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Restorative Justice Diversion for Young Offenders: A Markov Cohort Model of Recidivism and Justice-System Costs

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ABSTRACT

International standards urge states to deal with children in conflict with the law without resorting to formal judicial proceedings wherever appropriate. Yet decisions about restorative justice (RJ) diversion are seldom supported by explicit estimates of its long-term consequences for reoffending and public budgets. This study develops a Markov cohort model that follows 1,000 young people aged about 15, eligible for diversion after a minor or moderate offence, over ten annual cycles. It compares formal processing with RJ diversion. The effect of RJ on annual reoffending was expressed as an odds ratio (base case 0.80), informed by published meta-analyses of youth diversion and restorative conferencing. Costs are illustrative assumptions in US dollars. The study is a modelling exercise, and no individual data were analysed. Under formal processing, the model produced 1,816 proven reoffences and 148 custody-years per 1,000 young people over ten years; RJ diversion averted 182 reoffences (10.0 %) and 16 custody-years. Justice-system costs fell by $3,246 per young person, of which $1,300 came from cheaper initial processing. In a probabilistic sensitivity analysis with 5,000 draws, RJ diversion was cost-saving in 99.6 % and dominant (cheaper and more effective) in 97.1 % of simulations. Threshold analysis showed that RJ remained cost-saving unless it increased the odds of reoffending by more than 14 %, or cost more than $4,746 per case. The results support the presumption in favour of diversion in Article 40(3)(b) of the Convention on the Rights of the Child. They also suggest that the economic case does not depend on large recidivism effects, provided that procedural safeguards for children and victims are respected.

Introduction

How a society responds to the offences of children and adolescents has consequences that extend well beyond the individual case. Most young people who offend do so during a limited period of adolescence and desist without intensive intervention (Moffitt, 1993; Farrington, 1986). Contact with the formal justice system may itself, however, increase the likelihood of further offending, by attaching a criminal label, disrupting education and drawing young people into delinquent peer networks (Becker, 1963; McAra & McVie, 2007). These insights

underlie a long-standing principle of international law: wherever appropriate and desirable, children in conflict with the law should be dealt with without resorting to judicial proceedings, provided that human rights and legal safeguards are fully respected (Convention on the Rights of the Child [CRC], 1989, Art. 40(3)(b); United Nations General Assembly, 1985, rule 11).

Restorative justice (RJ) offers one of the most widely used forms of diversion. In a restorative conference, the young person, the victim, their supporters and a trained facilitator meet to discuss the harm caused and to agree on how it can be repaired (Zehr, 1990; Braithwaite, 1989). The United Nations Economic and Social Council has endorsed basic principles for the use of restorative programmes in criminal matters (Economic and Social Council [ECOSOC], 2002). The European Union has set safeguards for victims who participate in restorative services (Directive 2012/29/EU, Art. 12). In Kazakhstan, reconciliation of the parties is a ground for exemption from criminal liability for minor and medium-gravity offences (Criminal Code of the Republic of Kazakhstan, 2014), and mediation in criminal matters has been available since 2011 (Law of the Republic of Kazakhstan on Mediation, 2011).

Policy makers who consider expanding RJ diversion must weigh uncertain long-term benefits against immediate costs and risks. Meta-analyses suggest that diversion and restorative conferencing reduce reoffending modestly on average, but the estimates vary in size and precision (Petrosino et al., 2010; Wilson & Hoge, 2013; Strang et al., 2013; Wong et al., 2016). Few studies translate these effects into the outcomes that justice ministries budget for, namely future court cases, custodial sentences and their costs. Decision-analytic modelling, widely used in health economics to synthesise evidence and project long-term consequences under uncertainty (Briggs et al., 2006; Drummond et al., 2015), is rarely applied to juvenile justice.

This article develops a Markov cohort model comparing formal processing with RJ diversion for young people who have committed a minor or moderate offence. It addresses four questions. RQ1: How many proven reoffences, custodial sentences and custody-years does RJ diversion avert over five and ten years? RQ2: What are the consequences for justice-system and societal costs? RQ3: How robust are these results to uncertainty in effectiveness, costs and behavioural parameters? RQ4: How large must the effect of RJ be, and how much may it cost, for diversion to remain cost-saving? The contribution is to link international legal standards on diversion to a transparent quantitative framework that justice ministries can populate with local data.

2. Background

2.1 Diversion, labelling and the age–crime curve

Criminological research has established that offending peaks in adolescence and declines steeply in early adulthood (Farrington, 1986). Moffitt (1993) distinguished a large group of adolescence-limited offenders from a small group whose antisocial behaviour persists across the life course. For the former, the main policy objective is to avoid interventions that interrupt the natural process of desistance. Labelling theory holds that formal sanctioning may amplify deviance by reshaping identity and social opportunities (Becker, 1963). Longitudinal evidence from the Edinburgh Study of Youth Transitions and Crime found that repeated contact with the juvenile justice system was associated with reduced chances of desistance, holding other factors constant (McAra & McVie, 2007).

Systematic reviews broadly support diversion. Petrosino et al. (2010) synthesised randomised trials of formal system processing of juveniles and found no crime-control benefit; across outcome measures, processing appeared to increase delinquency relative to diversion or release, although the pooled prevalence effect was small and not statistically significant. Wilson and Hoge (2013) meta-analysed 45 evaluations reporting on 73 diversion programmes and concluded that diversion was more effective in reducing recidivism than conventional judicial processing. On simple averages, recidivism was 31.5 % among diverted youth and 41.3 % among those processed conventionally.

2.2 Restorative justice and reoffending

Restorative justice reframes crime as harm to people and relationships, and it gives victims, offenders and communities a direct role in deciding how that harm should be repaired (Zehr, 1990). Braithwaite's (1989) theory of reintegrative shaming predicts that disapproval of the act, expressed within a relationship of respect and followed by reintegration, is more likely to reduce reoffending than stigmatising punishment. Latimer et al. (2005) synthesised 22 studies and found that restorative programmes were associated with higher victim and offender satisfaction, greater compliance with restitution and lower recidivism. They cautioned that self-selection into voluntary programmes could inflate these effects. The Campbell review by Strang et al. (2013), restricted to randomised trials of face-to-face conferences, found a modest but significant reduction in the frequency of repeat convictions over two years. Victims assigned to conferences also reported higher satisfaction and fewer symptoms of post-traumatic stress. A journal version of the review estimated that, across seven experiments in the United Kingdom, the benefits in crime prevented were 3.7 to 8.1 times the cost of delivering conferences (Sherman et al., 2015). For youth specifically, Wong et al. (2016) meta-analysed restorative diversion programmes and found them effective overall, with an odds ratio of 1.28 in favour of the programmes. Bergseth and Bouffard (2007) reported longer-term reductions in reoffending among juveniles referred to a restorative programme.

2.3 International and national legal framework

Article 40(3)(b) of the CRC requires states to promote, wherever appropriate and desirable, measures for dealing with children in conflict with the law without resorting to judicial proceedings, provided that human rights and legal safeguards are fully respected. Rule 11 of the Beijing Rules calls for consideration of diversion without formal trial wherever appropriate, and for diversion involving referral to community services to require the consent of the juvenile or their parents (United Nations General Assembly, 1985). The Committee on the Rights of the Child (2019), in General Comment No. 24, urges states to make diversion the preferred manner of dealing with children in the majority of cases. It insists that diversion be voluntary, based on free consent and accompanied by access to legal advice, and that its completion lead to definite closure of the case. The ECOSOC (2002) Basic Principles require that restorative processes be used only with the free and voluntary consent of the parties, who may withdraw at any time, and that failure to reach an agreement not be used against the offender in subsequent proceedings. Directive 2012/29/EU adds safeguards for victims. Restorative services must serve the victim's interest, rest on informed and revocable consent, and require the offender to acknowledge the basic facts of the case.

In Kazakhstan, the 2014 Criminal Code allows exemption from criminal liability in connection with reconciliation of the parties for minor and medium-gravity offences where the

harm has been repaired, with extended availability for certain categories, including minors. The Law on Mediation (2011) applies to criminal disputes. Domestic commentators have noted that reconciliation is often treated as a procedural formality, and that repeated use by the same offenders raises concerns about its effect on reoffending. These concerns underline the importance of distinguishing structured restorative processes, with preparation, victim participation and follow-up, from simple settlement.

2.4 Economic evaluation of justice interventions

Economic evaluation compares alternative courses of action in terms of both costs and consequences (Drummond et al., 2015). In crime prevention, cost–benefit analyses have monetised the harms of crime to victims and the costs to the justice system (Welsh & Farrington, 2000; Cohen & Piquero, 2009). Markov cohort models represent a population moving between mutually exclusive states over discrete cycles. They suit outcomes that recur and evolve over time, such as reoffending (Sonnenberg & Beck, 1993; Briggs et al., 2006). Probabilistic sensitivity analysis and acceptability curves allow the uncertainty in all parameters to be propagated to the decision (Fenwick et al., 2001). These methods remain rare in juvenile justice, where evaluation has focused on single trials or meta-analyses of recidivism rather than on long-term system consequences.

2.5 Research gap

Three gaps motivate the present study. First, the meta-analytic literature reports effects on recidivism over short follow-up periods, usually one to two years, whereas the costs that matter to justice ministries, especially custody, accumulate over many years. Second, existing cost–benefit estimates for restorative conferencing come largely from trials with adult and mixed-age offenders in a few common-law jurisdictions, and they do not distinguish savings at the point of diversion from savings due to reduced reoffending. Third, the decision problem has rarely been analysed under explicit uncertainty, so it is unclear how robust the economic case is and which parameters drive it. A transparent decision model addresses all three gaps. It extrapolates published effects over a longer horizon, decomposes costs and savings, and quantifies the probability that diversion is the better choice. It does so in a form that can be adapted to jurisdictions, such as Kazakhstan, where restorative practice is developing but evaluation data are scarce.

3. Methods

3.1 Design and reporting

The study is a model-based economic evaluation. It uses no individual-level data, and its results are projections conditional on the stated assumptions. The structure and reporting follow established guidance for decision-analytic modelling and the CHEERS 2022 statement where applicable (Briggs et al., 2006; Husereau et al., 2022). The hypothetical cohort comprises 1,000 young people aged about 15 who have committed a first or second minor or moderate offence and are legally eligible for diversion. Two strategies are compared. In formal processing (FP), the case is prosecuted and dealt with by a youth court, typically with a supervision order. In RJ diversion, the case is referred to a facilitated restorative conference; if the conference does not take place or the agreement is not completed, the case returns to formal processing. The time horizon is ten years in the base case and five years in a scenario, with annual cycles. Two perspectives are used: the justice system (police, prosecution, courts,

supervision and custody), and a societal perspective that adds a monetised cost of harm to victims.

3.2 Model structure

Figure 1 shows the model. After the index decision, all members of the cohort enter state N (no reoffence since the index offence). In each cycle, people in N may commit a proven reoffence, moving to state R (has reoffended), or may desist, moving to state D. People in R face a higher annual probability of reoffending and a lower probability of desistance. People in D may relapse to R. All live states are exposed to a small annual mortality risk (state X). Each reoffence generates processing costs and, with a probability that is higher for repeat reoffences, a custodial sentence of mean duration d, whose cost is d times the annual custody cost. Reoffending probabilities decline exponentially with time since the index offence, reflecting the age–crime curve (Farrington, 1986). Costs and outcomes are discounted at 3 % per year with a half-cycle correction.

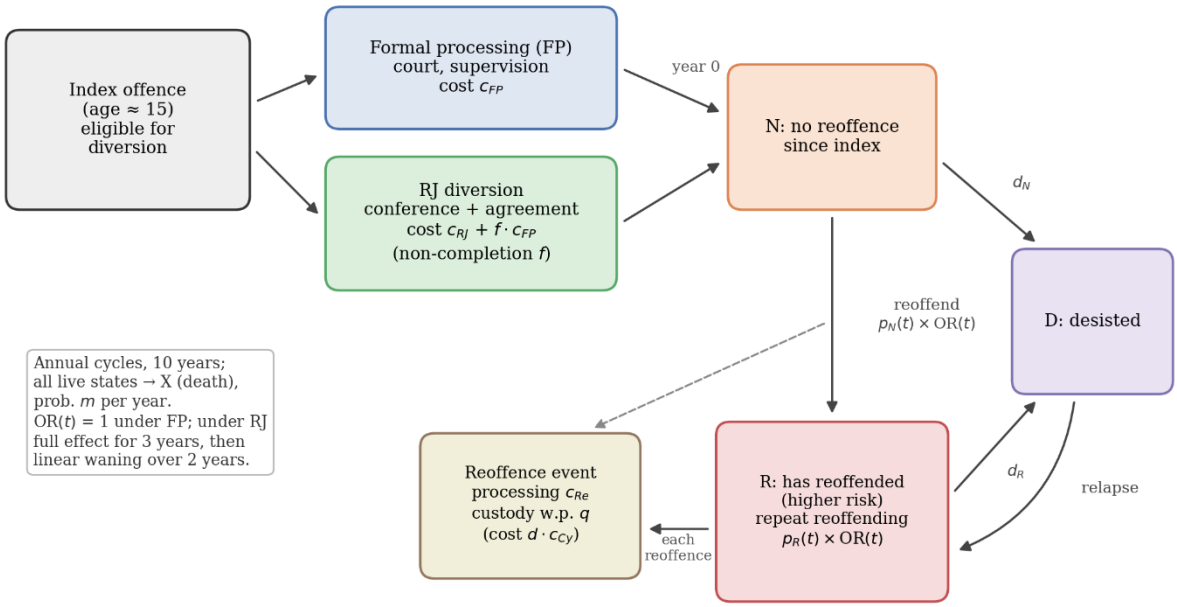


Figure 1. Structure of the Markov cohort model. N = no reoffence since the index offence; R = has reoffended; D = desisted; X = death (not shown). Each reoffence incurs processing costs and, with probability q, a custodial sentence.

3.3 Effect of restorative justice diversion

The effect of RJ diversion is represented as an odds ratio (OR) applied to the annual probability of reoffending in all states. Table 1 summarises the evidence. Standardised mean differences were converted to log odds ratios by multiplying by $\pi/\sqrt{3}$ (Chinn, 2000). The Petrosino et al. (2010) estimate for formal processing (d = −0.109) corresponds to an OR of 0.82 for diversion; the Wong et al. (2016) estimate corresponds to 0.78; and the simple averages reported by Wilson and Hoge (2013), which are unadjusted and probably optimistic, correspond to 0.65. The base case uses an OR of 0.80, close to the two more conservative estimates. In the probabilistic analysis, the log OR follows a normal distribution with standard error 0.12, giving a 95 % interval of 0.63 to 1.01, and 2.8 % of draws imply that RJ increases reoffending. The effect is applied on an intention-to-treat basis to the whole referred cohort,

consistent with the trials that inform it. It operates in full for three years and then wanes linearly to zero over two further years. Durations from one year to permanent are explored in sensitivity analysis.

Formally, if p is the annual reoffending probability under formal processing in a given state and year, the corresponding probability under RJ diversion is obtained on the odds scale, as shown in Equation 1, where w(t) = 1 for t ≤ 3, w(t) = 1 − (t − 3)/2 for 3 < t ≤ 5, and w(t) = 0 thereafter. Applying the effect on the odds scale keeps probabilities within the unit interval and allows the same OR to be used in states with different baseline risks.

$$p_RJ(t) = p(t)\cdot OR^{w(t)} / [1 - p(t) + p(t)\cdot OR^{w(t)}] \quad (1)$$

Table 1. Evidence on the effect of diversion and restorative justice on reoffending and its translation into the model

Source	Comparison	Reported result	Model OR	Use
Petrosino et al. (2010)	Formal processing vs diversion/release, juveniles	d = −0.109 (not statistically significant)	0.82	Converted with ln OR = d·π/√3 (Chinn, 2000)
Wong et al. (2016)	Restorative diversion, youth	OR = 1.28 in favour of RJ	0.78	Inverted to odds of reoffending
Wilson & Hoge (2013)	Youth diversion vs conventional processing	Average recidivism 31.5 % vs 41.3 % (simple averages)	0.65	Unadjusted; optimistic bound
Strang et al. (2013); Sherman et al. (2015)	RJ conferences, 10 RCTs, mixed ages	Modest reduction in frequency of reconvictions over 2 years	–	Qualitative support; benefit–cost 3.7–8.1 in UK trials
Latimer et al. (2005)	RJ programmes, 22 studies	Lower recidivism; self-selection bias noted	–	Qualitative support
Model base case	Synthesis	–	0.80	PSA 95 % interval 0.63–1.01

Note. OR = odds ratio of reoffending for RJ diversion relative to formal processing (values below 1 favour RJ); d = standardised mean difference; RCT = randomised controlled trial; PSA = probabilistic sensitivity analysis.

3.4 Transition probabilities and costs

Table 2 lists all inputs. The year-1 reoffending probability for people in N (0.25) was chosen so that the cumulative proportion reoffending within two years under formal processing is about 40 %. The model value (40.2 %) is close to the average recidivism of conventionally processed youth reported by Wilson and Hoge (2013). Follow-up periods varied across their studies, however, so this is a plausibility check rather than a formal calibration. Other transition probabilities are illustrative assumptions consistent with the age–crime curve. Costs are illustrative values in US dollars, chosen to reflect plausible relative magnitudes rather than prices in a particular jurisdiction: an RJ conference is cheaper than

prosecution and court processing, and custody is the most expensive component. The cost of an RJ referral includes the conference and, for the 20 % of referrals that do not complete, the full cost of formal processing. Victim costs are included only in the societal perspective, because their monetary valuation is contested (Cohen & Piquero, 2009).

Table 2. Model inputs, distributions for probabilistic sensitivity analysis and sources

Parameter	Base case	PSA distribution	Source / basis
Annual reoffending, no prior reoffence (year 1)	0.25	Beta(25, 75)	Calibrated: 2-year reoffending ≈ 40 %
Annual reoffending after a reoffence (year 1)	0.40	Beta(40, 60)	Assumption
Annual decline in reoffending (age–crime curve)	0.10	Uniform(0.05, 0.15)	Farrington (1986); Moffitt (1993)
Custody risk per reoffence: first / repeat	0.10 / 0.20	Beta(10, 90) / Beta(20, 80)	Assumption
Annual desistance from N / R	0.10 / 0.05	Beta(10, 90) / Beta(5, 95)	Assumption
Annual relapse from D	0.03	Beta(3, 97)	Assumption
Annual mortality	0.0015	Fixed	Assumption
OR of annual reoffending, RJ vs FP	0.80	log-normal, SE 0.12 (95 % 0.63–1.01)	Table 1
Effect duration	3 years full, 2 years waning	Full years uniform 1–5	Assumption
RJ non-completion (returned to FP)	0.20	Beta(20, 80)	Assumption
Cost of formal processing (c_FP)	3,500	Gamma, CV 0.20	Illustrative
Cost of RJ conference (c_RJ)	1,500	Gamma, CV 0.25	Illustrative
Cost per reoffence processed (c_Re)	5,000	Gamma, CV 0.25	Illustrative
Annual custody cost / mean duration	75,000 / 0.5 years	Gamma CV 0.20 / Uniform(0.3, 0.7)	Illustrative
Victim cost per reoffence (societal)	7,000	Gamma, CV 0.50	Illustrative; Cohen & Piquero (2009)
Discount rate	3 %	0–5 % (one-way)	Drummond et al. (2015)

Note. Costs in US dollars, illustrative. FP = formal processing; RJ = restorative justice; CV = coefficient of variation; SE = standard error of the log odds ratio.

3.5 Analyses

The base-case analysis reports, for each strategy, proven reoffences, custodial sentences, custody-years, the proportion ever reoffending, and discounted costs by component. Incremental results are expressed as reoffences averted per 1,000 young people and incremental cost per young person. Where RJ is both cheaper and more effective, it is described as dominant, and no cost-effectiveness ratio is calculated. Deterministic sensitivity analysis varied fourteen parameters one at a time across plausible ranges and is summarised in tornado diagrams. Scenario analyses substituted the alternative effect estimates in Table 2, a null and an adverse effect, alternative effect durations, a five-year horizon, discount rates of 0 % and 5 %, higher non-completion and higher RJ costs. Probabilistic sensitivity analysis drew all parameters simultaneously from the distributions in Table 2 in 5,000 Monte Carlo iterations. Results are shown on the cost-effectiveness plane and as cost-effectiveness acceptability curves for a willingness to pay of $0 to $30,000 per reoffence averted (Fenwick et al., 2001). Threshold analyses identified the OR and the RJ cost per case at which RJ diversion would become cost-neutral, and a two-way analysis mapped incremental cost jointly over both. To identify the parameters that drive decision uncertainty, Spearman rank correlations between each sampled input and the incremental outcomes were computed across the probabilistic draws. The expected value of perfect information (EVPI) was estimated as the difference between the expected net monetary benefit with perfect information and that of the decision based on current information, at several values of willingness to pay (Briggs et al., 2006). The model was implemented in Python with vectorised calculations. It was verified by checking that the cohort summed to one in every cycle and that identical inputs produced identical outcomes in both arms.

4. Results

4.1 Base case

Table 3 and Figure 2 present the base-case results. Under formal processing, 40.2 % of the cohort had reoffended within two years, 60.1 % within five years and 67.7 % within ten years. The cohort accumulated 1,816 proven reoffences, 295 custodial sentences and 147.7 custody-years per 1,000 young people. Under RJ diversion, the corresponding figures were 34.4 %, 54.6 % and 63.6 % ever reoffending, and 1,634 reoffences, 263 custodial sentences and 131.6 custody-years. RJ diversion therefore averted 182 proven reoffences per 1,000 young people over ten years, a reduction of 10.0 %, and 16.1 custody-years. Put differently, about 5.5 young people had to be diverted to avert one proven reoffence. The share of the cohort in the desisted state at year ten was 38.4 % under RJ and 36.7 % under formal processing.

Because the effect of RJ is assumed to wane after three years, the gap in cumulative reoffences widened mainly during the first five years and grew slowly thereafter (Figure 2b). Over a five-year horizon, RJ averted 159 reoffences per 1,000. That is 87 % of the ten-year total.

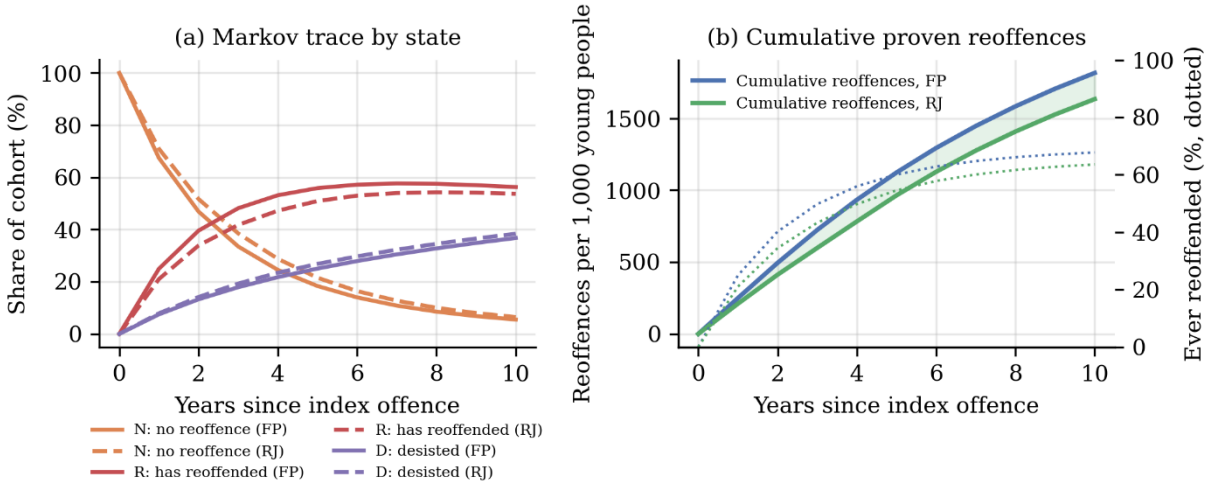


Figure 2. Base-case Markov traces. (a) Share of the cohort in each state under formal processing (FP, solid) and RJ diversion (dashed). (b) Cumulative proven reoffences per 1,000 young people (left axis) and proportion ever reoffending (dotted, right axis).

Discounted justice-system costs were $21,211 per young person under formal processing and $17,965 under RJ diversion, a saving of $3,246 (Table 3). This corresponds to $3.25 million per 1,000 young people diverted. The saving had three sources: cheaper initial processing ($1,300), fewer reoffences to process ($844) and fewer custodial sentences ($1,103). Thus 40 % of the saving arose at the point of diversion, and 60 % from reduced reoffending, more than half of it from custody. From the societal perspective, which also counts harm to victims, the saving rose to $4,427 per young person. RJ diversion was dominant in the base case: it was both less costly and more effective.

Table 3. Base-case results over ten years (per 1,000 young people for outcomes; per young person for discounted costs)

Outcome	Formal processing	RJ diversion	Difference
Proven reoffences per 1,000 (undiscounted)	1,816	1,634	−182
Custodial sentences per 1,000	295	263	−32
Custody-years per 1,000	147.7	131.6	−16.1
Ever reoffended by year 2 (%)	40.2	34.4	−5.7
Ever reoffended by year 5 (%)	60.1	54.6	−5.5
Ever reoffended by year 10 (%)	67.7	63.6	−4.2
Desisted at year 10 (%)	36.7	38.4	1.6
Initial processing cost ($ per youth)	3,500	2,200	−1,300
Reoffence processing cost ($)	8,037	7,194	−844
Custody cost ($)	9,674	8,571	−1,103
Total justice-system cost ($)	21,211	17,965	−3,246
Victim costs ($)	11,252	10,071	−1,181
Total societal cost ($)	32,463	28,036	−4,427

Note. Costs in US dollars (illustrative), discounted at 3 % per year; reoffences and custody are undiscounted counts. Initial processing cost under RJ includes formal processing for the 20 % of referrals that do not complete.

4.2 Deterministic sensitivity and scenario analyses

Figure 3 shows the one-way sensitivity analysis. Incremental justice-system cost was most sensitive to the effect size. It ranged from $-5,052 at an OR of 0.63 to $-1,207 at an OR of 1.01. It was also sensitive to the costs of formal processing and of the RJ conference, and to the duration of the effect. Across all fourteen one-way variations, RJ diversion remained cost-saving. The number of reoffences averted depended almost entirely on the effect size and its duration. It ranged from -9 (that is, slightly more reoffences) at an OR of 1.01 to 353 per 1,000 at an OR of 0.63. With a single year of full effect and then waning, it fell to 92 per 1,000.

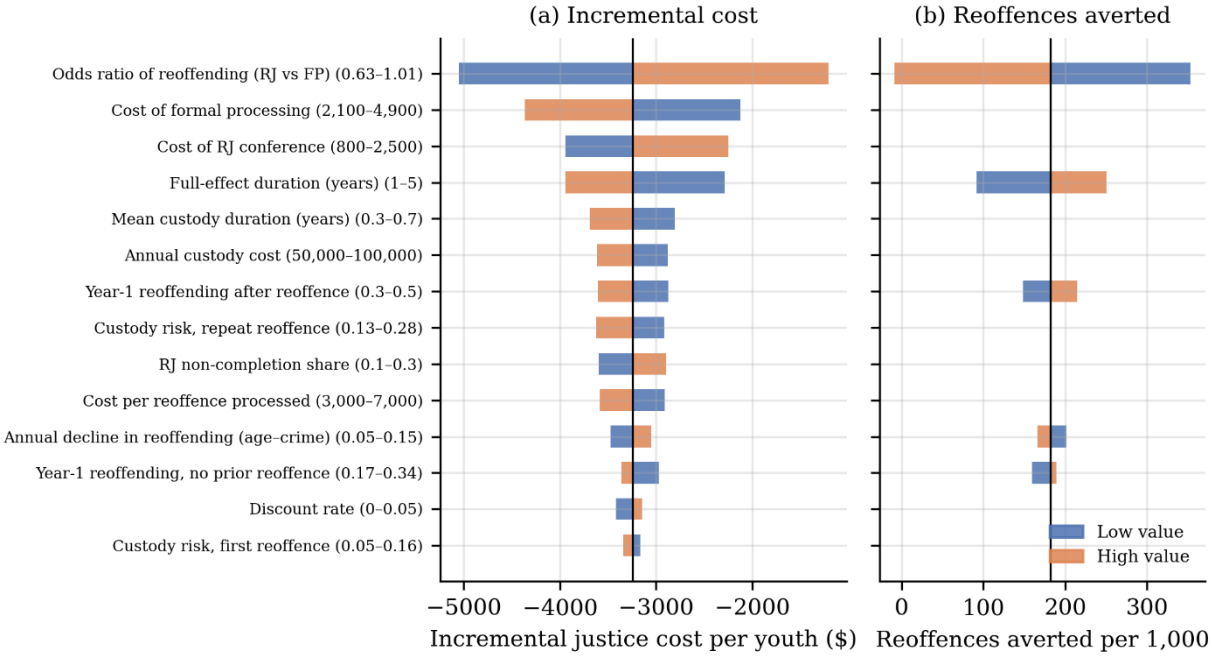


Figure 3. One-way sensitivity analysis (tornado diagrams) for (a) incremental justice-system cost per young person and (b) reoffences averted per 1,000 young people over ten years. Ranges in parentheses; vertical lines mark the base case.

Table 4 reports the scenario analyses. Using the alternative effect estimates in Table 1, reoffences averted ranged from 162 per 1,000 (Petrosino et al., 2010) to 328 (Wilson & Hoge, 2013 averages), and justice-system savings from $3,037 to $4,793 per young person. If RJ had no effect on reoffending, it still saved $1,300 per young person, the difference in initial processing costs. If RJ increased the odds of reoffending by 10 %, it remained marginally cheaper from the justice-system perspective ($393 saving). From the societal perspective it became more costly, however (+$154), and it generated 84 additional reoffences per 1,000. A permanent effect raised reoffences averted to 353 per 1,000 and savings to $4,939. Doubling the RJ cost to $3,000 per case reduced the saving to $1,746, and a non-completion rate of 40 % reduced it to $2,546.

Table 4. Scenario analyses (ten-year horizon unless stated)

Scenario	Reoffences	Custody-years	Δ justice cost ($/youth)	Δ societal	Result

	averted /1,000	averted /1,000		cost ($/youth)	
Base case (OR 0.80)	182	16.1	−3,246	−4,427	Dominant
Wilson & Hoge (2013) averages, OR 0.65	328	28.9	−4,793	−6,918	Dominant
Wong et al. (2016), OR 0.78	200	17.7	−3,438	−4,736	Dominant
Petrosino et al. (2010), OR 0.82	162	14.4	−3,037	−4,091	Dominant
No effect (OR 1.00)	0	0.0	−1,300	−1,300	Cost-saving, equal effect
Adverse effect (OR 1.10)	−84	−7.5	−393	154	Cost-saving, less effective
Permanent effect	353	32.1	−4,939	−7,108	Dominant
Effect 1 year, no waning	64	5.6	−1,995	−2,423	Dominant
Horizon 5 years	159	13.2	−2,972	−4,022	Dominant
Discount rate 0 %	182	16.1	−3,420	−4,695	Dominant
Discount rate 5 %	182	16.1	−3,145	−4,271	Dominant
Non-completion 40 %	182	16.1	−2,546	−3,727	Dominant
RJ cost 3,000 per case	182	16.1	−1,746	−2,927	Dominant
Formal processing cost 2,000	182	16.1	−2,046	−3,227	Dominant

Note. Δ = RJ minus formal processing; negative cost values indicate savings. OR = odds ratio of reoffending. Dominant = lower cost and fewer reoffences.

4.3 Probabilistic sensitivity analysis

Figure 4 and Table 5 summarise the probabilistic analysis. Across 5,000 draws, RJ diversion averted a mean of 170 reoffences per 1,000 (95 % interval -3 to 422) and 14.9 custody-years (95 % interval -0.3 to 41.0). The mean incremental justice-system cost was −$3,098 per young person (95 % interval −$6,351 to −$721). RJ was cost-saving from the justice-system perspective in 99.6 % of draws and from the societal perspective in 99.3 %. It reduced reoffending in 97.2 % and was dominant in 97.1 %. Only 0.1 % of draws fell in the north-east quadrant (more costly and more effective) and 0.3 % in the north-west quadrant (more costly and less effective). Most of the remaining draws, 2.5 %, lay in the south-west quadrant, where RJ was cheaper but slightly less effective. The acceptability curves (Figure 4b) start at 99.6 % at zero willingness to pay. They decline slightly as willingness to pay rises, because a higher value placed on reoffences averted penalises the small share of draws in which RJ increased reoffending.

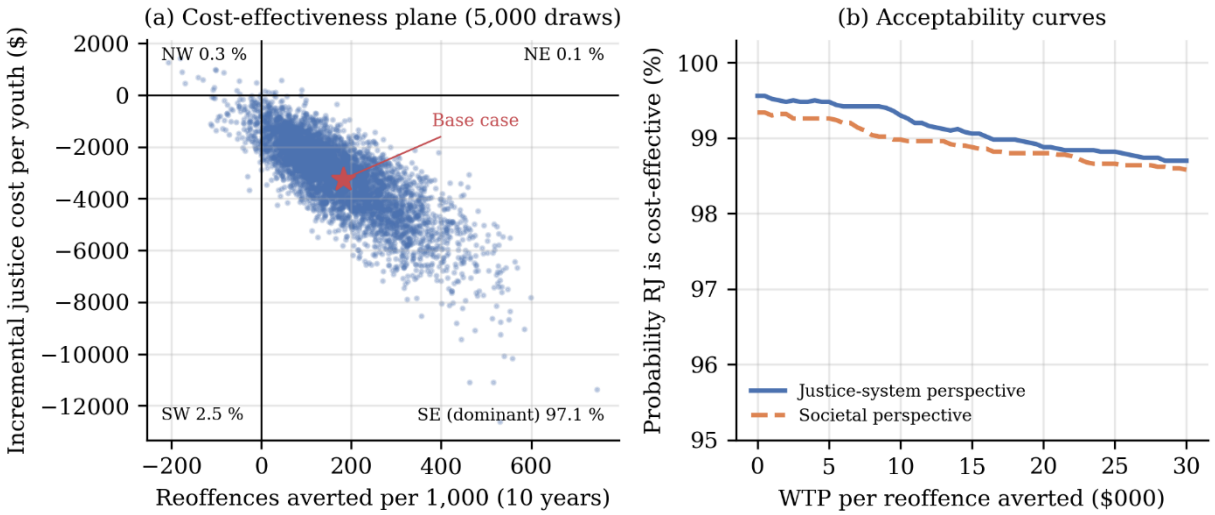


Figure 4. Probabilistic sensitivity analysis (5,000 draws). (a) Cost-effectiveness plane: reoffences averted per 1,000 young people against incremental justice-system cost per young person; percentages show the share of draws in each quadrant. (b) Cost-effectiveness acceptability curves.

4.4 Threshold analysis

Figure 5 presents the threshold analyses. Holding other inputs at base-case values, RJ diversion remained cost-saving from the justice-system perspective for any OR below 1.145, and from the societal perspective for any OR below 1.089. In other words, it would have to increase the odds of reoffending by about 14 % or 9 %, respectively, before it cost more than formal processing. At the base-case effect, the RJ conference could cost up to $4,746 per case (3.2 times the base-case value) before diversion ceased to save justice-system resources, and up to $5,927 from the societal perspective. With no effect on reoffending, the cost-neutral RJ cost was $2,800. The two-way analysis (Figure 5b) shows that the base case lies well inside the cost-saving region, and that along the cost-neutral frontier each 0.1 reduction in the OR allows about $973 of additional RJ cost per case.

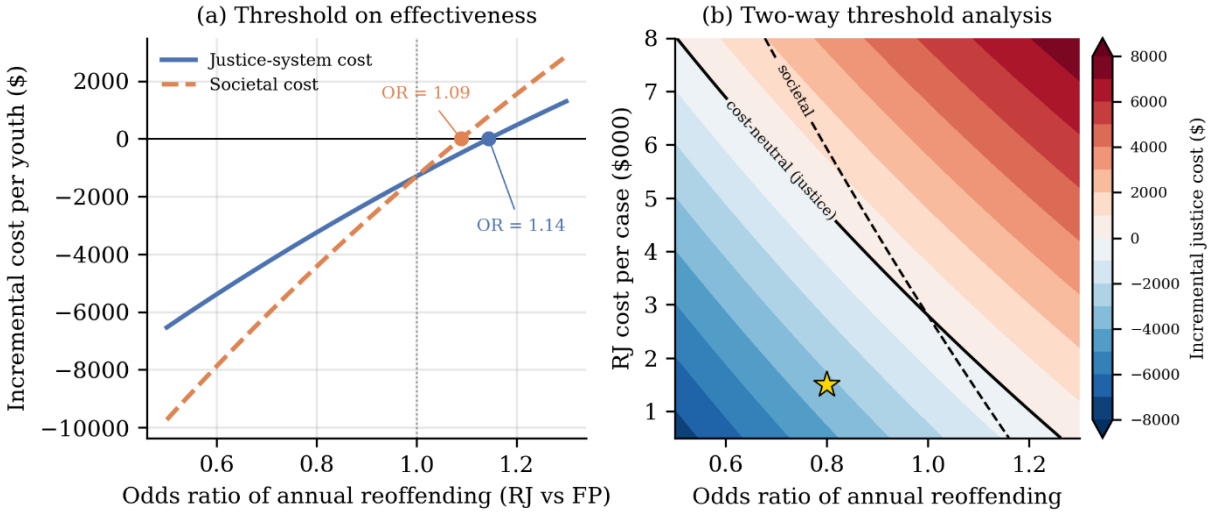


Figure 5. Threshold analyses. (a) Incremental cost per young person as a function of the odds ratio of reoffending, with cost-neutral thresholds. (b) Two-way analysis of the odds

ratio and the RJ cost per case; solid line = justice-system cost-neutral frontier, dashed = societal; star = base case.

Table 5. Probabilistic sensitivity and threshold analyses

Measure	Deterministic	PSA mean (95 % interval)
Reoffences averted per 1,000	182	170 (−3 to 422)
Custody-years averted per 1,000	16.1	14.9 (−0.3 to 41.0)
Incremental justice cost per youth ($)	−3,246	−3,098 (−6,351 to −721)
Incremental societal cost per youth ($)	−4,427	−4,182 (−9,089 to −800)
P(cost-saving, justice) / P(cost-saving, societal)	–	99.6 % / 99.3 %
P(fewer reoffences) / P(dominant)	–	97.2 % / 97.1 %
Threshold OR for cost neutrality: justice / societal	1.145 / 1.089	–
Threshold RJ cost per case: justice / societal ($)	4,746 / 5,927	–
Threshold RJ cost per case if OR = 1 ($)	2,800	–

Note. PSA = probabilistic sensitivity analysis with 5,000 draws; P = probability; OR = odds ratio of reoffending (RJ vs formal processing). Thresholds hold other inputs at base-case values.

4.5 Drivers of uncertainty and value of further research

Across the probabilistic draws, the odds ratio was the input most strongly correlated with both incremental justice-system cost (Spearman $\rho = 0.62$) and reoffences averted ($\rho = -0.80$). It was followed, for costs, by the cost of formal processing ($\rho = -0.40$), the duration of the full effect ($\rho = -0.39$) and the cost of the RJ conference ($\rho = 0.28$). Effect duration was the second most important driver of reoffences averted ($\rho = 0.48$). The baseline reoffending, custody and desistance parameters had only weak correlations with the incremental results ($|\rho| \leq 0.10$ for costs), because they affect both arms similarly. The EVPI was $2.24 per young person at zero willingness to pay, $6.08 at $10,000 and $12.73 at $20,000 per reoffence averted. That is, it was $2,244 to $12,732 per 1,000 young people. These small values indicate that further research is unlikely to change the decision to prefer diversion. Better evidence on the size and persistence of the effect would, however, improve estimates of the budgetary consequences, which matter for planning.

5. Discussion

5.1 Principal findings

The model suggests that diverting young people from formal processing to restorative conferencing is likely to reduce both reoffending and justice-system costs. In the base case, RJ diversion averted 182 reoffences and 16 custody-years per 1,000 young people over ten years and saved $3,246 per young person. It was cost-saving in 99.6 % of probabilistic simulations. Two features of the result deserve emphasis. First, a substantial part of the saving (40 %) arises at the point of diversion, because a conference is assumed to be cheaper than prosecution and trial. The economic case therefore does not depend on large recidivism effects. RJ remained cost-saving even if it slightly increased reoffending, up to an OR of 1.14. Second, the reoffending benefit is concentrated in the early years and is sensitive to how long the effect

lasts. This is consistent with the observation in the trials that effects are measured over relatively short follow-up periods (Strang et al., 2013).

5.2 Interpretation and comparison with previous evidence

The magnitude of the modelled reduction, about one-tenth of proven reoffences over ten years, is modest. It is consistent with the description of RJ effects as modest but cost-effective (Sherman et al., 2015). The finding that diversion is cost-saving is consistent with the benefit–cost ratios reported for the UK conference trials and with economic analyses of crime prevention more broadly (Welsh & Farrington, 2000). The model adds two elements to this evidence. It projects consequences over a longer horizon with explicit treatment of custody, the most expensive component of the system. It also identifies the conditions under which the conclusion would fail. These are an adverse effect larger than about 14 % on the odds of reoffending, RJ costs more than three times the base-case value, or very high rates of non-completion combined with small effects. Policy makers can check these conditions against local data.

The results should be read alongside the non-monetary outcomes that the model does not value. Victims who take part in conferences report higher satisfaction and fewer symptoms of post-traumatic stress (Strang et al., 2013). Young people avoid the stigma and collateral consequences of a criminal record (McAra & McVie, 2007). If these benefits were included, the case for diversion would be stronger. Conversely, the model does not capture net-widening, in which young people who would otherwise have received an informal warning are drawn into a more intensive process. Net-widening would reduce both the cost savings and, if contact with the system is criminogenic, the reoffending benefit.

5.3 Implications for law and policy

The findings support the presumption in favour of diversion in Article 40(3)(b) of the CRC, Rule 11 of the Beijing Rules and General Comment No. 24 (Committee on the Rights of the Child, 2019). They show that the presumption is unlikely to conflict with public safety or fiscal responsibility under plausible assumptions. Three implications follow. First, eligibility for RJ diversion should be defined broadly for minor and moderate offences and should not be restricted to cases in which recidivism benefits can be demonstrated in advance, since the economic case holds even with small effects. Second, quality matters. The benefits depend on completion and on the duration of the effect, so programmes should invest in preparation, victim participation and follow-up of agreements, rather than reducing restorative justice to a formal settlement. This is consistent with the ECOSOC (2002) Basic Principles and with the safeguards of Directive 2012/29/EU, which require informed and revocable consent, acknowledgement of the basic facts and attention to the victim's interests.

Third, for Kazakhstan, the analysis suggests that reconciliation under the Criminal Code should be complemented by structured restorative programmes for minors. Such programmes should be delivered by trained facilitators, with data collected on participation, completion and subsequent offending. The concern of domestic commentators that repeated reconciliation may be associated with reoffending could then be assessed empirically. The model provides a template for evaluation: once local data on reoffending, custody and costs are available, the parameters can be replaced and the analysis repeated. Procedural safeguards remain essential whatever the economic result. Diversion must be voluntary, the child must have access to legal

advice, and failure to reach agreement must not be used against the child in subsequent proceedings (Committee on the Rights of the Child, 2019; ECOSOC, 2002).

5.4 Implementation and generalisability

The results depend on programmes being delivered as intended. Several implementation features deserve attention. The first is the proportion of eligible cases in which victims agree to participate. Where victims decline, surrogate victims or indirect forms of mediation may be used, but their effects may differ from those of face-to-face conferences. The second is timeliness. Long delays between the offence and the conference weaken the link between act and response and erode the cost advantage over formal processing. The third is the training and accreditation of facilitators. A conference that is poorly prepared may harm victims and fail to engage the young person. The fourth is monitoring of agreements, since non-completion both raises costs, through return to formal processing, and may weaken the effect on reoffending. In the model, a doubling of non-completion to 40 % reduced the saving by about one-fifth, so completion rates are a natural performance indicator.

The cost structure assumed here, in which a conference is cheaper than prosecution and court processing and custody is the most expensive response, is common to many justice systems, but relative prices differ. In systems where formal processing of minor youth cases is already very cheap, for example because most cases end with a quick administrative warning, the saving at the point of diversion would be smaller. The case for RJ would then rest more heavily on the recidivism effect. Conversely, where pre-trial detention and custodial sentences are used frequently for young people, the savings from averted custody would be larger than estimated here. Users of the model should therefore replace the cost inputs with local values before drawing budgetary conclusions. The threshold results in Section 4.4 indicate how far local values may deviate before the conclusion changes.

5.5 Limitations

The study has several limitations. First, it is a modelling exercise. Transition probabilities and costs are illustrative assumptions, not estimates for a specific jurisdiction, and the absolute values of costs and savings should not be interpreted as predictions. Second, the effect estimates come from heterogeneous meta-analyses. They differ in comparison groups, outcome measures, age ranges and follow-up periods, and some are unadjusted or not statistically significant. The base-case OR is a judgement-based synthesis, not a formal pooled estimate. Third, the model assumes that the effect applies to the whole referred cohort, as in intention-to-treat analyses, and does not model selection into RJ, which may bias observational estimates (Latimer et al., 2005). Fourth, as a cohort model, it ignores heterogeneity between young people and the dependence of risk on detailed offending history, beyond the distinction between states N and R. It also treats each proven reoffence as equivalent, regardless of seriousness. Fifth, it omits net-widening, victim and offender well-being, and wider social costs such as lost education and employment. Sixth, costs incurred outside the justice system, such as social and health services, are excluded. Future work should calibrate the model to administrative data, estimate effects separately for violent and property offences, and incorporate victim outcomes.

6. Conclusion

International law asks states to divert children from judicial proceedings wherever appropriate. This Markov cohort model suggests that restorative justice diversion for young

people who have committed minor or moderate offences is likely to reduce reoffending and custody and to save justice-system resources. Under base-case assumptions, it saved $3,246 per young person and averted 182 reoffences per 1,000 over ten years, and it was cost-saving in 99.6 % of probabilistic simulations. The economic case is robust because it rests partly on the lower cost of a conference relative to prosecution. It does not depend on large recidivism effects: RJ diversion would cease to be cost-saving only if it substantially increased reoffending or cost several times more than assumed. These findings are conditional on illustrative inputs and should be confirmed with local data. They nevertheless support expanding well-designed, voluntary restorative programmes with strong procedural safeguards, consistent with the CRC, the Beijing Rules and the ECOSOC Basic Principles.

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