.23 in outpatient settings.

Across all settings, unit cost was on average $0.69 for a prescreen, $5.53 for a full screen, $8.56 for a brief intervention, $26.06 for a brief treatment, and $7.83 for a referral to treatment. Brief treatment sessions had the longest service delivery duration across all settings (mean: 45:49 min, SE: 5:57), resulting in the SBIRT component with the highest unit cost. A brief treatment session typically takes longer to deliver than, say, brief intervention, because brief treatment is intended to be in-depth counseling, often for patients with greater disease severity. Whereas the main purpose of brief intervention is to modify client intentions, brief treatment additionally seeks to get the client to engage in behavior change, usually combining more than one clinical technique (e.g., cognitive–behavioral and motivational enhancement therapy). Referrals to treatment lasted approximately 4:37 min and required the most support relative to their duration, likely because the practitioners had to collect information as part of the referral process. Although staff who delivered prescreens generally had a higher wage ($26.45) than staff who delivered full screens ($21.60), brief interventions ($23.07), brief treatments ($25.54), and referrals to treatment ($22.46), prescreens still had by far the lowest unit cost due to their relatively short durations and their relatively low need for support time or materials.

3.2. Annual costs

Table 3 shows the annual costs and the average annual cost per positive screen for 10 programs within the four grantees. Across all programs, the annual cost averaged $557,610. Labor costs ($398,115) comprised over 70% of the total cost, and SBIRT service delivery staff ($293,672) comprised over 70% of the labor costs and about 50% of the total annual cost.

The average program had 8 full-time equivalents (FTEs), of which about 1 FTE was a clinical supervisor, 0.1 FTE a program administrator, 0.4 FTE clerical staff, and the remaining 6.6 FTEs service delivery staff. Programs were generally unable to provide reliable data on the level of effort of non-SBIRT practitioners performing prescreens. The total cost associated with these staff was calculated by multiplying the unit cost of a prescreen performed by a general medical staff by the estimated number of intakes from GPRA.

Table 3. Average annual program costs.

Cost Type	Average across all programs	G1			G2		G3[b]		G4		
		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Labor Cost											
Service delivery staff											
SBIRT service delivery staff											
FTE	6.6	5.0	2.7	8.0	1.0	9.3	10.0	9.2	8.3	5.8	13.0
Cost	$293,672	$245,625	$106,701	$232,603	$59,850	$577,491	$431,982	$447,342	$320,953	$201,730	$586,869
Generalist prescreen staff[a]											
FTE	–	–	–	–	–	–	–	–	–	–	–
Cost	$3942	$6829	$0	$738	$574	$3159	$13,761	$6288	$1356	$1897	$8390
Clinical supervision staff											
FTE	0.9	0.3	2.0	0.5	0.0	1.2	2.0	0.9	1.0	1.2	1.0
Cost	$61,200	$21,288	$87,365	$30,855	$0	$119,902	$174,669	$83,805	$46,415	$53,046	$55,860
Program administration staff											
FTE	0.1	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.1	0.0	0.1
Cost	$21,473	$0	$0	$0	$0	$0	$28,719	$176,210	$12,000	$0	$19,270
Clerical staff											
FTE	0.4	0.2	0.0	0.0	1.0	1.1	1.0	1.0	0.0	0.0	0.3
Cost	$17,828	$6550	$0	$0	$26,600	$61,646	$35,792	$45,572	$0	$0	$19,946
Total Labor											
FTE	8.0	5.5	4.7	8.5	2.0	11.5	13.1	12.0	9.4	7.0	14.4
Cost	$398,115	$280,292	$194,066	$264,196	$87,024	$762,198	$684,923	$759,217	$380,723	$256,674	$690,335
Nonlabor Cost											
Space	$8703	$4608	$5527	$6617	$1839	$15,811	$13,657	$11,443	$6567	$8385	$12,581
Overhead or administrative charges	$113,083	$128,934	$89,270	$121,530	$40,031	$232,382	$77,079	$81,308	$104,838	$71,358	$184,103
Contracted services costs	$2500	$0	$13,000	$0	$0	$0	$0	$0	$12,000	$0	$0
Training costs	$2732	$3750	$0	$11,639	$300	$0	$0	$11,630	$0	$0	$0
Travel costs	$5159	$9000	$7320	$12,602	$200	$0	$10,890	$5200	$5000	$1377	$0
Equipment costs	$6606	$29,000	$0	$0	$1500	$0	$2400	$33,160	$0	$0	$0
Supplies and materials costs	$6409	$2500	$2598	$0	$0	$15,000	$3600	$1236	$5000	$16,402	$17,753
Other costs	$14,302	$0	$40,693	$30,216	$0	$0	$68,973	$2640	$500	$0	$0
Total Nonlabor Costs	$159,495	$177,793	$158,408	$182,604	$43,870	$263,193	$176,598	$146,617	$133,905	$97,521	$214,437
Total Cost (labor + nonlabor)	$557,610	$458,084	$352,474	$446,800	$130,894	$1,025,391	$861,522	$905,835	$514,628	$354,195	$904,772
# Positive screens, FY 2012	1394	1676	1615	827	349	734	3931	3083	244	254	1222
Average cost per positive screen, FY 2012	$400	$273	$218	$540	$375	$1397	$219	$294	$2109	$1394	$740

Note: FTE = full-time equivalent.

[a] Programs were generally unable to provide reliable data on the number of generalist FTEs. Costs for generalist prescreen staff were calculated by multiplying the unit cost of a generalist prescreen by the estimated number of intakes.

[b] Due to unexplained reductions in patient flow in this grantee after March 2012, for the months of April 2012 to September 2012, the positive screen numbers were imputed based on the average of March 2011 through March 2012.

About 71% of the non-labor costs were incurred in overhead or administrative charges. Overhead charges were generally used to pay for administrative services that support activities not paid for directly, such as marketing, accounting, information services, and regulatory. This was followed by the cost of space, equipment, supplies and materials, travel, training, and contracted services, which comprised a relatively small portion of the annual costs.

Annual costs varied widely between programs. Costs ranged from $131,000 to over $1 million. Although regional differences in salaries are a factor, differences in cost were driven primarily by differences in the number of FTEs, which ranged from 2.0 FTEs in the smallest program to 14.4 FTEs in the largest program. To compare annual costs between-programs, annual costs were divided by the number of positive screens in each program. Average annual costs ranged from $218 to $2109. To some degree, programs with a higher annual program cost had a lower average cost per positive screen than programs with a lower total average cost. This association was naturally related to the size of the population served. There were exceptions to this association. For example, among the 10 programs, program 6 had the sixth highest patient flow yet the third highest cost per patient (see Table 3).

4. Discussion

This paper estimated the unit costs and the annual costs of SBIRT delivery. The two cost approaches were used to inform two distinct but important questions: (1) How much more does it cost to provide an extra unit of service to each patient? (2) How much does it cost to sustain a fully operational SBIRT program? Service providers may want to know how much they should be reimbursed for each service and also how much it costs to sustain those services. While the service unit cost approach followed in the current study provides the incremental cost of one service event for a patient, the annual cost approach accounts for all costs related to SBIRT delivery. This study advances the field of SBIRT research by consistently applying rigorous cost methodologies across multiple sites of service to provide cost estimates for three medical settings.

As expected, the unit cost of each SBIRT component increases with the duration of the service, with a cost across the three settings of $0.69 for prescreening, $5.53 for screening, $8.56 for brief intervention, $26.06 for brief treatment, and $7.83 for referral to treatment. The cost of each prescreen is very similar across the three settings, and the cost of the other services does not vary more than $5 across the three settings.

An important finding is that for a screen followed by a brief intervention, support activities account for a larger portion of the total labor cost than direct service delivery across all settings. This is most evident in the ED setting where the time spent supporting a full screen and a brief intervention is 2 to 3 times higher than direct service delivery. This finding might be explained by ED settings having rapid patient flow and being chaotic environments where medical providers have limited time available with the patient. Compared with ED and outpatient settings, direct services in the inpatient setting take longer. This might also be explained by patient flow, where the availability of patients in inpatient settings before they move to another ward of the hospital may facilitate longer service times.

For annual costs, labor costs represent 73% of the total annual costs and direct service delivery labor is the largest single contributor to annual operating costs. The fact that labor costs clearly dominated annual costs is not surprising because SBIRT services rely largely on labor, rather than, for example, capital equipment; this is consistent with other studies focusing on substance abuse interventions (French et al., 1997). The largest non-labor cost is overhead costs. The annual cost of SBIRT per positive screen is about $400. Although there were few programs to allow strong conclusions, the annual cost estimates are broadly consistent with economies of scale in that the cost per screen decreases with the number of screens per year.

Similar methods to those used here were applied in the cost analysis of a previous cohort of SBIRT SAMHSA grantees. Bray et al. (2014) estimates were based on a limited number of observations without using a true time-and-motion approach, the cost of materials was not included, the cost of prescreens was not estimated, and national instead of local unit costs were used. The authors noted the importance of including support activities when calculating the cost of SBIRT services, and also found that support activities took considerably less time in outpatient settings than in ED or inpatient settings, and that the time devoted to BI was lower in EDs than in outpatient and inpatient settings.

It is also informative to compare the results from the current study to the general literature on the costs of SBI, even if SBIRT programs and costing methods differ. A recent review of estimates of the cost of alcohol SBI in medical settings in different countries focuses on alcohol SBI because “few, if any, studies exist on the costs of broader SBIRT programs for the full range of substance use issues” (Bray et al., 2012; page 912). The authors conclude that the median screening time was 2 min with a median cost of $4.21 (converting from 2009 to 2012 U.S. dollars) and that the median brief intervention time was 13.75 min with a median cost of $53. The screening costs are similar in magnitude to the screening costs in the current study. The costs of brief intervention are lower in the current study, perhaps because practitioner wages are relatively low and the time to perform interventions is lower. Limiting the comparison further to the four studies where brief interventions were conducted by a nurse or a health care worker (Freemantle et al., 1993, Kaner et al., 2003, Neighbors et al., 2010, Zarkin et al., 2004), the average time of a brief intervention was 8 min and the average cost was $7 ($7.76 in 2012 U.S. dollars). These estimates are yet closer to those of the current study.

We did not compare patient-specific unit costs to annual costs because the resources included in each calculation method were different. Whereas unit costs in our analysis were restricted to costs that could be attributed to an individual patient, annual costs included in addition to those costs, costs associated with SBIRT services that were borne by the program but that could not be attributed to an individual person; examples include the cost of clerical staff, administrative services, and training. Moreover, annual costs were obtained for 10 programs and all grantees, whereas unit costs were limited to a sample of sites.

The extent to which our results can be translated to other SBIRT programs depends on how similar the implementation strategy is to the SBIRT programs analyzed here. The degree of generalizability of the programs analyzed to the broader treatment system nationwide cannot be measured. Moreover, our findings pertain to the U.S. health care system and may not generalize to other countries where services are organized and financed differently. However, while annual

costs are more intrinsic to the programs analyzed, unit cost estimates might be generalizable across programs and cross-nationally. To facilitate this generalizability, unit cost resources were valued at their opportunity cost, quantity of resources and dollar values were presented separately, and grant-related costs were excluded. This means that other jurisdictions can apply their own unit costs to the quantity of resources presented here. For example, in this study, SBIRT practitioners were the main providers for all components of SBIRT. Hence, when translating the costs presented here, estimates should adjust for differences in staff wages with the current study. If SBI had been done by a primary care physician, as implemented in many other studies in different countries (Bray et al., 2012), our current cost estimates would have been higher.

The analysis has several limitations. For the unit cost approach, brief treatment and referral to treatment services were rarely observed, and thus the cost estimates cannot be used to allow strong conclusions about the costs of brief treatment and referral to treatment in the sites observed. In addition, the extent to which the sample of sites is representative of all sites in the cohort cannot be formally assessed, nor can the extent to which the number of observations is representative of all services provided within sites. Furthermore, even though observational methods used standardized procedures and instruments, the presence of observers in a service setting may have led to staff acting differently because they were being observed (Smith & Barnett, 2003). Finally, some activities, particularly support activities, may have been performed outside the purview of the observer, resulting in underestimated unit costs.

For annual costs, we showed some evidence of economies of scale. It was outside the scope of this analysis to study the dynamics of patient flow and service capacity. It might be expected that as patient flow increases, the need to hire an additional practitioner also increases, which will increase program-level costs to the point where patient flow increases enough to justify the new hire. Similar to the unit cost estimation, our annual cost approach attempted to separate the costs of being a SAMHSA grantee from the true costs of delivering SBIRT services. Although some of these costs are easy to distinguish (e.g., collecting GPRA data), others involve subtle differences in level of effort and require respondents to allocate, sometimes imprecisely, documented costs to different activities. The imprecision may lead to errors in the annual cost estimates. Although all programs delivered core SBIRT services, variations that might exist between and within grantee programs were not taken into account in our analysis. This study focused on the data collection methods for service unit and annual costs and on costing SBIRT in different settings without further adjustments.

Despite the limitations, the cost results are useful to understand the actual costs of providing SBIRT. Our findings highlight the importance of support activities and their cost relative to direct service delivery. Ignoring the cost of support activities would seriously underestimate SBIRT services cost. Annual cost estimates suggest that the labor costs of service delivery are important considerations when contemplating SBIRT financing structures. Health administrators in the United States can use our results to compare how much sites are reimbursed for SBIRT to how much services actually cost in terms of resource capacities. Our findings may also be used to improve patients' scheduling, staffing, and other management tasks in health care settings.

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