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ORIGINAL ARTICLE

Economic Impact of Multisystemic Therapy for Child Abuse and Neglect

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Abstract
This study evaluated the economics of Multisystemic Therapy for Child Abuse and Neglect (MST-CAN) by applying the Washington State Institute for Public Policy (WSIPP) cost-benefit model to data from a randomized effectiveness trial with 86 families (Swenson et al. in JFP 24:497–507, 2010b). The net benefit of MST-CAN, versus enhanced outpatient treatment, was $26,655 per family at 16 months post-baseline. Stated differently, every dollar spent on MST-CAN recovered $3.31 in savings to participants, taxpayers, and society at large. Policymakers and public service agencies should consider these findings when making investments into interventions for high-need families involved with child protective services.

Keywords Cost-benefit analysis · Multisystemic Therapy (MST) · Child maltreatment · Trauma · Evidence-based treatment

Introduction

There is a critical need for treatments that can reduce child abuse and neglect among families involved with child protective services (CPS) systems; in 2014 alone, over 700,000 children were substantiated victims of abuse and neglect in the United States (U.S. Department of Health and Human Services 2016). Experiencing such maltreatment is associated with short- and long-term negative effects, including trauma-related symptoms (e.g., posttraumatic stress disorder), mental health problems, substance abuse, criminality, and low educational or occupational attainment (Currie and Widom 2010; Hussey et al. 2006; Springer et al. 2007). As a result of these effects, child maltreatment incurs a substantial economic burden to society in expenses associated with social services, health care, lost productivity, and decreased quality of life (Fang et al. 2012; Gelles and Perlman 2012; Habetha et al. 2012). Thus, the implementation of effective treatments for child abuse and neglect has the potential to produce considerable personal, social, and economic benefits. Research that demonstrates such benefits would be useful for policymakers to consider in their funding decisions about mental health services for CPS-involved youth and their families (Steuerle and Jackson 2016; Wekerle 2011).

The present study investigated the economic costs and benefits of an adaptation of Multisystemic Therapy (MST; Henggeler et al. 2009) in the treatment of families referred to CPS due to child maltreatment, known as MST for Child Abuse and Neglect (MST-CAN; Swenson et al. 2010a). MST-CAN is an intensive community-based treatment that has demonstrated effectiveness in reducing serious caregiver and child mental health difficulties, out-of-home placement, and caregiver-to-child physical abuse and neglect. Consistent with the treatment development framework for MST adaptations (Henggeler et al. 2009), a small ($N=33$) randomized efficacy trial first investigated the effects of MST applied to families referred for child abuse or neglect (vs. a group-based parent training intervention; Brunk et al. 1987) and a subsequent, larger ($N=86$) randomized effectiveness trial evaluated the full MST-CAN model with families referred for physical abuse (Swenson et al. 2010b). Given evidence for the clinical effectiveness of MST-CAN in these studies, it seems likely that MST-CAN could also produce significant cost savings.

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To date, two investigations have used different methods to evaluate the financial costs and benefits of MST-CAN, as applied primarily to serious child neglect cases, at international implementation sites. In the first (Pérez et al. 2018), researchers in Switzerland used cost-comparison analysis to examine the actual costs of MST-CAN (based on program budgets) versus the hypothetical costs of alternative interventions (based on social workers' reports of the contingency plan for each youth referred to MST-CAN, in the event there had not been an opening in the program). Results indicated that the costs of MST-CAN were 16–50% lower than the costs of the contingency plans, the majority of which were out-of-home placement. More recently, a program evaluation of MST-CAN in England (Watmuff and Ross 2016) included a preliminary cost-benefit analysis, the findings of which suggested that every £1.00 spent on MST-CAN returned £1.59 (i.e., approximately $2.09 per $1.00 spent in USD, based on the 2016 exchange rate) in benefits associated with range of outcomes (e.g., reduced incidences of taking children into care, reduced alcohol and drug dependency, improved mental health) as compared to the assumed costs of usual services. Taken together, these findings are a significant first step in understanding the economic benefits of treatment for this complex population using a comprehensive treatment model. The next important steps are to estimate the economic impact of MST-CAN (a) using actual rather than hypothetical expenses of comparison services and (b) with families referred for physical abuse (as in Swenson et al. 2010b).

Useful to a broader economic evaluation of MST-CAN is the Washington State Institute for Public Policy (WSIPP) comprehensive cost-benefit analysis model (hereafter, WSIPP model; see WSIPP 2016a), which estimates the financial benefits of psychosocial intervention programs (vs. comparison programs) to taxpayers, program participants, and society at large. The WSIPP model has been used in several peer-reviewed studies that attest to its validity (e.g., Drake et al. 2009; Lee et al. 2012) and is now used for program evaluation in 24 states as part of Results First, a joint initiative between Pew Charitable Trusts and the MacArthur Foundation (Pew Charitable Trusts 2018). However, to date, the WSIPP model has not been applied to MST-CAN. In the present study, we used the WSIPP model to investigate the economic benefits of MST-CAN in reducing expenses to (a) participants (e.g., health care, lost productivity); (b) taxpayers (e.g., CPS, out-of-home placements); and (c) society (e.g., crime victimization, human capital).

Method

Participants

Participants were 86 youths and their caregiver who participated in a randomized clinical trial evaluating the effectiveness of MST-CAN (Swenson et al. 2010b). In the original study, families were referred consecutively by CPS to a community mental health center (CMHC). Those families were randomly assigned to MST-CAN ($n = 44$) or an enhanced version of the standard outpatient treatment for child physical abuse provided at that agency (i.e., enhanced outpatient treatment or EOT; $n = 42$). The inclusion criteria for the study were: (a) a determination by CPS that physical abuse had occurred, (b) youth was in the age range of 10–17, (c) the family resided in the CMHC service area, and (d) the CPS case was opened within the past 90 days. Families were excluded if (a) the youth was currently or previously enrolled in a standard MST program, (b) the youth had been removed from the family and reunification was not deemed appropriate by CPS, or (c) the youth or caregiver was experiencing active psychosis.

The mean youth age was 13.88 years (SD = 2.07); 55.8% were female; and 68.6% were Black, 22.1% were White, and 9.3% identified as other race/ethnicity. The participating caregiver who was the subject of the abuse report had a mean age of 41.79 years (SD = 10.49); 65.1% were female; and 58.1% were single parents. More than 80% of the reported abuse incidents involved at least minor injuries and 23.3% of the families had a prior maltreatment report with CPS. Families in the MST-CAN and EOT conditions did not differ significantly on any baseline demographic or maltreatment characteristics.

Treatment Conditions

Services in both treatment conditions were delivered by staff at the aforementioned CMHC. The mean numbers of treatment hours were 88 for the MST-CAN group (M length = 7.6 months, range 2–12 months) and 76 for the EOT group (M length = 4.0 months, range 1–12 months). Treatment completers and dropouts were included in each condition to provide an intent-to-treat analysis. Details about the therapists, supervision practices, training, and treatment fidelity for each condition are provided in Swenson et al. (2010b).

MST-CAN

MST-CAN (Swenson et al. 2010a) focuses on aspects of the youth's and caregiver's ecologies that are functionally related to physically abusive and neglectful behavior (see

e.g., Dubowitz et al. 2011). It uses a structured analytic process to identify risk factors for maltreatment, prioritize the risk factors that serve as the primary drivers for maltreatment, and develop interventions that address those primary drivers. MST-CAN interventions use evidence-based clinical techniques (e.g., behavioral and cognitive-behavioral therapies, structural/strategic family therapy) to target risk factors across individual (e.g., caregiver's beliefs and attitudes, skills deficits, comorbid mental health problems), family (e.g., risk reduction and child safety planning, abuse clarification process, improvement of family relationships), and social network (i.e., collaboration with agencies that monitor the youth's safety and well-being, such as CPS and school) levels of the family's social ecology.

Clinical services in the present study were provided in home, school, and/or community settings at times convenient to the family. The treatment team consisted of three full-time MST-CAN therapists (with a primary therapist assigned to each family), a supervisor, and a family case manager. Given the clinical complexity and serious safety concerns of many cases involving child physical abuse, families received multiple contacts each week (at least three therapeutic sessions per week across family, social network, and individual systems) and therapists also provided services through a 24 h a day, 7 days a week on-call rotation. The entire family participated in treatment, with an average of five family members participating per case. Therapist caseloads were small (no more than four families at a time) to meet this level of clinical intensity. In addition, a psychiatrist provided evidence-based pharmacotherapy for youth and caregivers when warranted as well as consultation on psychiatric emergencies (e.g., suicidality).

EOT

Families allocated to this condition received standard outpatient services that were enhanced with study-specific modifications; these services consisted of three major components. First, each youth received a mental health diagnostic evaluation and psychiatric assessment. Second, each caregiver participated in Systematic Training for Effective Parenting of Teens (STEP-TEEN; Dinkmeyer et al. 1998), a structured group-based parenting program. Finally, strategies outside of normal outpatient clinic procedures were used to engage families in STEP-TEEN, including use of home visits to coordinate appointments and provision of vouchers to cover the costs of transportation to sessions. All components were provided by a dedicated therapist who spent approximately 5 h/week on intervention activities.

Supplemental Services

When warranted based on clinical need, the CMHC directly provided or contracted additional services for youth and caregivers, including individual, family, and group outpatient therapy; day treatment programs; school-based services; residential treatment; and substance abuse treatment. In the MST-CAN condition, all services delivered during program participation were provided by the MST-CAN therapist, but some families received supplemental services within the follow-up period as part of their aftercare plan. In the EOT condition, supplemental services were delivered throughout the study period as needed.

Procedures

All procedures and measures were approved by the Institutional Review Board of the Medical University of South Carolina. Those relevant to the present study are described below.

Original Study

Following referral from CPS, a research assistant met with each family to explain the study; the family's CPS caseworker accompanied the research assistant to this meeting to answer questions and assure the family that participation in the study was not mandatory. Informed consent or assent was obtained from all individual participants included in the study. Standardized measures were administered individually to the youth and primary caregiver at five time points (baseline, 2, 4, 10, and 16 months). Caregivers also completed a brief service utilization interview once a month. Furthermore, data regarding incidents of child maltreatment and out-of-home placement during the 16-month follow-up period were obtained through administrative chart review by a CPS supervisor.

Present Study

We applied the WSIPP model to outcome data for participants in the MST-CAN and EOT conditions. Extensive technical documentation of the model is available from WSIPP (see WSIPP 2016b); we provide summaries of the relevant parameters and procedures throughout this article to the extent permitted by space constraints. The WSIPP model, which operates using Visual Basic for Applications in Microsoft Excel, is an integrated set of computational routines designed to produce internally consistent benefit-cost ratios. Analyses are conducted from a "whole state" perspective (see WSIPP 2016a) that accounts for the wide range of potential benefits associated with investment by state agencies (either directly or indirectly through local

agencies) in interventions for the public good and can be easily interpreted by administrators and policymakers; for child maltreatment, these benefits can be broadly categorized as related to (1) participants, (2) taxpayers, and (3) society at large.

Within the WSIPP model, we adjusted all monetary values to 2015 values (to account for inflation) using two price indices: (1) the Medical Care Index of the Consumer Price Index for All Urban Consumers (Bureau of Labor Statistics 2016) to adjust health care expenditures and (2) the Chain-Weighted Implicit Price Deflator for Personal Consumption Expenditures (Washington State Economic and Revenue Forecast Council 2016) to adjust all other expenditures. Given that many monetary values in the model were derived in Washington, we further adjusted those values to reflect South Carolina cost of living using the Council for Community and Economic Research (CCER) Cost of Living Index (CCER 2016).

Effectiveness Measures

We measured treatment effects using a combination of standardized measures and administrative data. Youth and caregiver reports of abusive parenting strategies were collected using four subscales from the conflict tactics scale (CTS; Straus et al. 1998): neglect, psychological aggression, minor assault, and severe assault. There is evidence of construct and discriminant validity for the CTS (Straus et al. 1998) and internal consistencies for the present sample ranged from moderate to strong ($\alpha = 0.59$–0.89). In addition, as part of the aforementioned CPS chart review, we recorded the number of incidents of (a) credible reports of child maltreatment that resulted in an open case and (b) out-of-home placement. Consistent with the approach of the WSIPP model to analyzing such outcomes, these data were dichotomized to indicate whether each youth experienced a given outcome during the 16-month follow-up period; the WSIPP researchers built their model to analyze dichotomous, rather than continuous (e.g., count) outcomes, because the former are much more readily available to various decision-makers. In addition, as described subsequently in the Analytic Strategy, we subsequently used meta-analysis to combine the nine measures of child maltreatment (i.e., four subscales of CTS youth report, four subscales of CTS caregiver report, and report of child maltreatment) into a single outcome measure.

Cost Measures

MST-CAN

The operating costs of an MST-CAN program differ from typical community outpatient due to their structure. Specifically, MST-CAN programs have commonly been funded by state or national public service agencies (i.e., child welfare or child protection) and implemented by private service organizations. Moreover, those funding agencies contract with a company called MST Services, which provides assistance with program development, implementation support, and training/quality assurance.

We estimated the full operating costs of an MST-CAN program in a community setting in 2015 using a representative annual budget from MST Services. We did not estimate costs from the grant budget for the original clinical trial because there are key administrative differences between clinical trials and actual mental health services (e.g., training and licensing fees were not included in the grant). Although there are currently no active MST-CAN teams in South Carolina, MST Services keeps costs largely uniform across teams (i.e., regardless of the state in which they are located) with cost-of-living differences serving as the primary source of variability. Therefore, we used a representative annual budget that was derived from private service organizations in New York and Connecticut (i.e., the two states that currently have active MST-CAN teams). The budget included personnel costs (e.g., salaries for therapists, supervisor, psychiatrist, and family case manager; employee health insurance), nonpersonnel expenditures (e.g., supplies, office space, utilities, computers), training and licensing costs, cell phone service contracts, and mileage reimbursement to therapists for travel related to providing services. All expenses involved in operating the MST-CAN program were summed (for a total of $537,240) and divided by the number of families who typically receive services in a given year (i.e., 24) to calculate the cost per family. This cost was then adjusted for the difference in cost of living between New York/Connecticut (i.e., averaged across those states) and South Carolina (i.e., the site of the original effectiveness trial) using the Council for Community and Economic Research (CCER) Cost of Living Index (CCER 1998). The estimated present value cost of MST-CAN was $15,961 per family.

EOT

In contrast to MST-CAN, usual community outpatient services for child maltreatment use a fee-for-service model in which all expenses (e.g., personnel costs, supplies, utilities) are captured through hourly session rates. We estimated the cost of EOT per family using three steps. First, we obtained the hourly Medicaid reimbursement rates for mental health diagnostic evaluations (as provided by doctoral- and master's-level clinicians) and group therapy (as provided by master's-level clinicians) to Local Education Agencies from South Carolina Department of Health and Human Services (SCDHHS 2015). Table 1 presents reimbursement rates for these service categories, as well as for other service categories that were used for subsequent cost estimates. Second,

Table 1 Reimbursement rates for mental health and substance use interventions by service category

Service category	Rate	Unit	Source
Psychiatric diagnostic evaluation—doctorate	$224.63	Hour	SCDHHS LEA
Psychiatric diagnostic evaluation—masters	$153.94	Hour	SCDHHS LEA
Mental health outpatient—individual	$111.90	Hour	SCDHHS LEA
Mental health outpatient—group	$24.30	Hour	SCDHHS LEA
Family therapy with/without patient	$107.04	Hour	SCDHHS LEA
Mental health day program	$222.72	Day	SCDHHS DAODAS
Mental health residential—youth	$847.00	Day	MUSC
Mental health residential—adult	$810.00	Day	MUSC
Substance abuse outpatient	$99.32	Hour	SCDHHS DAODAS
Substance abuse day program	$222.72	Day	SCDHHS DAODAS
Substance abuse residential	$1,111.00	Day	MUSC

SCDHHS South Carolina Department of Health and Human Services, *LEA* local education agency, *DAODAS* Department of Alcohol and Other Drug Abuse Services, *MUSC* Medical University of South Carolina

we estimated the costs of the three service components for the EOT group: (1) the cost of the mental health diagnostic evaluation included 1 h with a psychiatrist and 1.5 h with a master's-level clinician, resulting in $456 per family; (2) for the STEP-TEEN parenting group, we multiplied the average number of groups attended per family (i.e., 6.8), the standard length of 1.5 h per group, and the reimbursement rate for group therapy, all of which comes to $248 per family; and (3) the cost of the enhanced engagement strategies was based on a representative salary for a master's-level therapist ($3,333.33/month), which we adjusted for the proportion of time spent providing non-reimbursed services (i.e., 3.5 h per 40-h week, or 0.088) and the average length of treatment per family (i.e., 2.8 months), for a cost of $68 per family. Third, we estimated the cost of supervision for all services delivered by a master's-level therapist using the same procedures as for enhanced engagement strategies, but with monthly salary at $4000 and proportion of non-reimbursed services at 0.025 (i.e., 1 h per 40-h week), resulting in $23 per family. The total costs of EOT services were $795 per family.

Supplemental Services

Table 1 presents the reimbursement rates for each supplemental service category as well as the source of each rate (SCDHHS 2014, 2015; Bruce Cross, MHA, business manager for Medical University of South Carolina, personal communication, May 2, 2013). Given that SCDHHS reimbursement rates for Local Education Agencies had not changed since 2013 (SCDHHS 2013), we assumed that rates from other sources that were expressed in 2013 and 2014 dollar values were still applicable in 2015 as well.

We used a cost-offset approach to account for the incremental costs of supplemental services in the MST-CAN versus EOT conditions, such that the incremental costs were counted under the condition with higher supplemental costs. We calculated the costs of additional services in each condition by (a) multiplying the number of units (i.e., hours or days) provided in each service category, based on the aforementioned service utilization survey, by the respective reimbursement rate of that service (see Table 1); (b) summing those costs across all service categories; and (c) dividing the total costs by the respective sample size. Per-family costs for supplemental services were $2903 in the MST-CAN condition and $5712 in the EOT condition. The costs of EOT services (i.e., $795) and the incremental costs of supplemental services in the EOT condition (i.e., $3619) summed to a present value cost of $4414 for the EOT condition.

Benefit Measures

The WSIPP model estimates benefits of reductions in child maltreatment in three domains: participant, taxpayer, and society. Furthermore, the WSIPP model allows for specification of parameters based on level of risk; in line with inclusion criteria for the present study, we estimated all benefits using parameters for youth that (a) require treatment for child abuse and neglect and (b) are at imminent risk for out-of-home placement.

Participant

Benefits to program participants are defined in the WSIPP model in terms of avoided expenses for medical care (e.g., hospital and physician costs, mental health care, rehabilitation, health insurance claims processing) and quality-of-life losses (i.e., pain and suffering) related to experiencing maltreatment. Values for these expenses are taken from Miller et al. (2001), with the assumptions that (a) 50% of medical care expenses and 100% of quality-of-life losses are directly incurred by maltreated youth and (b) expenses in both categories were 80% from urban settings and 20% from rural

settings. Miller et al. estimated quality-of-life expenses, which represent the intrinsic value of avoiding victimization, by subtracting tangible expenses (e.g., medical/mental health care, public services) from typical compensatory damages awarded by a jury. The weighted average expenses to participants across maltreatment types were $1416 for medical care and $34187 for quality-of-life.

Taxpayer

Taxpayer benefits are defined in the WSIPP model for avoided social services and out-of-home placements due to subsequent episodes of child maltreatment. Expenses for social services are based on estimates of the annual marginal capital and operating expenses for the following public services in Washington state: (1) child protection investigation, (2) police involvement, (3) family court proceedings, (4) in-home services (i.e., not out-of-home placement), and (5) adoption, as well as (6) the remaining 50% of the aforementioned medical care costs, for a total of $9074 per youth. Expenses for out-of-home placement involve an additional $48,481 per youth associated with (7) protective custody (i.e., foster care).

Society

The costs and benefits of a given treatment program have economic effects beyond participants and taxpayers. The WSIPP model estimates four categories of benefit to society at large. First, programs that affect rates of crime can produce benefits through reductions in tangible (e.g., medical and mental health services, lost productivity) and intangible (e.g., pain and suffering, lost quality of life) expenses to crime victims; Miller et al. (2001) specified values for various crime categories (e.g., $183,734 for sexual offenses, $15,757 for robbery). Second, programs that increase human capital (i.e., education and job skills) in a given region can produce "spillover" benefits by increasing coworkers' productivity and attracting more employers (McMahon 2010). The WSIPP model assumes a modal value of 37%, taken from Belfield et al. (2011), for these spillover benefits. Third, the value of program effects on mortality (i.e., value of a statistical life; Viscusi 2008) can be estimated through a combination of (a) estimated loss of lifetime labor market earnings due to premature death and (b) results of "willingness to pay" studies that estimated the amount of money that people spend to reduce risks of death. The modal value of a statistical life in the WSIPP model, based on the findings of Kniesner et al. (2010), is approximately $9.4 million. Finally, programs that produce changes in taxpayer expenses also affect the deadweight cost of taxation, which represents the value of economic welfare loss in the general population because money collected for taxes cannot be used for other purposes (Feldstein 1978). The WSIPP researchers use a default value of 50% for the deadweight cost of taxation, following the recommendations of Heckman et al. (2010).

Linked Outcomes

The WSIPP model estimates additional participant, taxpayer, and societal benefits of unmeasured outcomes for which WSIPP (2016a) found a demonstrated relation ("link") to child maltreatment through meta-analyses of relevant empirical studies. For example, their meta-analysis of the association between childhood maltreatment and subsequent criminality showed a moderate association ($d = 0.53$). The 15 outcomes that are linked to child maltreatment in the WSIPP model include: (1) employment, (2) years of education completed, (3) academic test scores, (4) high school graduation, (5) grade retention, (6) special education, (7) depression, (8) anxiety, (9) posttraumatic stress disorder, (10) alcohol use disorder, (11) other substance use disorder, (12) tobacco use, (13) obesity, (14) disruptive behavior, and (15) crime. Details regarding the monetization of these linked outcomes, including "trumping" procedures used to avoid double-counting benefits, are provided in the WSIPP (2016b) technical document.

Analytic Strategy

We used the WSIPP model to estimate the incremental benefit of MST-CAN relative to EOT from a "whole state" perspective. Analyses were based on three sets of measures: (1) effectiveness (i.e., reductions in incidents of maltreatment and out-of-home placement in the MST-CAN vs. EOT conditions, which we calculated using meta-analysis); (2) costs (i.e., resources used to provide MST-CAN vs. EOT); and (3) benefits to participants, taxpayers, and society at large (i.e., for MST-CAN vs. EOT). Results of the analyses were expressed in terms of a net benefit estimate (i.e., benefits minus costs) and a benefit-cost ratio (i.e., benefits divided by costs). MST-CAN was considered cost-beneficial relative to EOT if the net benefit was positive and the benefit-cost ratio exceeded 1.00 (see Steuerle and Jackson 2016).

Calculation of Effect Sizes

The WSIPP model requires that the user specify a single effect size (i.e., Cohen's *d*; Cohen 1988) and standard error (*SE*) for each measured outcome; when multiple measures are available for the same outcome, the user must first estimate a pooled effect using meta-analysis. For the present study, we used MIX 2.0 (Bax et al. 2006) to conduct a meta-analysis that estimated the mean *d* and *SE* of the nine measures of child maltreatment from the original effectiveness trial. We used a fixed-effects model, given that the goal of

the meta-analysis was to estimate the mean of the present set of effect sizes. We took individual *d*s and variances for the CTS subscales from Swenson et al. (2010b). Because the original study did not report *d* and variance for the dichotomous measure of child maltreatment incidents, we calculated statistics for that measure using the Cox logit estimator (Cox 1970) for 2 × 2 contingency tables; that statistic has been shown to provide an unbiased estimate of *d* under the greatest number of conditions (Sánchez-Meca et al. 2003). Separately from the meta-analysis, we estimated *d* and variance for the single dichotomous measure of incidents of out-of-home placement using the Cox logit estimator and then calculated its *SE* using the formula $SE = \sqrt{Var} \Big/ \sqrt{n}$.

Model Assumptions

The WSIPP model includes four assumptions in all analyses of child maltreatment outcomes. First, the model assumes that participant and taxpayer expenses decrease at an average rate of 53% per year following an incident of child maltreatment. Second, the WSIPP model calculates crime victim (linked) benefits using an assumed distribution of expected crimes, based on a large body of evidence (e.g., Truman and Langton 2015) suggesting that the actual numbers of offenses that are committed across various types of crimes are greater than the numbers of arrests for such offenses. Third, the WSIPP researchers assume that benefits of reductions in child maltreatment will continue to accrue over the individual's lifetime and thus calculate benefits over a time horizon based on life expectancy [i.e., number of years that program participants are expected to live posttreatment; based on Centers for Disease Control and Prevention life tables (Arias 2010)]. Finally, the model uses economic discounting to express reductions in any benefits that accrued into the future (i.e., over the years following treatment). The default annual discount rate is 3.5%, which is derived from the average expected after-tax rate of return on savings (see Steuerle and Jackson 2016).

Sensitivity Analyses

We conducted a sensitivity analysis (see Steuerle and Jackson 2016), which is built into the WSIPP model, to examine how the cumulative net benefit would be influenced by uncertainty (i.e., variability) in values of seven key parameters in the model: (1) effect sizes for outcome measures, (2) rates of undetected crime victimization, (3) spillover benefits from human capital, (4) value of reductions in mortality, (5) deadweight costs of taxation, (6) discount rate, and (7) treatment costs. Specifically, we performed a Monte Carlo simulation (with 10,000 iterations) in which the value of each parameter was randomly drawn from a probability distribution: (a) for effect sizes, a normal distribution based on *d* and *SE*; and (b) for all other parameters, a triangular distribution under which the density of the distribution is assumed to increase linearly from specified minimum and maximum plausible values (i.e., lowest probability) to the modal value (i.e., highest probability). We retained the default minimum and maximum plausible values of each triangular distribution from the WSIPP model (see WSIPP 2016b), which were as follows: (2) expenses related to undetected crime victimization varied ± 20% from the modal values; (3) spillover benefits from human capital ranged from 25–42%; (4) value of a statistical life varied from approximately $5.4–$13.4 million in 2015 dollars; (5) deadweight costs of taxation ranged from 0–100%; (6) discount rate varied from 2 to 5%; and (7) treatment costs varied ± 10% from the aforementioned present value costs. After completing the simulations, we then evaluated the robustness of the net benefits (i.e., of MST-CAN vs. EOT) by examining if the balance (i.e., positive or negative) changed over the range of plausible benefits.

Results

Effectiveness

Results of the meta-analysis indicated that the mean effect sizes favored MST-CAN for maltreatment ($d = 0.34$; $SE = 0.002$) and out-of-home placement ($d = 0.63$; $SE = 0.050$). Other statistics describing clinical outcomes (e.g., intercepts and slopes from latent growth models), which were not used for the present analyses, are reported in Swenson et al. (2010b).

Benefits

Table 2 lists the average expected present (i.e., 2015) value of avoided expenses to participants, taxpayers, and society of providing MST-CAN over EOT (i.e., incremental benefit). For each category of avoided expense, values are presented for child maltreatment, out-of-home placement, and six linked outcomes on which MST-CAN had a meaningful effect (through child maltreatment) in the model: (1) employment, (2) grade retention, (3) special education, (4) alcohol use disorder, (5) tobacco use, and (6) crime. The total incremental benefits per family who received MST-CAN versus EOT were $12,526 to participants, $17,292 to taxpayers, and $8,314 to society. We then summed the benefits to participants, taxpayers, and society to calculate the cumulative incremental benefit of $38,202 per family who received MST-CAN.

Table 2 Participant, taxpayer, and society expenses avoided for MST-CAN by outcome measure

Outcome measure	Avoided expense ($)			
	Participant	Taxpayer	Society	Cumulative
Child maltreatment	3007	142	71	3220
Out-of-home placement	0	11,900	5950	17,850
Linked outcomes				
CM to employment	9425	4020	0	13,445
CM to grade retention	0	62	31	93
CM to special education	0	190	95	285
CM to alcohol use disorder	2	0	3	5
CM to tobacco use	92	578	796	1466
CM to crime	0	400	1438	1838
Total	12,526	17,292	8384	38,202

All expenses are expressed in 2015 dollars

MST-CAN multisystemic therapy for child abuse and neglect, *CM* child maltreatment

Cost-Benefit Analysis

We summed the benefits to participants, taxpayers, and society to calculate the cumulative expected benefits per family. We then subtracted the present value cost of the EOT condition per family (i.e., $4414) from the present value cost of providing MST-CAN per family (i.e., $15,961) to calculate the incremental cost of MST-CAN over EOT (i.e., $11,547). Next, we subtracted the incremental cost of MST-CAN from each of the aforementioned estimated benefits to obtain the net benefit of MST-CAN over EOT to participants, taxpayers, and society as well as the cumulative net benefit. We also divided each estimated benefit by the incremental cost to obtain the respective benefit-cost ratios (i.e., participant, taxpayer, society, and cumulative) for MST-CAN. Table 3 summarizes the net benefits and benefit-cost ratios for MST-CAN (vs. EOT) under the "primary analysis" heading. The cumulative net present value was $26,655 per family and the cumulative incremental benefit per dollar of cost was $3.31.

Sensitivity Analysis

To conduct the sensitivity analysis, we first calculated the avoided expenses of MST-CAN to participants, taxpayers, and society using 10,000 iterations of the Monte Carlo simulation. We then calculated 95% confidence intervals ($M \pm 1.96SD$) for each cost and benefit category across the 10,000 iterations and successively substituted those values into the cost-benefit analysis formulas. Table 3 reports the resultant minimum and maximum plausible net present values and benefit-cost ratios. The results were robust to variance in key model parameters, with net present values of $14,432–$39,925 and benefit-cost ratios of 2.24–4.47.

Table 3 Cumulative benefit of MST-CAN to participants, taxpayers, and society

Benefit	Primary analysis		Limits of 95% CI from sensitivity analysis[a]			
	Net present value ($)[b]	Benefit-cost ratio[c]	Minimum		Maximum	
			Net present value ($)[b]	Benefit-cost ratio[c]	Net present value ($)[b]	Benefit-cost ratio[c]
Participant	979	1.09	7218	0.38	9670	1.84
Taxpayer	5745	1.50	1629	1.14	10,044	1.87
Society	(3163)	0.73	(4682)	0.60	(1308)	0.89
Cumulative[d]	26,655	3.31	14,432	2.24	39,925	4.47

All expenses are expressed in 2015 dollars. Dollar amounts in parentheses indicate negative savings

MST-CAN multisystemic therapy for child abuse and neglect, *CI* confidence interval

[a]Based on the results of a Monte Carlo simulation with 10,000 iterations

[b]The difference between the benefit and the incremental cost of providing MST-CAN over enhanced outpatient treatment (EOT); that is, $11,547 for the primary analysis, $11,608 (on average) for the minimum values under the sensitivity analysis, and $11,503 (on average) for the maximum values under the sensitivity analysis

[c]The benefit divided by the respective incremental cost of providing MST-CAN over EOT

[d]Because participant, taxpayer, and society net present values each include the incremental cost of MST-CAN over EOT, the cumulative values are not the simple sum of these benefits and have been adjusted to reflect a single incremental cost of MST-CAN

Discussion

Decisions about state investment in services for maltreated youth and their families are best informed by research regarding both the clinical effectiveness and the economic feasibility of various interventions. The present study examined the economic costs and benefits of an empirically-supported community-based treatment (i.e., MST-CAN) for this population. The study had several strengths, including (a) a comprehensive and well-validated cost-benefit model (i.e., WSIPP model); (b) data from a randomized controlled trial; (c) measures of child maltreatment from multiple informants; (d) a sample of families who received services in a community mental health setting (i.e., effectiveness trial); and (e) actual (rather than estimated) treatment costs from MST-CAN and comparison programs. The results also complement findings of economic benefits from MST-CAN implementation efforts in Switzerland and England with families who were referred for neglect (Pérez et al. 2018; Watmuff and Ross 2016).

The present findings demonstrate that MST-CAN produced economic benefits from a "whole state" perspective when compared with standard outpatient services that were enhanced with specific engagement strategies and a parenting program (i.e., EOT). Specifically, providing MST-CAN to a single family referred for child physical abuse returned an average of $12,526 to participants, $17,292 to taxpayers, and $8384 to society at large relative to the provision of EOT. In addition, the benefits to program participants and taxpayers (i.e., the funding source for publicly funded programs) each exceeded the incremental cost of MST-CAN independently, with respective returns of $1.09 and $1.33 per dollar spent. Furthermore, the cumulative net benefit of MST-CAN was $26,655 per family, such that $1 spent on MST-CAN resulted in total savings of $3.31. Moreover, a sensitivity analysis indicated that the estimated net benefits of MST-CAN produced by the WSIPP model were robust to variations in key model parameters (e.g., effect sizes for outcome measures, rates of undetected crime victimization).

Of the cumulative benefits of MST-CAN, the vast majority (81.9%) were associated with two outcomes: (1) reductions in out-of-home placement (46.7%); and (2) improvement in expected adult employment rates, a linked outcome for child maltreatment (35.2%). These outcomes have different implications for financial investment in MST-CAN: Savings associated with out-of-home placement are based on a directly measured outcome that can be tracked immediately following intervention initiation, whereas savings associated with employment are estimated from actuarial values over a lengthy time horizon (i.e., based on life expectancy; Arias 2010). Government agencies often show a preference for more certain (e.g., directly measured) and immediate outcomes when investing public funds, to the detriment of services with long-term or indirect benefits (Elmore 1987). However, even the benefits observed reductions in out-of-home placement alone produced a benefit-cost ratio of 1.55, suggesting that MST-CAN produces concrete benefits that could justify its funding by government agencies, plus numerous indirect benefits that unfold over time.

The economic benefits of MST-CAN observed in the present study have important implications regarding the design of services for complex cases involving child maltreatment. Specifically, our findings highlight two key advantages of comprehensive treatment models such as MST-CAN. First, MST-CAN interventions target key social–ecological risk factors (e.g., ineffective parenting practices, caregiver mental health concerns, social skill and problem-solving deficits) that are associated with the incidence of child physical abuse and neglect in families. A major limitation of typical treatments for child maltreatment, including the EOT condition in the present study, is their relatively narrow focus and failure to account for the multidetermined nature of abuse and neglect behaviors. Second, MST-CAN interventions are provided in natural community contexts (e.g., home, school, recreation center) at times convenient to families. The MST-CAN model of service delivery helps to diminish barriers to service access and provides ecologically valid information for the MST analytic process of assessment and intervention development. By addressing social–ecological risk factors and providing accessible services within each family's social environment, MST-CAN has the capacity to produce clinical and economic benefits beyond those observed in standard treatments that focus on individual family members, are limited in coordination, and lack bearing on the natural ecology of youth who are physically abused or neglected.

Policymakers and government entities would benefit from consideration of the cost savings shown in this study when allocating scarce financial resources to interventions for child maltreatment, especially for families with extensive clinical needs who are at high risk for repeated contact with CPS. Otherwise, the high initial cost of providing a comprehensive treatment such as MST-CAN (i.e., representative value of $15,961 per family in 2015; costs vary by state and country) may seem formidable when compared with the cost of standard services, especially given that less comprehensive treatments are often cheaper and more profitable for providers to implement. The present findings suggest that state investment in MST-CAN, through provision of funds to the relevant public agencies (e.g., CPS), results in broad societal benefits and improved economic functioning of the state. Given that the observed benefits of MST-CAN were spread across taxpayers, program participants, and society at large, state funding (in the United States, or national funding

in countries with centralized health services) is ideal for such interventions because local agencies will not accrue the majority of savings.

One of the primary reasons that MST-CAN, as a community-based treatment, is costlier than standard services is that MST-CAN requires substantial changes in the organizational structure (e.g., a shift to community-based intervention delivery) and culture (e.g., increased emphasis on responsibility for clinical outcomes) of provider organizations. For example, the MST model includes numerous quality assurance mechanisms that support implementation of the treatment with fidelity in community provider settings, including standardized protocols for training, intervention, and supervision as well as ongoing monitoring of treatment practices and clinical outcomes (see Schoenwald 2016). These mechanisms produce additional costs, yet they also help to maintain higher levels of intervention quality and effectiveness. Given the importance of such structural and cultural changes, public service agencies must develop strong partnerships with provider organizations—that involve financial as well as practical assistance—to support implementation of MST-CAN.

The present study has several methodological limitations. First, resources were not available to track all possible outcomes associated with MST-CAN, although we estimated benefits for outcomes that we could not measure directly (e.g., employment, tobacco use, crime) using the linked outcomes included in the WSIPP model. Second, our estimates of MST-CAN and EOT treatment costs did not incorporate startup costs (e.g., program development, staff training). Nevertheless, these costs are nearly equivalent in MST-CAN and EOT programs and represent a small proportion ($<10\%$) of a first-year budget. Third, we were unable to take a societal perspective that accounted for costs incurred by families for participation in services (e.g., lost time, travel expenses) because we did not track the necessary information during the original effectiveness trial. However, given that families received similar amounts of services in the MST-CAN and EOT conditions and they did not have to travel to receive MST-CAN services, we expect that the costs to families would have been higher for EOT than for MST-CAN and thus the incremental cost of MST-CAN used in the present study may be conservatively large. Finally, independent replication of our findings is necessary given that the sample size was modest ($N=86$) and that the lead developer of MST-CAN was a consultant to the MST-CAN team in the effectiveness trial.

In conclusion, the cost savings identified in this study demonstrate economic benefits of implementing MST-CAN and create a persuasive argument for increased funding of this treatment model. When considered along with previous economic analyses of MST-CAN (Pérez et al. 2018; Watmuff and Ross 2016) and other cost-benefit studies of MST adaptations (e.g., Dopp et al. 2014; WSIPP 2016a), as well as recommendations from professional organizations (e.g., World Health Organization 2006), the present findings suggest that comprehensive community-based treatments play an important role in efforts to reduce the financial and social consequences of child physical abuse.

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Compliance with Ethical Standards

Conflict of interest Cindy M. Schaeffer and Cynthia Cupit Swenson are consultants in the development of Multisystemic Therapy for Child Abuse and Neglect and related programs through MST Services, Inc., which has the exclusive licensing agreement through the Medical University of South Carolina for the dissemination of Multisystemic Therapy technologies. Alex R. Dopp and Jennifer S. Powell declare that they have no conflicts of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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