


ORIGINAL ARTICLE OPEN ACCESS

Cost-Effectiveness of Functional Family Therapy for Youth Probationers in Singapore: Findings From a Randomized Controlled Trial

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Received: 7 August 2024 | **Revised:** 25 February 2025 | **Accepted:** 4 March 2025

Keywords: at-risk youth | cost-effectiveness | economic evaluation | functional family therapy | ICER | juvenile justice | recidivism

ABSTRACT

This randomized controlled study evaluated the cost-effectiveness of Functional Family Therapy (FFT) compared to Treatment As Usual (TAU) among 120 youth probationers in Singapore. The Incremental Cost-Effectiveness Ratio (ICER) was calculated to determine the cost per unit of non-recidivism, covering the period from probation inception to 3 years post probation. Overall, FFT showed higher costs (S\$1183 vs. S\$1070) but better non-recidivism rates (79% vs. 65%) compared to TAU. The ICER was S\$807 per youth probationer (95% CI: S\$230–S\$1,061). For high-risk youth, FFT was both less costly and more effective (ICER: –S\$2396), while for moderate-risk youth, it was more costly but more effective (ICER: S\$2809). Using willingness-to-pay benchmarks published by Cohen et al., FFT was considered more cost-effective than TAU. The study concluded that FFT is a cost-effective intervention for youth probationers in Singapore.

The global prevalence of youth delinquency ranges from 6% to 10.9% (Young et al. 2017). Youth delinquency has been associated with school dropout, academic difficulties, low employment rate, and a wide range of physical and mental well-being consequences (Evans-Chase and Zhou 2014). In addition, it also incurs significant economic and social costs for society, such as victimization costs, the costs of operating detention or custodial facilities and conducting supervision, and further financial and productivity losses associated with recidivism (Harrington et al. 2005; National Audit Office 2011; Welsh et al. 2008). International research has acknowledged that these substantial costs are a significant global concern. The costs of youth crime in various countries are approximately 1.8% to 10.5% of the countries' Gross Domestic Product (Cohen 2020). While an increasing trend in crime-related expenses is observed, it is not solely due to an increase in the number of crimes. Factors include an elevated quality of life, leading to perceived higher costs per crime, and the complexity of modern crimes, which

require greater resources for investigation and prevention (see Wickramasekera et al. 2015 for a review).

Current research provides two fundamental methodologies for estimating the costs of crime, commonly referred to as the “cost of crime” approach and the “willingness-to-pay” approach, which offer distinct perspectives on assessing the economic impact of criminal activities. The “cost of crime” approach, as defined by Cohen (2020) and Nagin (2001), follows a bottom-up method, calculating the expenses associated with crime after it has occurred. For example, it focuses on costs incurred by individual victims, such as property damage, and the physical and emotional toll. It considers criminal justice system costs and lost productivity costs due to incarceration. A previous study conducted by McCollister et al. (2010) entailed the estimation of unit costs for a variety of criminal offenses, all adjusted to reflect 2008 US dollar values. These estimates encompassed a range of offenses, including murder, rape/sexual

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assault, robbery, household burglary, and stolen property. Importantly, these unit cost estimates are closely aligned with the broader range of figures previously reported in academic literature. To illustrate, the estimated unit cost for robbery was approximately US\$42,310, while the estimate for sexual assault amounted to roughly US\$240,776. These unit cost estimates enable the calculation of the total economic value resulting from crime reduction, facilitating direct comparisons with program costs. This comparison helps in the decision-making process regarding which programs to support, scale up, or discontinue.

In contrast, the “willingness-to-pay (WTP)” approach (Cohen et al. 2004, 2010) takes a top-down perspective in cost-effectiveness analysis. This approach centers on estimating the public’s inclination to allocate resources for reducing the risk of criminal occurrences, considering factors such as risk avoidance behavior and societal cohesion. It presents a comprehensive view that encompasses both tangible and intangible elements of the societal costs associated with crime, making it the favored method for assigning monetary values to the overall impact of criminal activities. In a nationally representative study involving 1,300 U.S. residents, Cohen et al. (2001) revealed that the average US household was willing to contribute between US \$100 and US\$150 annually to support crime control programs aimed at reducing specific crimes by 10% within their respective communities. Collectively, these figures unveiled a noteworthy marginal WTP, signifying a commitment of approximately US \$31,000 per burglary, US\$75,000 per serious assault, US\$253,000 per armed robbery, US\$275,000 for preventing rape and sexual assault, and a substantial US\$9.9 million for reducing the incidence of murder. These findings provide valuable insights into the economic dimension of crime control programs and their potential societal impact.

In the current study, we employed the WTP approach to benchmark the Incremental Cost-Effectiveness Ratio (ICER) of an intervention. When the ICER falls below the lower bound of the range of WTP, it signifies that the intervention aligns with societal preferences for investing in crime reduction. Conversely, if the ICER exceeds WTP, it may indicate that the intervention is less cost-effective relative to prevailing societal values. This comparison augments the assessment of the intervention’s economic viability within the framework of societal investment priorities.

1 | Effects and Cost-Effectiveness of Functional Family Therapy (FFT)

Poor family functioning has been found to be an important predictor of youth delinquency (Shek et al. 2022; Chng et al. 2016; Chu et al. 2015). As such, strengthening family functioning has been recognized as a key objective of youth rehabilitation programs. FFT is an evidence-based, short-term, and intensive intervention that has been found to be effective in addressing youth delinquency of those aged between 11 and 18 years old (Alexander et al. 2013). FFT consists of three distinct phases, each with specific yet interconnected objectives. The *engagement/motivation phase* is dedicated to fostering a positive therapeutic alliance, nurturing hope, and cultivating

motivation for change within the family. It also addresses risk factors linked to treatment dropout, such as blame, negative emotions, hopelessness, and scheduling conflicts. During the *relational assessment/behavior change phase*, the therapist aids family members in understanding the functions served by problematic behaviors within the family dynamic. This facilitates the substitution of problematic behaviors with more adaptive alternatives that fulfill the same function without negatively impacting family functioning. Additionally, therapists assist the family in developing healthy communication and problem-solving skills. Finally, in the *generalization phase*, the emphasis is on sustaining positive behavioral changes and guiding the family in extending these changes to other aspects of their lives.

FFT has been shown to be effective in areas, including truancy, violence, property offenses, and substance abuse (Celinska et al. 2019; Heywood and Fergusson 2016; Slesnick and Prestopnik 2009; Vardanian et al. 2020; White et al. 2013). In FFT, youth delinquencies are seen as a part of longstanding patterns of dysfunctional family dynamics (Sexton 2000; Alexander et al. 2013) and FFT is designed to ameliorate such dysfunctional dynamics to reduce the associated delinquent behaviors. These are typically achieved through recognizing and reducing families’ maladaptive communication patterns, setting clear boundaries about each family member’s responsibilities, reinforcing protective family factors, and then generalizing these changes to the larger community context (Sexton 2000; Alexander et al. 2013).

FFT has been implemented in over 300 sites across 11 countries (Robbins et al. 2016) and its effectiveness has been studied across different cultural contexts (e.g., Aos et al. 2011; Baldwin et al. 2012; Carr 2014; Gottfredson et al. 2018; Hartnett et al. 2016; Henggeler and Sheidow 2012; Heywood and Fergusson 2016). Research has shown that FFT demonstrated long-term effectiveness, with positive outcomes maintained even at follow-up periods of at least 1 year (Henggeler and Sheidow 2012; Robbins et al. 2016), and the positive impact also extends to siblings of FFT participants (Alexander et al. 2013). Furthermore, research indicates that FFT had a significantly positive impact on youth with high risk and high needs in the family domain (Elliott 1997; Sexton and Turner 2010).

Once the effectiveness of an intervention is demonstrated, the next question is often whether it is financially prudent to pursue such an effect in view of the limited resources. From a policy perspective, cost-effectiveness analysis (CEA) is the preferred economic evaluation method because it provides information on which intervention program is more desirable when outcomes measured are in nonmonetary units such as the number of reduced crimes (French et al. 2008).

The international CEA studies published to date found mixed results regarding the cost-effectiveness of FFT for reducing the rates of youth delinquent behaviors. For example, some studies found that FFT is more cost-effective in reducing youth recidivism rates as compared to an alternative intervention program such as a residential program (Early et al. 2012; Novak et al. 2021). On the other hand, another study found that FFT is more costly than another form of family intervention (i.e.,

Multisystemic Therapy) despite yielding the same effectiveness in improving the quality of life among adolescents with anti-social behaviors (Vermeulen et al. 2017). Possible factors contributing to this variation include the choice of comparative programs, program implementation quality, outcome measures selected, data sources and collection methods, time frames for assessments, population characteristics, resource allocation efficiency, and policy and funding constraints. Understanding the interplay of these factors is essential for assessing FFT's financial viability and informing resource allocation decisions. Further research is therefore needed to comprehensively evaluate FFT's cost-effectiveness in diverse contexts.

2 | The Implementation of FFT in Singapore

Family intervention has played an important role in youth rehabilitation in Asia (e.g., Chu and Daffern 2024). In Singapore, FFT was first implemented in late 2014. The details of the implementation process were documented by Gan et al. (2018), demonstrating a cross-cultural application of this Western-developed intervention in an Eastern context.

Following the implementation protocol prescribed by the model developer, a team of psychologists and social workers underwent a 2-day intensive training conducted by a certified FFT trainer, followed by a series of coaching sessions (four 2-day sessions in the first year and one 1-day session annually in the subsequent 2 years) by a certified FFT consultant. Additionally, the team also attended weekly supervision sessions with a US-based consultant in the first year and a trained local supervisor from the second year onwards. The local supervisor maintained fortnightly or monthly consultations with the certified FFT consultant to ensure continuous guidance while gradually localizing expertise.

Despite cultural challenges, such as language barriers and emotion suppression, the Singapore FFT team achieved high fidelity to the model, with dissemination and fidelity ratings exceeding developer-prescribed benchmarks (Gan et al. 2018). This success could be attributed to culturally sensitive adaptations, organizational support, systematic therapist selection and training, and effective stakeholder engagement. Further, a Randomized Controlled Trial (RCT) conducted by Gan et al. (2021) demonstrated the effectiveness of FFT for youth offenders in Singapore. Compared to Treatment-As-Usual (TAU), youths in the FFT group showed more sustainable improvement in well-being, greater reliable change in family functioning, and higher probation completion rates.

3 | The Present Study

FFT has been shown to be effective, but as an intensive program requiring substantial training support, a key consideration for adopters and decision-makers is its cost-effectiveness. Moreover, given the distinct family dynamics, cultural values, and societal norms in Asian communities, there is a need for further local evidence on FFT. The present study aims to investigate the cost-effectiveness of FFT for youth probationers referred to the Ministry of Social and Family Development (MSF) by the

juvenile justice system in Singapore. Additionally, the study will conduct a differential cost-effectiveness analysis across risk levels (moderate vs. high) as assessed by the Youth Level of Service/Case Management Inventory (YLS: CMI) 2.0. The study's outcomes will provide valuable insights for informing the efficient use of resources in youth crime prevention and rehabilitation programs in Singapore.

4 | Methods

4.1 | Participants

This study used the same participant sample as the previous RCT on FFT in Singapore (Gan et al. 2021). One hundred and twenty youth offenders (107 males, 13 females) aged 13–18 (*Mean* = 16.2, *SD* = 1.33), who had been placed on community-based probation, were included in the study.

All participants started their court-mandated probation orders between December 2014 and March 2018, and the average length of the probation orders was 606 days (*Median* = 549, *SD* = 119, *range* = 364–913). Among the participants, 90% resided in subsidized public housing, and 45.8% came from low-income families that were eligible for government-funded social assistance. The types of crimes committed by the participants included property crimes, violent offenses, financial crimes, drug-related offenses, and public order violations.

4.2 | Procedure and Design

Participants had been deemed eligible to participate in this study and the previous study as they met the following inclusion criteria: (i) a baseline risk severity of “Moderate” or higher on both the *Family Circumstances/Parenting* domain and *Total Risk* on the YLS/CMI 2.0, using locally derived norms (Chu et al. 2015), (ii) at least 8 months remaining on their probation orders, and (iii) had a stable living arrangement with their caregiver(s). In contrast, excluded participants were those who were already receiving other interventions or presented with active psychotic symptoms, low intellectual functioning, sexualized behaviors, or high risk of suicidal or self-injurious behaviors.

Approval to conduct this study was granted by a Research Ethics Committee in MSF (refer to Gan et al. 2021 for details). Participants in both FFT and TAU groups attended the mandatory probation programs. In addition, participants in the FFT group attended FFT whereas those in the TAU group attended alternative programs that addressed offense- and family-related needs. Participants who completed FFT engaged in an average of 12 therapy sessions over approximately 4.7 months. The TAU programs, while potentially varying in their specific targeting areas, were structurally similar to FFT (Gan et al. 2021).

4.3 | Cost Analysis

In CEA research, costs could be estimated from either a payer's or societal perspective (Kim et al. 2020). The societal perspective encompasses the entirety of costs and consequences attributable

to an intervention across diverse stakeholders. This entails not only direct program costs but also indirect costs, such as productivity losses and caregiver burden. Conversely, the payer perspective confines its purview to the financial outlays borne exclusively by the payer, typically encompassing direct costs related to the interventions, such as manpower, training, and running costs (Kim et al. 2020).

For the present study, costs were calculated from a payer's perspective – costs generated in organizations and systems that supported the rehabilitation of youth offenders through TAU programs or FFT. Adopting a payer's perspective will help identify the resources needed for effective rehabilitation programs for youth offenders and provide crucial data to support policy decisions and budget allocations within the juvenile justice system. By narrowing the scope to direct costs related to program implementation, such as manpower and operational expenses, the research caters to the practical concerns of program delivery entities and resonates with the Singaporean context. This approach ensures analytical precision, contextual relevance, and practical applicability in assessing the cost implications of FFT for youth offenders.

The costs were estimated for programs delivered during the period of each participant's probation order, of which the first started in December 2014, and the last completed probation in January 2020. The cost for each program was the sum of program cost and training cost. All costs were calculated in Singapore dollars (S\$).

4.3.1 | Program Cost per Probationer

Program cost refers to the cost associated with the running of the program for probationers. This cost was calculated based on one of the following methods:

If the program was conducted by MSF staff or staff from other social service agencies, the formula below was used to calculate program cost. The MSF staff per hour rate was determined based on the average pay per annum of officers belonging to the substantive grade that typically conducted these programs. Meanwhile, the staff per hour rate for staff from other social service agencies was determined based on the salary guide by the National Council of Social Service, which is the umbrella body for social service organizations in Singapore. It was assumed that all staff worked 1900 h a year, based on previous estimates. If the exact number of sessions and number of hours per session were unavailable, it was assumed that there were 12 program sessions, each an hour long. This was the average session number and duration based on all the available programs in this study. The following formula was used for the calculation.

$$\frac{\text{Staff per hour rate} \times \text{No. of hours per session} \times \text{Total No. of sessions} \times \text{Total No. of staff delivering program}}{\text{No. of participants enrolled in the program}}$$

Costing data was unavailable for one TAU program. In this case, the program cost was calculated by averaging the cost of the other TAU programs.

If the program was conducted by an external vendor, the program cost was calculated based on the average procurement cost per year, according to the following formula:

$$\frac{\text{Average procurement cost per year}}{\text{No. of participants enrolled in the program}}$$

4.3.2 | Training Cost per Probationer

The training cost refers to the cost associated with the training received by staff to carry out the program. This cost was calculated based on one of the following methods:

If the training was conducted by MSF staff members, the training cost was calculated based on the average pay per annum of staff belonging to the substantive grade that typically conducted these training sessions. It was assumed that staff worked 1900 h a year, based on previous estimates. The following formula was used for the calculation.

$$\frac{\left[\left(\begin{array}{l} \text{Trainer per hour rate} \\ \times \\ \text{No. of trainers per year} \end{array} \right) \right] \times \text{Total training hours per year}}{\text{No. of probationers who attended per year}}$$

If the training was conducted by an external trainer, the training cost was calculated based on the value quoted during the procurement process. The following formula was used for the calculation:

$$\frac{\text{Average procurement cost per year}}{\text{No. of probationers who attended per year}}$$

Given that the funds for interventions were expended over several years, all costs were discounted using a discount rate of 4% (Drupp et al. 2018; Evans and Sezer 2004).

4.3.3 | Cost Calculation for Missing Values

For participants where the number of sessions attended was not recorded, the average number of sessions attended by other participants of the program was used to estimate the program cost.

4.4 | Effectiveness Analysis

Measuring and reporting probation completion (e.g., Early et al. 2014) and recidivism rates (e.g., Horn et al. 2020) are the

most common and effective approaches for tracking probation or rehabilitation success. For the present study, the non-recidivism rate was used to measure the program's

effectiveness, and it is defined as the percentage of clients that stayed crime-free from probation inception to 3 years post probation. The data was obtained from the youth's probation reports, which detailed any infringements, as well as from official criminal records, detailing charges and convictions.

4.5 | CEA

CEA calculates and compares ratios of cost and effectiveness across study conditions. The ratio is presented in the form of an ICER. The numerator of an ICER represents the difference in cost between the interventions being compared, while the denominator of an ICER represents the difference in outcomes between the compared interventions. In this study context, the value of ICER quantifies the disparity between the cost and effectiveness of FFT and TAU.

Given the possible variation with regard to the estimates of input parameters such as unit costs and discount rates, probabilistic sensitivity analysis was conducted to address this parameter uncertainty. Non-parametric bootstrapping was conducted. The uncertainty surrounding the ICER was estimated using bootstrapping with 1000 replications of the trial data of the cost and effect pairs. The bootstrapped ICER can then be presented on a cost-effectiveness plane to demonstrate which quadrant the bootstrapped samples fall under (see Figure 1).

The x-axis of Figure 1 represents the incremental outcomes of an alternative intervention, such as FFT, over the current intervention, such as TAU, and the y-axis the incremental cost. Values in the south-east (SE) quadrant mean that FFT is more effective and less costly than TAU and is therefore considered cost-effective. The values in the north-west (NW) quadrant mean that FFT is more costly and less effective than TAU. Values in the north-east (NE) quadrant equate to FFT being both more costly and more effective than TAU, and values in the south-west (SW) quadrant represent FFT being less costly and less effective than TAU.

For the current study, due to a lack of a WTP value for Singapore, we have employed estimates from Cohen et al. (2001), who conducted a study with a US nationally representative

sample. These estimates suggest an approximate WTP of US \$31,000 to prevent burglary, US\$75,000 for the prevention of a serious assault, and US\$253,000 to deter armed robbery. In accordance with the methodological framework proposed by Turner et al. (2019) for inflation adjustment in health economic evaluations, we adopted the recommended method by applying the original country's inflation rate, followed by currency conversion using contemporaneous exchange rates. Specifically, we utilized the American inflation rate of 4.1% (US Bureau of Labor Statistics 2023) and the exchange rate of 1 USD = 1.3186 SGD (Monetary Authority of Singapore 2023), both as of 2023, to adjust and convert the values. The WTP as of 2023 Singapore dollars was S\$42,552 for preventing burglary, S\$102,950 for preventing a serious assault, and S\$347,284 for deterring armed robbery. If the ICER of FFT over TAU falls below any of the benchmarks, then FFT is considered more cost-effective than the TAU.

5 | Results

5.1 | Background Characteristics of Participants

Sixty-three youth offenders were included in the FFT group whereas 57 were included in the TAU group. Table 1 presents the demographic characteristics of these two groups of participants. There were no statistical differences in their age, sex, and socioeconomic status across the two groups.

5.2 | Treatment Cost and Effectiveness and ICER Results

As shown in Table 2, the average cost per offender was S\$1,183 for FFT, and S\$1,070 for TAU. On average, FFT reduces re-offending by 14% as compared to the TAU group from probation inception to 3 years post probation. The ICER calculated for FFT versus TAU is S\$807. This indicated that for every additional youth offender to complete probation and not re-offend 3 years post probation, using FFT incurred an additional S\$807 as compared to using TAU. The 95% CI, based on the 2.5th and 97th percentile of the ranked ordered bootstrap estimates was S \$230–S\$1,061.

Figure 2 presents the results of FFT's cost-effectiveness. The cost-effectiveness plane shows that the north-east quadrant contains most of the bootstrap estimates. The ICER was lower than the WTP thresholds, which ranged from S\$42,552–S \$347,284. Sensitivity analysis using alternative WTP estimates (Cohen et al. 2004; Domínguez and Scartascini 2024) was conducted and yielded consistent findings.

5.3 | Variation in Cost-Effectiveness by Initial Risk Level

The differential cost-effectiveness analysis was further conducted across two risk levels, specifically moderate versus high. The moderate group consisted of participants whose total YLS/CMI scores fell under the “moderate risk” range, while the high

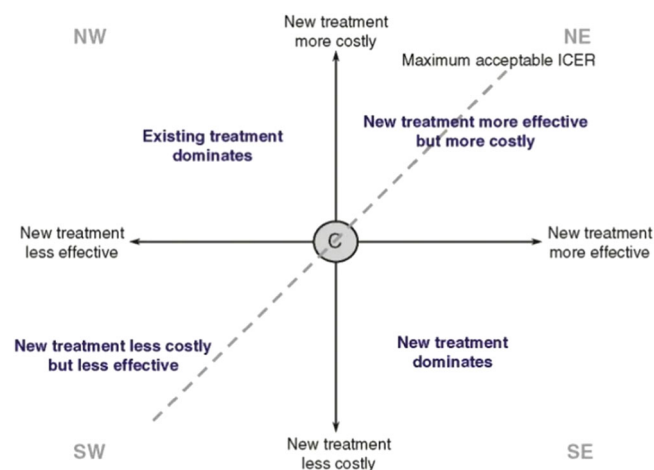


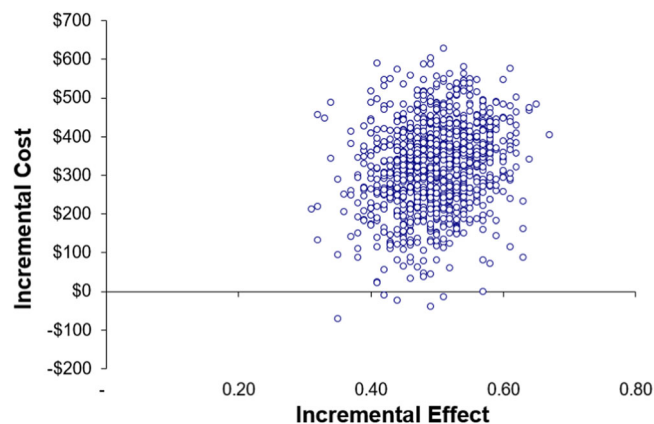
FIGURE 1 | An illustration of the cost-effectiveness plane. [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 1 | Background characteristics of youth offenders by treatment group.

	Value (SD or %)		t/X^2	p
	FFT ($n = 63$)	TAU ($n = 57$)		
Age	16.3 (1.28)	16.0 (1.39)	$t(118) = -0.898$	0.37
Sex (male)	57 (90.5%)	50 (87.7%)	$X^2(1) = 0.235$	0.63
Socioeconomic status (meet criteria for social assistance)	29 (46%)	26 (45.6%)	$X^2(1) = 0.002$	0.96

TABLE 2 | Average cost and effect across two treatment groups.

	FFT ($n = 63$)	TAU ($n = 57$)
Average cost per offender in program and training	S\$1,183	S\$1070
Non-recidivism rate	79%	65%
ICER (95% CI)	S\$807 (S\$230–S\$1061)	

**FIGURE 2** | The cost effectiveness plane of incremental costs versus incremental non-recidivism rates. [Color figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

group consisted of participants whose total YLS/CMI scores fell under either the “high risk” or “very high risk” range. As shown in Table 3, for the high-risk subgroup, FFT was less costly yet more effective than TAU, with an estimated ICER of -S\$2,396 per youth offender. For the moderate-risk subgroup, FFT was more costly and more effective than TAU, with an estimated ICER of S\$2,809 per youth offender.

6 | Discussion and Conclusion

The present study aimed to evaluate the cost-effectiveness of FFT for youth probationers in Singapore. A randomized controlled trial design was adopted, and a total of 120 youth probationers were randomly assigned to receive either TAU or FFT. Our findings showed that the average cost per participant in the FFT group was S\$1,183 while it was S\$1070 in the TAU group. The non-recidivism rate was 79% in the FFT group and 65% in the TAU group. The ICER was calculated to be S\$807 per youth probationer, with a 95% CI ranging from S\$230 to S\$1061. Using the WTP for a crime control program adjusted to

2023 Singapore dollars (Cohen et al. 2001), FFT was considered a cost-effective intervention for youth probationers in Singapore.

The differential cost-effectiveness findings between the high-risk and moderate-risk subgroups can be explained primarily through the relative effectiveness and cost of FFT compared to TAU for each group. For the high-risk subgroup, FFT demonstrated higher effectiveness and lower costs compared to TAU, resulting in a negative ICER of -S\$2396 per youth offender. In contrast, for the moderate-risk subgroup, FFT was more effective yet more costly than TAU, with an ICER of S\$2809 per youth offender. The ICER value of mod-risk group is still lower than the WTP benchmark.

These divergent results can be elucidated through two potential mechanisms. First, the effectiveness of FFT for high-risk youth aligns with the Risk-Need-Responsivity model in offender rehabilitation, which posits that intensive interventions are most suited for high-risk offenders. Second, high-risk youth tended to present with more risk factors that typically prompted conventional services to provide more interventions and support. These various interventions/support, in totality, likely increased the cost of services. FFT, on the other hand, was able to address multiple risks and needs (e.g., parenting issues, family relationships, individual risk factors, and siblings’ behavioral issues) concurrently through a systemic approach and was hence more cost-effective than referring each family member to separate interventions.

Taken together, the findings from the current study suggested that FFT was a cost-effective, evidence-based intervention for youth probationers, especially for the high-risk subgroup. Although the initial training cost for FFT may appear higher than many alternative programs, providing FFT to youth probationers and their families is likely more cost-effective in the long run than offering multiple programs/services to the same group.

6.1 | Strengths, Limitations, and Avenue for Future Research

Strengths of our study included a cost-effectiveness analysis that was prospectively designed, with the cost parameters tracked in conjunction with the original RCT study (Gan et al. 2021). Additionally, we tracked the recidivism outcomes of clients to objectively compare the effectiveness of FFT and TAU for youth offenders from probation inception to 3 years post probation. These outcomes are important for understanding the effectiveness of FFT in targeting delinquent behaviors of youth offenders.

TABLE 3 | Differential ICER of FFT versus TAU across entering risk levels on high versus moderate risk subgroups.

	High-risk subgroup		Moderate-risk subgroup	
	FFT (<i>n</i> = 17)	TAU (<i>n</i> = 12)	FFT (<i>n</i> = 46)	TAU (<i>n</i> = 45)
Average cost per offender in program and training	S\$1059	S\$1634	S\$1229	S\$920
Non-recidivism rate	82%	58%	78%	67%
ICER	−S\$2396		S\$2809	

While this cost-effectiveness analysis provides practical insights, it is important to acknowledge its limitations. The focus on success rates and unit costs may not capture the full spectrum of benefits and costs associated with FFT and TAU. Future studies may consider expanding the scope to include implicit costs, societal benefits, and longer-term impacts of juvenile offending. This could involve exploring the emotional and psychological costs associated with juvenile offending and the ripple effects on related systems, such as healthcare, education, workforce, and community resources. A more comprehensive understanding of the economic effects of reduced recidivism and enhanced family functioning, as well as the potential benefits from breaking the cycle of intergenerational transmission of criminality, may also provide insight beyond the costs and benefits directly borne by the program funders. Extending the follow-up period beyond 3 years could offer a clearer understanding of long-term cost-effectiveness and potential cost savings. Additionally, investigating the WTP value in the Singaporean context would provide a more comprehensive understanding of the economic implications of youth crime interventions. These expanded approaches would offer a more holistic view of the true value and impact of FFT and TAU within Singapore's juvenile justice system and broader social fabric.

Moreover, the current sample exhibited missing data, such as program attendance and varying program duration. This was primarily attributed to gaps in documentation and record-keeping practices for the TAU program, as a significant portion of the data had to be retrieved retrospectively after the RCT study. Although imputation with mean replacement has been employed to address the missing values to some extent, future implementation should focus on ensuring thorough data collection. To ensure the robustness of our findings, we conducted sensitivity analyses to evaluate the impact of these imputed values on our results. These measures were implemented to minimize uncertainty associated with the missing data and bolster the reliability of our conclusions.

Furthermore, a comprehensive analysis of FFT in comparison to other evidence-based intervention programs targeting youth delinquency, both within the specific context of Singapore and across diverse international settings, could provide valuable insights. Such an approach would yield a more holistic understanding of which interventions offer the most efficient utilization of resources while attaining desirable outcomes.

This study is among the first in Singapore to evaluate the cost-effectiveness of a social intervention. It advances research on family therapy for youth offenders by demonstrating FFT's cost-effectiveness in a non-Western context, strengthening the cross-cultural validity of family-based interventions. By utilizing objective

outcome measures (e.g., recidivism rates, probation completion rates) and economic indicators (e.g., direct implementation costs), it provides a comprehensive assessment of FFT's impact across different risk levels over an extended follow-up period.

Beyond research, these findings have practical significance for juvenile justice and social service systems. The cost-effectiveness analysis offers data-driven insights for resource allocation, which will help agencies balance financial responsibility with service needs. By differentiating cost-effectiveness for high- and moderate-risk youth, this study also supports practitioners in tailoring interventions for greater outcomes.

In conclusion, this study is one of the pioneering efforts to examine the cost-effectiveness of FFT in a non-Western context, and its findings will help policymakers tier and adequately resource services that target the problem behaviors of youth probationers. Overall, this study equips family therapists, juvenile justice professionals, and policymakers with evidence-based tools to make informed decisions about adopting and implementing family-centered approaches in youth rehabilitation programs.

Acknowledgments

Authors have read the manuscripts, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to this journal. All authors have approved the final article.

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APPENDIX A

Table A1

TABLE A1 | Average cost and effect and standard errors across two treatment groups.

	FFT (<i>n</i> = 63)	TAU (<i>n</i> = 57)
Average cost per offender in program and training	S\$1183	S\$1070
Standard error of Average cost	S\$67	S\$123
Non-recidivism rate	79%	65%
Standard error of non-recidivism	4%	5%