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Cost and cost-effectiveness of three strategies for training clinicians in motivational interviewing

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ABSTRACT

Objective: To evaluate the cost and cost-effectiveness of three strategies for teaching community program clinicians motivational interviewing (MI): self-study (SS), expert-led (EX), and train-the-trainer (TT).
Methods: This economic analysis was conducted as part of a three-arm clinician training trial comprising 12 community treatment programs randomly assigned to the three conditions ($n=92$ clinician participants). EX and TT conditions used skill-building workshops and three monthly supervision sessions. SS provided clinicians MI training materials only. The primary outcome measure was the number of clinicians meeting MI performance standards at 12-week follow-up. Unit costs were obtained via surveys administered at the 12 participating programs. Resource utilizations and clinician outcomes were obtained from the training trial. Costs and outcomes were normalized to account for differing numbers of clinicians across programs and conditions. Incremental cost-effectiveness ratios and cost-effectiveness acceptability curves were used to evaluate the relative cost-effectiveness of the three training strategies.
Results: SS is likely to be the most cost-effective training strategy if the threshold value to decision makers of an additional clinician meeting MI performance standards at 12-week follow-up is less than approximately $2870, and EX is likely to be the most cost-effective strategy when the threshold value is greater than approximately $2870.
Conclusions: This study provides accurate estimates of the economic costs and relative cost-effectiveness of three different strategies for training community program clinicians in motivational interviewing and should be of interest to decision makers seeking to implement empirically supported addiction treatments with scarce resources.

1. Introduction

The systematic evaluation of different strategies for training clinicians to implement empirically-supported psychosocial addiction treatments has increased in the literature (Beidnas and Kendall, 2010; Madson et al., 2009; Martino, in press), but to date evaluation of the costs and cost-effectiveness of clinician training strategies are very rare, even though many studies have noted that the cost of training clinicians must be weighed against the degree of benefits expected from them (Cucciare et al., 2008; Miller et al., 2005). Without knowing the cost-effectiveness of different approaches for training clinicians in empirically supported addiction treatments, program directors and policy-makers have little guidance in deciding if expenditures on training initiatives are justifiable.

One of the few strategies that has been demonstrated to be effective in training clinicians in empirically supported addiction treatments is the use of skill-building workshops followed by supervision that includes treatment integrity rating-based feedback and coaching, all delivered by treatment experts (Miller et al., 2004; Sholomskas et al., 2005). However, one of the main barriers associated with the use of expert-delivered workshop training and supervision is the high cost of obtaining experts to train clinicians. As a result, the train-the-trainer (TT) model has become a popular method for extending the reach of expert trainers by having experts train practitioners in the designated treatment and in how to teach it to others (Hawkins and Sinha, 1998; Hein et al., 2009; Miller and Rollnick, 2002; Martino et al., 2010). In the TT model, trained practitioners are then expected to return to their programs and train, supervise, and monitor staff members' treatment implementation. The initial costs of preparing the practitioners as trainers presumably are offset by lower clinician training and supervision costs for those trained by the practitioner/trainers.

Recently, Martino et al. (2010) examined the relative effectiveness of self-study (SS), expert-led (EX), and train-the-trainer (TT)

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strategies for teaching community program clinicians motivational interviewing (MI) and found that, in comparison to SS, at a 12-week follow-up point both EX and TT resulted in a significantly higher percentage of clinicians reaching standards of MI performance that have been commonly used to certify clinicians in MI effectiveness trials (Carroll et al., 2006, 2009; Ball et al., 2007). However, the costs and relative cost-effectiveness of all of these efforts is unknown. Thus, in the present report we present an evaluation of the costs and cost-effectiveness of SS, EX, and TT approaches for teaching community program clinicians MI. MI, developed by Miller and colleagues (Miller et al., 1998; Miller and Rollnick, 2002) is a well-established effective brief treatment for improving client program retention and alcohol and drug use treatment outcomes in community treatment programs (Carroll et al., 2006, 2009; Ball et al., 2007; Lundahl et al., 2010). International and U.S. policymakers have strongly encouraged clinicians to learn MI as one of the several evidence-based addiction treatments to improve client care (Giuseppe and Clerici, 2006; Hintz and Mann, 2006; Miller et al., 2006; Reickmann et al., 2009).

To our knowledge, this is the first economic analysis of multiple strategies for training clinicians in empirically validated therapies, in this case, MI. Training costs are presented in a variety of ways to be useful to decision makers. We also provide incremental cost-effectiveness ratios (ICERs) and cost-effectiveness acceptability curves (CEACs) that define the range of values over which each training strategy would likely be the most cost effective for increasing the number of clinicians achieving adequate levels of MI performance.

2. Methods

Methods and results of the training strategies trial are described in the main report (Martino et al., 2010). The study design and main outcomes are summarized briefly below, followed by the methods used for the cost analysis and the cost-effectiveness analysis. Clinician outcome and resource utilization data for these analyses are taken from the main trial and combined with cost data obtained prospectively from the participating programs.

2.1. Description of training strategies trial

Twelve outpatient substance abuse treatment programs in Connecticut, USA were randomly assigned to one of the three MI training conditions (4 programs per condition): SS, EX, and TT. Ninety-two clinicians within these programs participated in the program-assigned conditions (SS = 31, EX = 32, TT = 29). Eligibility criteria for clinicians included working a minimum of 20 h per week, having a caseload that included English-speaking substance-using clients, no formal MI workshop training 12 weeks prior to study enrollment (the period of time in which workshop training effects are likely to dissipate without follow-up structured supervision; Walters et al., 2005), and no prior supervision using rating-based feedback and coaching. Clinicians completed baseline, post-workshop, post-supervision, and 12-week follow-up assessments and received financial compensation for these activities. At each assessment point, clinicians submitted audiotaped 40-min sessions in which they were instructed to conduct MI with clients who had substance use problems. Clinicians, not research staff, selected clients based on clinical judgment of the suitability of substituting MI for their standard practice and the client's willingness to be audiotaped (signed consent obtained).

The primary trial outcomes were the clinicians' (1) MI adherence and competence in actual and role-played client sessions and (2) the percentage of clinicians performing MI adequately (described in detail below). Baseline clinician characteristics (demographics, education, discipline, licensure status, years of counseling experience, MI training experiences), primary outcomes, and retention rates (98% post-workshop; 90% post-supervision; and 82% 12-week follow-up) did not differ between the training conditions.

2.1.1. Training conditions.

2.1.1.1. Self-study (SS). Clinicians assigned to this condition were provided with a copy of the MI textbook (Miller and Rollnick, 2002), training videotapes (Miller et al., 1998), and a MI treatment manual (Martino et al., 2004). Clinicians reviewed these materials in a 1-h meeting with the expert and were asked to spend an additional 20 h reviewing these materials over the next 12 weeks.

2.1.1.2. Expert-led (EX). Clinicians were provided with the same training materials as the SS participants. In addition, clinicians completed a 15-h workshop in MI and then practiced the approach in audiotaped client sessions. These sessions were rated for MI adherence and competence by the expert trainer (S.M.) and served as the basis for individual face-to-face supervision in which clinicians received personal rating-based feedback about their use of MI strategies and coaching to further improve their MI performance. Clinicians received this supervision once per month for 3 months.

2.1.1.3. Train-the-trainer (TT). Two clinicians for each program in the TT condition were trained as trainers. Trainers learned MI from the expert trainer within 15-h workshops and supervision as described above. After demonstrating adequate MI performance with actual client sessions, they completed another 15-h workshop training to learn how to conduct the MI workshop and rating-based supervision. Trainers received monthly consultation calls from the expert for 3 months and delivered the workshop and supervision to their clinicians in the same manner as the expert. Trainers and clinicians received the same training materials as the SS participants.

2.1.2. Measurement of adequate performance. The Independent Tape Rater Scale (ITRS; Ball et al., 2002), which has been demonstrated to be a reliable and valid measure of the integrity of MI delivery in multiple studies (Gibbons et al., 2010; Martino et al., 2008; Santa Ana et al., 2009), was used to assess the clinicians adherence (frequency of use) and competence (skill or quality) in implementing MI. In the trial, 10 MI consistent items were rated along 7-point Likert scales. To determine if clinicians' met adequate MI performance standards, the same threshold was used as in prior clinical trials of MI with community program clinicians, that is, the clinicians conducted sessions in which they were rated as having at least half of the ITRS MI consistent scale items rated average or above in terms of adherence and competence (Carroll et al., 2006, 2009; Ball et al., 2007).

2.2. Sample used in the economic analyses

A substantial number of clinicians in each training arm met MI performance standards at baseline (29 total; 7 in SS, 13 in EX, 9 in TT). Since this occurrence is both (a) unlikely to happen in practice (i.e., programs would want to reserve scarce training dollars for clinicians not meeting MI performance standards), and (b) likely to bias the cost effectiveness results for the three training strategies, clinicians meeting MI performance standards at baseline were excluded from the present study. Five additional clinicians were excluded due to either missing or malfunctioning baseline assessment audiotapes (2 in SS, 2 in EX, 1 in TT). Thus, the training costs and measure of effectiveness in the present study are based on the subsample of clinicians who did not meet independently-rated adequate MI performance standards at baseline ($n = 58$; 22 in SS, 17 in EX, 19 in TT). As described in detail further below, to allow direct comparisons across programs and arms, the training costs and effectiveness measure for this subsample were normalized assuming eight clinicians per cohort (eight was both the median and the modal number of clinicians per cohort in the trial).

2.3. Cost analysis

Cost data were collected prospectively alongside the training strategies trial. A research assistant administered a survey to the Chief Financial Officer, Chief Executive Officer, or accountants at each program to obtain necessary cost information (e.g., program overhead and fringe rates; annual expenditures on rent/mortgage, utilities and maintenance). In addition, participants provided their annual salary/hourly wage at the baseline assessment. Data on resources used (e.g., number of supervision sessions attended, time spent by expert and program-based trainers in activities, time spent by clinicians reviewing the training materials) came from the training trial.

Costs were calculated from the perspective of the program and adjusted to 2006 US dollars using the Consumer Price Index. Such costs included those related to workshop training sessions, rating audiotaped practice sessions, supervision sessions, training of program-based trainers, and time spent by participants reviewing training materials. All labor costs included fringe benefits and overhead. Research-specific costs (e.g., incentive payments for study participation) were excluded from the analysis.

Although most of the items presented in the detailed cost analysis are straightforward, several require explanation. First, to estimate the training-related space costs at each program, we obtained the annual economic space cost for each program's entire facility (including rent/mortgage, utilities, and maintenance), and then prorated this annual cost by (1) the fraction of the entire facility's space that was used for training-related activities, and (2) the fraction of the total number of program operating hours for which the space was used for training-related activities (Olmstead et al., 2010). Second, to estimate travel costs (time and mileage), the round-trip distance between the expert trainer's workplace and each study program was assumed to be equal to the average round-trip distance across all study programs (81.3 miles). Third, to estimate the cost (from the program's perspective) of the self-reported time clinicians spent reviewing the training materials, we assumed (based on clinician anecdotes) that 25% of this time was done "on company time" with the balance occurring on personal time (we also explored the sensitivity of the results to this assumption).

2.3.1. Economic costs. Detailed economic costs were estimated at each program within each arm as follows. In the SS condition, program costs included (a) time spent by the expert conducting the 1-h orientation meeting and traveling to the program (including mileage reimbursement), (b) time spent by clinicians in the meeting and reviewing training materials, (c) space associated with the meeting, and (d) equipment (TV/VCR) and materials (books, manuals, training videos).

In the EX condition, program costs included (a) time spent by the expert trainer conducting the 15-h workshop, rating audiotaped practice sessions and completing feedback forms, traveling to the program (including mileage reimbursement), and providing face-to-face supervision, (b) time spent by clinicians in the workshop, receiving supervision, and reviewing training materials, (c) space associated with the workshop and supervision, (d) express mail costs from the supervisory process (i.e., audiotapes mailed to the expert for review), and (e) equipment (TV/VCR, tape recorders, microphones and audiocassette tapes) and materials (books, manuals, training videos).

In the TT condition, program costs included (a) time spent by the expert trainer conducting two 15-h workshops (the first to train the trainers in MI, and the second to train the trainers in how to deliver MI workshops to clinicians), traveling to the program (including mileage reimbursement), certifying the trainers (including rating audiotaped trainer practice sessions, completing feedback forms, and providing phone-based feedback), and providing phone-based trainer supervision throughout the study, (b) time spent by trainers in three 15-h workshops (the third to deliver MI training to clinicians at the program), receiving phone-based feedback during the certification process, preparing materials to deliver the third workshop to clinicians, receiving phone-based supervision from the expert during the study, rating audiotaped clinician practice sessions and completing feedback forms, and providing face-to-face supervision of clinicians, (c) time spent by clinicians in the third workshop, receiving face-to-face supervision from the trainers, and reviewing the training materials, (d) space associated with the workshops and face-to-face supervision, (e) express mail costs from the trainer certification process (i.e., audiotapes mailed to the expert for review), (f) phonecalls between the expert and trainers during certification and supervision, and (g) equipment (TV/VCR, tape recorders, microphones and audiocassette tapes) and materials for trainers and clinicians (books, manuals, training videos).

2.3.2. Normalized costs-based on eight clinicians per training cohort. As noted earlier, to allow direct comparisons of training costs across programs and arms, the actual economic costs incurred by the present study sample were normalized assuming eight clinicians per cohort. To this end, the actual economic costs were partitioned into fixed costs (i.e., costs that do not vary with the number of clinicians trained, such as the cost of the expert's time delivering the workshops) vs. variable costs (i.e., costs that vary with the number of clinicians trained, such as the cost of the clinicians' time in the workshops). Normalized costs were then obtained as "fixed cost + 8 × (variable cost/# of clinicians in cohort)."

2.3.3. One-time costs vs. recurrent costs. One potential comparative advantage of the TT strategy is that the initial costs of preparing the trainers may be offset by lower clinician training and supervision costs for subsequent cohorts trained by the trainers. To examine how the relative costs and cost-effectiveness of the three training strategies would change as a function of the number of cohorts trained, the normalized training costs were partitioned into one-time costs vs. recurrent costs. One-time costs in the SS and EX arms were minimal, comprising the TV/VCR, training videos, tape recorders (EX only) and microphones (EX only). In contrast, one-time costs in the TT arm were substantial, comprising the two expert-led workshops, trainer certification activities, and expert supervision of the trainers. The normalized total cost of training any given number of cohorts was then obtained as "one-time cost + (# of cohorts) × recurrent cost."

2.4. Effectiveness measure

Effectiveness in the present study was assessed in terms of the number of clinicians meeting *a priori* MI performance standards (as defined in Section 2.1.2) in actual client sessions at the 12-week follow-up. This outcome was chosen for three reasons. First, although the training trial assessed effectiveness using a number of training outcomes (e.g., MI adherence scores, MI competence scores), these outcomes are relatively unintuitive for decision-makers to understand in *economic* terms. Said differently, it is more intuitive to think about "$ per additional clinician meeting MI performance benchmark standards" than "$ per point increase in MI adherence or competence scores." Second, although the training trial made assessments at several points prior to the 12-week follow-up (baseline, post-workshop, post-supervision), the present study chose the 12-week follow-up to be conservative inasmuch as clinicians' MI skills may be expected to diminish slightly following the end of supervision. Third, although the training trial assessed MI performance using both actual and role-played client sessions, the present study focused exclusively on MI performance using actual client sessions because (1) role-played client sessions might not reflect how clinicians implement MI with clients they treat within their programs, a critical assessment area when studying treatment dissemination and implementation strategies (Martino, in press) and (2) the only previous cost analysis of a clinician training strategy in the field of addiction assessed performance exclusively in terms of actual client sessions (Tober et al., 2005).

As noted earlier, to allow direct comparisons of effectiveness across programs and arms, the number of clinicians meeting MI performance standards at 12-week follow-up (who did not do so at baseline) was normalized assuming eight "below criterion" clinicians per cohort at baseline. For example, if five clinicians in a given cohort did not meet MI performance standards at baseline and two of them did so at the 12-week follow-up, then the normalized effectiveness of the training at the program would be 8 × (2/5) = 3.2 clinicians.

2.5. Cost-effectiveness analysis

Following standard economic theory (Drummond et al., 2005; Gold et al., 1996), the ICERs are defined as the incremental cost of using a given training strategy, compared to the next least costly strategy, to produce an additional clinician meeting MI performance standards, and are presented as a function of the number of training cohorts expected. For a given number of cohorts, training strategies were eliminated if they were either strictly dominated (i.e., another strategy was less expensive and more effective) or extended dominated (i.e., a more costly strategy had a lower ICER). Economic theory then suggests that the most cost effective training strategy is the one with the greatest ICER that is less than the decision maker's willingness to pay for an additional clinician meeting MI performance standards. Both incremental costs and incremental effects used to calculate the ICERs were based on normalized costs and normalized effects as described above.

Cost-effectiveness acceptability curves (CEACs) are presented to illustrate the statistical uncertainty in our study due to our sample (Briggs, 2001; Fenwick et al., 2001). CEACs show the probability that each training strategy would be the most cost-effective, given the observed data, under different assumptions about the value of an additional clinician meeting MI performance standards. Costs and effects for each training strategy were bootstrapped (with 2000 replicates) to produce the CEACs (Briggs, 2001; Fenwick et al., 2001).

3. Results

3.1. Cost analysis

Tables 1–3 show the total economic cost of the SS ($6141), EX ($28,020), and TT ($49,217) arms, respectively. Within each arm, costs are also presented by major component and program. In the SS arm, training materials (39%) and clinician time to review the training materials (35%) accounted for the largest portions of the overall cost. In the EX arm, overall costs comprised the workshop (58%), supervision (33%), and clinician time to review the training materials (9%). And in the TT arm, overall costs comprised the expert-led workshop to train the trainers in MI (27%), the expert-led workshop to train the trainers in how to give the MI workshop to clinicians (23%), certifying the trainers in MI (6%), the trainer-led workshop to train the clinicians in MI (31%), supervision (10%), and clinician time to review the training materials (4%).

Tables 1–3 indicate that training costs vary considerably across programs within each arm, due primarily to (1) different clinician compensation rates across programs and (2) different numbers of clinicians trained at each program. For example, the overall cost of TT at program TT-4 ($15,146) is much higher than at program TT-1 ($10,855) because (1) the average fully-loaded hourly wage (including fringe benefits and overhead) at program TT-4 ($30.35) was higher than its counterpart at program TT-1 ($19.54) and (2) program TT-4 ($n = 6$) trained more clinicians than program TT-1 ($n = 5$).

To allow direct comparisons of total economic costs across programs and arms, Table 4a shows the results of normalizing the total costs assuming eight clinicians per cohort at each program (32 clinicians per arm). Remaining cost differences across programs within a given arm are due primarily to differences across programs in clinician compensation rates.

All of the costs presented in Tables 1–4 relate to training the initial cohort at each program as implemented in the trial. Columns 2–4 of Table 5 show how the total costs of the three training strategies would change as a function of the number of additional cohorts expected to be trained (normalized to assume eight clinicians per cohort and four programs per arm). Results in Table 5 are based on one-time costs across the four programs in each arm of $1270, $1725, and $27,874 for SS, EX, and TT, respectively, and recurring

Table 1
Economic cost of SS training (in 2006 US dollars) – by program.

Component	All programs combined (*n* = 22) ($)	SS-1 (*n* = 4) ($)	SS-2 (*n* = 7) ($)	SS-3 (*n* = 6) ($)	SS-4 (*n* = 5) ($)
Orientation meeting					
Clinician time in meeting	678	156	192	137	193
Expert					
Time in meeting	324	81	81	81	81
Travel time	440	110	110	110	110
Mileage cost	125	31	31	31	32
Space costs	6	1	1	1	3
Materials/equipment	2399	527	682	630	560
Orientation subtotal	*3972*	*906*	*1097*	*990*	*979*
Clinician time reviewing training materials	2169	273	927	342	627
Total cost	6141	1179	2024	1332	1606

Table 2
Economic cost of EX training (in 2006 dollars) – by program.

Component	All programs combined (*n* = 17) ($)	EX-1 (*n* = 6) ($)	EX-2 (*n* = 4) ($)	EX-3 (*n* = 4) ($)	EX-4 (*n* = 3) ($)
Workshop					
Clinician time in workshop	7914	2605	2449	1359	1501
Expert					
Time in workshop	4840	1210	1210	1210	1210
Travel time	876	219	219	219	219
Mileage cost	252	63	63	63	63
Space costs	57	22	7	6	22
Materials	2429	726	590	590	523
Workshop subtotal	*16,368*	*4845*	*4538*	*3447*	*3538*
Supervision					
Clinician time receiving feedback	746	241	224	131	150
Expert					
Time rating tapes	3951	1372	888	965	726
Time giving feedback	1975	686	444	482	363
Travel time	1314	329	329	327	329
Mileage	378	94	94	96	94
Space	7	2	1	2	2
FedEx fees	311	109	70	74	58
Materials	567	155	140	137	135
Supervision subtotal	*9249*	*2988*	*2190*	*2214*	*1857*
Clinician time reviewing training materials	2403	448	636	1076	243
Total cost	28,020	8281	7364	6737	5638

costs of $6624, $43,114, and $32,119 for SS, EX, and TT, respectively. Although one-time costs are minor for SS and EX, they account for 46% of the total training cost of the first cohort for TT. As a result, although TT is more expensive than EX in training one or two cohorts, TT is less expensive than EX for training three or more cohorts.

3.2. Effectiveness measure

Column 2 of Table 4b shows the number of clinicians meeting MI performance standards at 12-week follow-up (who did not do so at baseline) at each program. To be consistent with the normalized costs in Table 4a, the effectiveness results are normalized assuming eight clinicians per cohort at each program (32 clinicians per arm). As seen in column 4 of Table 4b, the normalized effectiveness results were fairly consistent across the programs within each arm. Aggregating the normalized effectiveness results across programs within each arm (i.e., assuming each arm started with 32 clinicians not meeting MI performance standards at baseline), the SS, EX, and TT training strategies would be expected to produce 5.2, 18.0 and 10.5 clinicians meeting MI performance standards at 12-week follow-up, respectively.

3.3. Cost-effectiveness analysis

Columns 8–10 of Table 5 present the *initial* ICERs of the three training strategies as a function of the number of training cohorts expected. As seen in column 10, TT is strictly dominated by EX for one or two cohorts and extended dominated by the combination of SS and EX for three or more cohorts. Accordingly, the ICERs were recalculated excluding TT and are presented in columns 11–13. As seen in columns 11–13, compared to SS, the incremental cost of using EX to produce an additional clinician meeting MI performance standards is approximately $2870, ranging from $2886 for the initial cohort to $2852 for 25 cohorts.

Fig. 1a and b show the CEACs for one and 25 training cohorts, respectively. Each CEAC shows the probability that a given training strategy is the most cost-effective given the observed data (Fenwick et al., 2001). Note that CEACs are a function of the threshold willingness-to-pay of the decision maker for an additional unit of outcome. For example, if only one training cohort is expected and the threshold willingness-to-pay of the decision maker for an additional clinician meeting MI performance standards is $2000, then Fig. 1a shows that the probability that SS, EX, and TT is the most cost-effective strategy is 94%, 6%, and 0%, respectively. In contrast, if the threshold value is $5000, then the probability that SS,

Table 3
Economic cost of TT training (in 2006 dollars) – by program.

Component	All programs combined ($n = 19$) ($)	TT-1 ($n = 5$) ($)	TT-2 ($n = 4$) ($)	TT-3 ($n = 4$) ($)	TT-4 ($n = 6$) ($)
Workshop #1[a]					
Trainer time in workshop	4851	1021	1112	1162	1556
Expert					
Time in workshop	4828	1206	1206	1210	1206
Travel time	873	218	218	219	218
Mileage cost	255	64	64	63	64
Space costs	102	7	36	33	26
Materials	2219	550	550	569	550
Workshop #1 subtotal	*13,128*	*3066*	*3186*	*3256*	*3620*
Workshop #2[b]					
Trainer time in workshop	4851	1021	1112	1162	1556
Expert					
Time in workshop	4828	1206	1206	1210	1206
Travel time	873	218	218	219	218
Mileage cost	255	64	64	63	64
Space costs	102	7	36	33	26
Materials	166	41	41	43	41
Workshop #2 subtotal	*11,075*	*2557*	*2677*	*2730*	*3111*
Trainer certification					
Trainer time receiving feedback	376	93	74	77	132
Expert					
Time rating trainer tapes	1449	402	322	323	402
Time giving trainers feedback	724	201	161	161	201
Phonecalls	143	36	35	37	35
FedEx fees	117	25	20	27	45
Materials	44	12	10	10	12
Trainer certification subtotal	*2853*	*769*	*622*	*635*	*827*
Workshop #3[c]					
Clinician time in workshop	8409	1513	2170	1907	2819
Trainers					
Time prepping workshop	646	136	148	155	207
Time in workshop	4851	1021	1112	1162	1556
Space costs	110	15	36	33	26
Materials	1250	327	261	270	392
Workshop #3 subtotal	*15,266*	*3012*	*3727*	*3527*	*5000*
Supervision					
Trainers					
Time receiving feedback from PI	240	51	56	58	75
Time rating clinician tapes	2052	477	445	426	704
Time giving feedback to clinicians	1025	238	222	213	352
Expert time giving feedback to trainers	483	121	121	121	120
Clinician time receiving feedback from trainers	727	142	217	175	193
Space	11	1	4	4	2
Phonecalls	95	24	23	25	23
Materials	123	34	29	27	33
Supervision subtotal	*4756*	*1088*	*1117*	*1049*	*1502*
Clinician time reviewing training materials	2139	363	513	177	1086
Total cost	49,217	10,855	11,842	11,374	15,146

[a] In workshop #1, the expert trained the trainers in MI.
[b] In workshop #2, the expert trained the trainers in how to deliver the MI workshop to and supervise clinicians.
[c] In workshop #3, the trainers trained the clinicians in MI.

EX, and TT is the most cost-effective strategy is 7%, 91%, and 2%, respectively. Due to economies of scale associated with TT's comparatively large one-time costs, if 25 training cohorts are expected then Fig. 1b shows that TT has a non-trivial (though still quite low) probability of being the most cost-effective strategy across a wide range of threshold values. Note that even though TT was dominated (either strictly or extended) for all numbers of training cohorts, it is included in the CEACs in Fig. 1a and b to avoid underestimating the uncertainty in SS and EX (Olmstead et al., 2007).

Finally, if 100% of the time that clinicians spent reviewing the training materials was done "on company time," as opposed to 25% as occurred in this study, then (1) the normalized total cost of SS, EX, and TT would have been $17,094, $58,848, and $70,230, respectively; (2) TT would still be dominated (either strictly or extended) for all numbers of training cohorts; and (3) compared to SS, the incremental cost of using EX to produce an additional clinician meeting MI performance standards would have been approximately $3250, ranging from $3262 for the initial cohort to $3228 for 25 cohorts.

4. Discussion

This study estimated the cost and cost-effectiveness of three strategies – SS, EX, and TT – for teaching community program clinicians to implement MI. Focusing only on costs, SS was the least expensive training strategy, followed by TT (assuming at least three training cohorts), and EX. Although EX was the costliest training strategy, it was also the most effective. In terms of cost-effectiveness, SS is likely to be the most cost-effective training strategy if the threshold value to decision-makers of an addi-

Table 4
(a) Fixed, variable, and normalized total costs (in 2006 US dollars) – by program and training arm and (b) normalized outcomes – by program and training arm.

Program	(a)					(b)			
	Fixed cost ($)	Variable cost ($)	Total cost ($)	# clinicians in cohort	Normalized total cost[a] ($)	# clinicians in cohort	# clinicians meeting MI perf stds at follow-up	% of clinicians meeting MI perf stds at follow-up	Normalized # of clinicians meeting MI perf stds at follow-up[b]
SS-1	543	636	1179	4	1815	4	0	0	0
SS-2	543	1481	2024	7	2236	7	2	29	2.3
SS-3	543	789	1332	6	1595	6	1	17	1.3
SS-4	535	1071	1606	5	2249	5	1	20	1.6
SS-total	*2164*	*3977*	*6141*	*22*	*7894*	*22*	*4*	*18*	*5.2*
EX-1	2369	5912	8281	6	10,252	6	2	33	2.7
EX-2	2353	5011	7364	4	12,375	4	3	75	6.0
EX-3	2350	4387	6737	4	11,124	4	2	50	4.0
EX-4	2368	3270	5638	3	11,088	3	2	67	5.3
EX-total	*9440*	*18,580*	*28,020*	*17*	*44,839*	*17*	*9*	*53*	*18.0*
TT-1	7761	3094	10,855	5	12,711	5	2	40	3.2
TT-2	7981	3861	11,842	4	15,703	4	1	25	2.0
TT-3	8174	3200	11,374	4	14,574	4	2	50	4.0
TT-4	9570	5576	15,146	6	17,005	6	1	17	1.3
TT-total	*33,486*	*15,731*	*49,217*	*19*	*59,993*	*19*	*6*	*32*	*10.5*

[a] Normalized for 8 clinicians at each program. Normalized total cost = fixed cost + 8 × (variable cost/# clinicians in cohort).
[b] Normalized for 8 clinicians at each program. Normalized # of clinicians meeting MI performance standards at follow-up = 8 × (% of clinicians meeting MI performance standards at follow-up).

Table 5
Normalized total costs, outcomes, and incremental cost-effectiveness ratios (in 2006 US dollars) – by number of training cohorts.

# of cohorts	Normalized total training cost[a]			Normalized # of clinicians meeting MI perf stds at follow-up			Normalized ICERs – Initial			Normalized ICERs – Final		
	SS ($)	EX ($)	TT ($)	SS	EX	TT	SS ($)	EX ($)	TT ($)	SS ($)	EX ($)	TT ($)
1	7894	44,839	59,993	5.2	18.0	10.5	–	2886[b]	SD	–	2886[b]	SD
2	14,518	87,953	92,112	10.4	36.0	21.0	–	2869[b]	SD	–	2869[b]	SD
3	21,142	131,067	124,231	15.6	54.0	31.5	–	304[c]	6484[d]	–	2863[b]	ED
4	27,766	174,181	156,350	20.8	72.0	42.0	–	594[c]	6065[d]	–	2860[b]	ED
5	34,390	217,295	188,469	26.0	90.0	52.5	–	769[c]	5814[d]	–	2858[b]	ED
10	67,510	432,865	349,064	52.0	180.0	105.0	–	1117[c]	5312[d]	–	2854[b]	ED
25	166,870	1,079,575	830,849	130.0	450.0	262.5	–	1327[c]	5011[d]	–	2852[b]	ED

ICER = incremental cost-effectiveness ratio. SD = strictly dominated by EX. ED = extended dominated by the combination of SS and EX.
[a] One-time costs across the four programs in each arm were $1270, $1725, and $27,874 for SS, EX, and TT, respectively. Recurrent costs were $6624, $43,114, and $32,119 for SS, EX, and TT, respectively.
[b] Defined as (column #3 – column #2)/(column #6 – column #5).
[c] Defined as (column #3 – column #4)/(column #6 – column #7).
[d] Defined as (column #4 – column #2)/(column #7 – column #5).

tional clinician meeting MI performance standards is less than approximately $2870 (i.e., $2852–2886, depending on the number of training cohorts expected), and EX is likely to be the most cost-effective strategy when the threshold value is greater than approximately $2870. In economic parlance, TT was dominated by EX for one or two training cohorts (i.e., TT was more costly and less effective than EX), and TT was extended dominated by the combination of EX and SS for three or more cohorts.

To our knowledge, this is only the second study to estimate the costs of any type of clinician training strategy in addiction, and the first study to examine the relative cost-effectiveness of two or more such training strategies. Tober et al. (2005) found that the costs of an expert-led workshop followed by supervision (similar to EX in the present study) averaged £1260 and £1390 per clinician "trained to criterion" in motivational enhancement therapy and social behavior and network theory, respectively (2000/2001 prices). Converting to 2006 US dollars (conversion factor = 1.92; http://www.measuringworth.com/calculators/exchange/), these training costs equate to $2419 and $2669, both of which are comparable to EX's average training cost per clinician meeting MI performance standards as found in the present study ($2491 = $44,839/18.0).

As noted by Tober et al. (2005), training is an investment expected to generate benefits into the future. That is, although training costs are substantial, when spread over time they account for only a small fraction of the total cost of treatment. For example, assuming that (a) five cohorts are trained at a given program, (b) a MI-trained clinician can deliver 736 MI sessions to clients per year (i.e., 46 weeks X 16 sessions per week), and (c) the effects of training would endure for only 1 year, then the training costs for SS, EX, and TT would add only $1.80 (i.e., $34,390/(26.0 × 736)), $3.28 (i.e., $217,295/(90.0 × 736)), and $4.88 (i.e., $188,469/(52.5 × 736) per client session, respectively.

As a practical matter, the normalized yield of MI-trained clinicians was low for all three training strategies in the trial (16% in SS, 56% in EX, 33% in TT). Two suggestions for potentially improving the yield of trained clinicians would be to increase the time available at the program for clinicians to review the training materials (SS, EX, and TT) and increase the frequency and/or lengthen the duration of supervision (EX and TT only). Of course, both of these suggestions would also increase training costs, so it is an empirical question as to whether either suggestion would improve the overall cost-effectiveness of the training strategies.

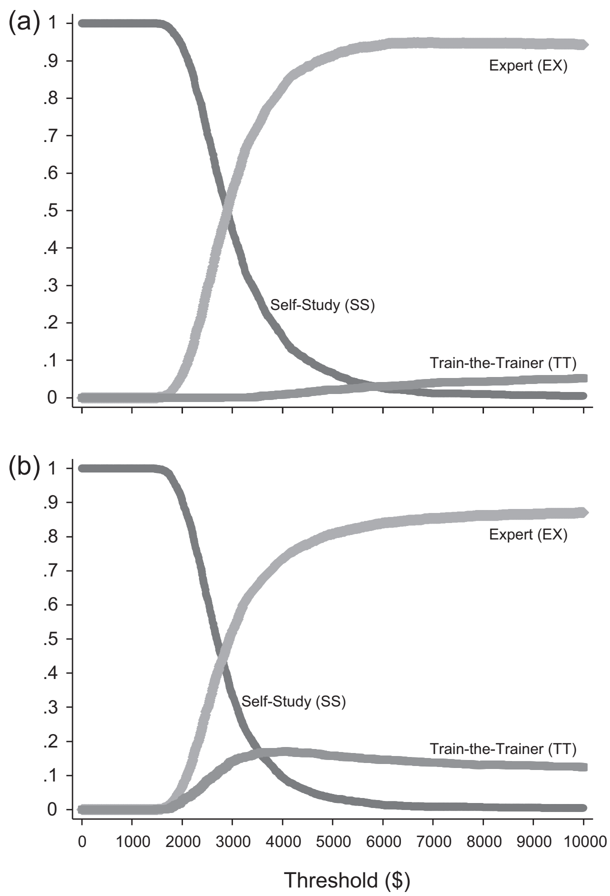

Fig. 1. Cost-effectiveness acceptability curves for clinicians meeting MI performance standards based on one cohort (a), and 25 cohorts (b). For a given threshold value, the probability of being cost effective is equivalent to the proportion of the 2000 bootstrapped replicates for which each training strategy (SS, EX, and TT) had the highest net benefit (Fenwick et al., 2001).

A related issue with cost implications is the criterion used to define adequate MI performance. To date, no empirically derived training criteria directly linked to client outcomes exist for any evidence-based behavioral treatment. While it is not certain if the criterion level of MI performance used in this study would translate to improved clinical outcomes, it was based on the MI certification standard used to train clinicians in several multi-site effectiveness trials wherein MI relative to treatment-as-usual achieved improved program retention or substance use outcomes (Ball et al., 2007; Carroll et al., 2006, 2009). If a higher performance criterion is needed to improve client care, presumably the motive for which program directors would agree to incur training expenses, then the cost of training would increase and potentially change the cost-effectiveness of these strategies.

The present study has several strengths. First, it is based on a randomized training trial conducted at 12 community treatment programs. Second, all costs were collected prospectively from the trial participants. Third, costs are presented in a variety of ways to be useful to decision makers (e.g., by major component, fixed vs. variable, one-time vs. recurrent, normalized for eight clinicians per cohort, etc.). Finally, in the absence of consensus threshold values for an additional MI-trained clinician, ICERs and CEACs are presented that define the range of values over which each training strategy would likely be the most cost-effective. Decision makers can use this information in combination with their own evaluation of the value of an additional MI-trained clinician to make policy decisions.

There are also several limitations. First, although the training trial implemented SS, EX, and TT as they are commonly implemented in the field, other implementations are possible which might alter the costs and clinician outcomes. For example, the median and modal number of clinicians per cohort was eight in the trial, but a different number (e.g., seven or nine) would have altered the costs (and perhaps the clinician outcomes) slightly. Second, the results in Table 5 depend on the following two assumptions: (1) trainers remain at their respective programs and (2) the trainers do not get better or worse over time at delivering the MI workshop and supervising clinicians. The first assumption seems reasonable inasmuch as seven out of the eight trainers in the trial remained at their respective programs for at least 1 year following the end of the trial. The second assumption has yet to be tested empirically. Finally, the logistical costs included in Tables 1–3 are likely to vary depending on the proximity of experts to programs. Fortunately, the costs in these tables are modular and decision makers can easily insert their own expected logistics costs in place of those incurred in the trial.

In conclusion, this study provides an important analysis of the cost and cost-effectiveness of three commonly used clinician training strategies in addiction. The detailed cost information provided here should be useful for decision makers seeking to implement empirically supported treatments in addiction with scarce resources. In addition, the results demonstrating that training costs are a relatively minor component of total treatment costs may encourage more programs to adopt empirically supported treatments in the future.

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Contributors

Martino was the Principal Investigator, designed the effectiveness study, wrote the protocol, and collected patient outcomes data. Canning-Ball collected patient outcomes and cost-related data from participating programs. Carroll contributed to the design of the effectiveness study. Olmstead conducted the cost and cost-effectiveness analyses, and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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