DEPARTMENT OF CORRECTIONS
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Note - The following matters should be taken into account in reviewing this material:

- The analysis is restricted to the effect of Tai Aroha on recidivism only and is an input into the wider evaluation currently being undertaken by Dr Polaschek (2021).
- The review forms part of a regular process of statistical analyses of reoffending that Corrections undertakes on its programmes;
- The analysis reviews the incidents of reoffending of 129 men who had completed the Hamilton based Tai Aroha 16 week programme between 2011 and 2019. While larger programmes look at each year separately, this programme is evaluated over a longer time period to ensure sufficient people are included in the analysis;
- The analysis uses information available from the Corrections electronic database, and does not include additional information from interviews and in-programme management or clinical records;
- the analysis is limited by:
    - the modest sized participant group and the ability to find a commensurate baseline group. This is particularly problematic here where all the reviewed cases, including the treatment participants, have complex and longstanding social and personal issues that create multiple opportunities for lifestyle and behavioural disruption
    - the determining outcome (reoffending) is a single behaviour/event and the statistical analysis cannot discern desistence (in this case) away from that event, only the event itself
    - the treatment programme has been updated over the time period assessed.

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Tai Aroha evaluation: Measurement of recidivism outcomes

As part of evaluating the effect of Tai Aroha on recidivism, Corrections has put together a dataset consisting of a treatment and two control populations over the period 2011 to 2019 and determined a set of outcomes to be evaluated relating to reconviction and reimprisonment during five different follow-up periods after the programme. Corrections have also provided a list of matching variables deemed to affect the selection into the Tai Aroha programme, and the reconviction/reimprisonment outcomes.

Description of the Data

The supplied data consists of a pool of individuals that underwent the Tai Aroha programme (the "treated" population) and a counterfactual pool of individuals who qualify for the Tai Aroha programme based on their observable characteristics but who did not attend the programme (the "control" population). A few additional filters have been applied to ensure that the control group is comparable to the treated group in general.

Two sets of control have been supplied –

1. the first set comprises of both treated & control individuals picked from the Home Detention category (to be referred to as the Home Detention Control Group),
2. the second dataset comprises of treated population from Home Detention compared with a control population from Prison (to be referred to as the Prison Control Group).

A detailed set of attributes were supplied on these individuals. The supplied attributes were selected based on whether these may affect the selection of these individuals into the Tai Aroha programme and/or affect reconviction & reimprisonment outcomes. In addition to these attributes, a set of observed outcomes were also supplied as part of the data. In general, the outcomes included the following-

1. binary indicators for reconviction & reimprisonment for follow-up periods of 12, 24, 36, 48 and 60 months and for seriousness of reoffending -any offences, significant violent/sex offences & serious violent/sex offences.
2. counts of reconvictions & reimprisonments for follow-up periods of 12, 24, 36, 48 and 60 months and for seriousness of reoffending- any offences, significant violent/sex offences & serious violent/sex offences

Description of the Statistical Method

The following section describes the statistical method being used to evaluate the effect of Tai Aroha on the supplied outcomes.

1. **Propensity Score matching is used to match the treated & control populations to measure the Average Treatment Effect on the Treated Population**- From the supplied dataset, propensity score matching was used to create matched treated and control populations to compare the effect of treatment on the outcome variables. The intention of this analysis is to look at the Average Treatment Effect on the Treated Population (ATT). This estimator is measured by keeping the treated units intact and in no way manipulating the treated population – and this estimator gives us the effect of treatment on the treated population, by constructing a control population that match with those that are treated. We aim to

measure the marginal effect of treatment wherever possible (by comparing the expected potential outcome under treatment to the expected potential outcome under control). For reconviction/reimprisonment indicator outcomes, we used an Odds Ratio measure to estimate the effect of treatment, and for reconviction/reimprisonment counts we used a Risk Ratio measure.

A key assumption in this propensity analysis is that the matching attributes supplied in the data contains all the covariates that account for the selection bias in receiving the intervention, sufficient to minimise any differences that exist between those who receive Tai Aroha and those who do not.

2. **The propensity matching technique used is a mixture of exact matching with optimal matching without replacement, with a 1:1 ratio** - A set of techniques have been compared to evaluate the best strategy for matching the datasets. The criteria used to evaluate the techniques are post-match balance and simplicity of interpretation. A random follow-up period was selected to evaluate the methods on, and each of these techniques were evaluated for that dataset.

   The techniques that were evaluated include nearest neighbour matching, optimal matching (with various matching ratio values, with and without replacement while selecting a control observation) and full-matching (inverse-weighted propensity matching- IPW). It was deemed important to retain all observations in the treated population (since the treated population is small, and since the intent is to measure ATT), so this also played an important part in the selection of the matching method. At the end of evaluation of matching techniques, optimal matching without replacement and full matching were found to give good balance between treated and control populations, without loss of observations. Optimal matching was selected for its simplicity and excellent post-matching balance, and a matching ratio of one treated to one control record (1:1) has been used.

   In addition to optimal matching, the treated and control populations were matched exactly on ROC*ROI score ranges for all outcome scenarios. Three tiers of ROC*ROI ranges were created such that there were an equal number of observations in each tier- these intervals were [0.249,0.658), [0.658,0.728), [0.728,0.951] (note that these intervals vary slightly for different follow-up period cohorts). Treated and control records were matched with each other within these strata. To control for changes in prosecution policy through time, the treated and control populations were also matched exactly on “time-window” variables. The time window variables used differ for different outcomes –

   a. serious offending outcomes were evaluated by exact matching on follow-up time periods before 2018 and after.
   b. significant offending outcomes do not use any exact matching on time periods,
   c. ‘any-offending’ outcomes use exact matching by grouping together observations in 2011 & 2012, 2013, 2014 & 2015, 2016 & 2017, 2018 & 2019.

   These year groupings were created based on subject matter expert advice. In the case of matching with the treated population with the Prison Control Group, exact matching is used on offence type as well. This matching was done as it was deemed important to account for the differences in types of offences committed within the treated population (comprising of

individuals from the home detention population) and the prison control group which on average may have committed more serious offences.

3. **Post-match balance is evaluated through Standardised Mean Differences & Variance ratios-** After matching, the balance between matching covariates were evaluated. The goodness of match was evaluated using Standardised Mean Differences for overall match, and by manually by looking at the absolute values of covariate means before and after matching. The importance of certain covariates was also considered while looking at the goodness of match. Lastly, variance ratios were also inspected to rule out any anomalous behaviour in the matching process.

   An example of the covariate balance (measured by Absolute Std. Mean Differences & Variance ratios) is provided in Figure 1. This is the covariate balance for 24-month follow-up periods for significant violent re-offending – this uses an exact matching on ROC*ROI score ranges. The unadjusted values (in blue) are the differences between treated and control populations before propensity matching, and the adjusted values (in red) are the differences after matching. The dotted line represents an absolute standardised mean difference of 0.1, which we take as the cut-off for a good covariate balance after matching.

   An excellent match between treated and control populations would be one in which all covariates have a standardised mean difference that is less than 0.1 – but this may not always be realistic to achieve. Whenever a covariate was found to have a value > 0.1 (absolute value) in the Std. Mean Differences between treated and control populations, this is treated as an unbalanced variable, and added as a covariate in a subsequent outcome regression to estimate the effect of treatment. Note that these unbalanced covariates will be different in each propensity match, and the selection of these covariates is a dynamic process. The outcome regression will provide an estimate of the effect of treatment on a particular outcome variable after controlling for the differences caused by the unbalanced variable. From this model, we apply a g-computation method to estimate a marginal effect of treatment (described in more detail below).

   The full post-matching covariate balance statistics has been supplied alongside the results (one file per outcome variable being evaluated).

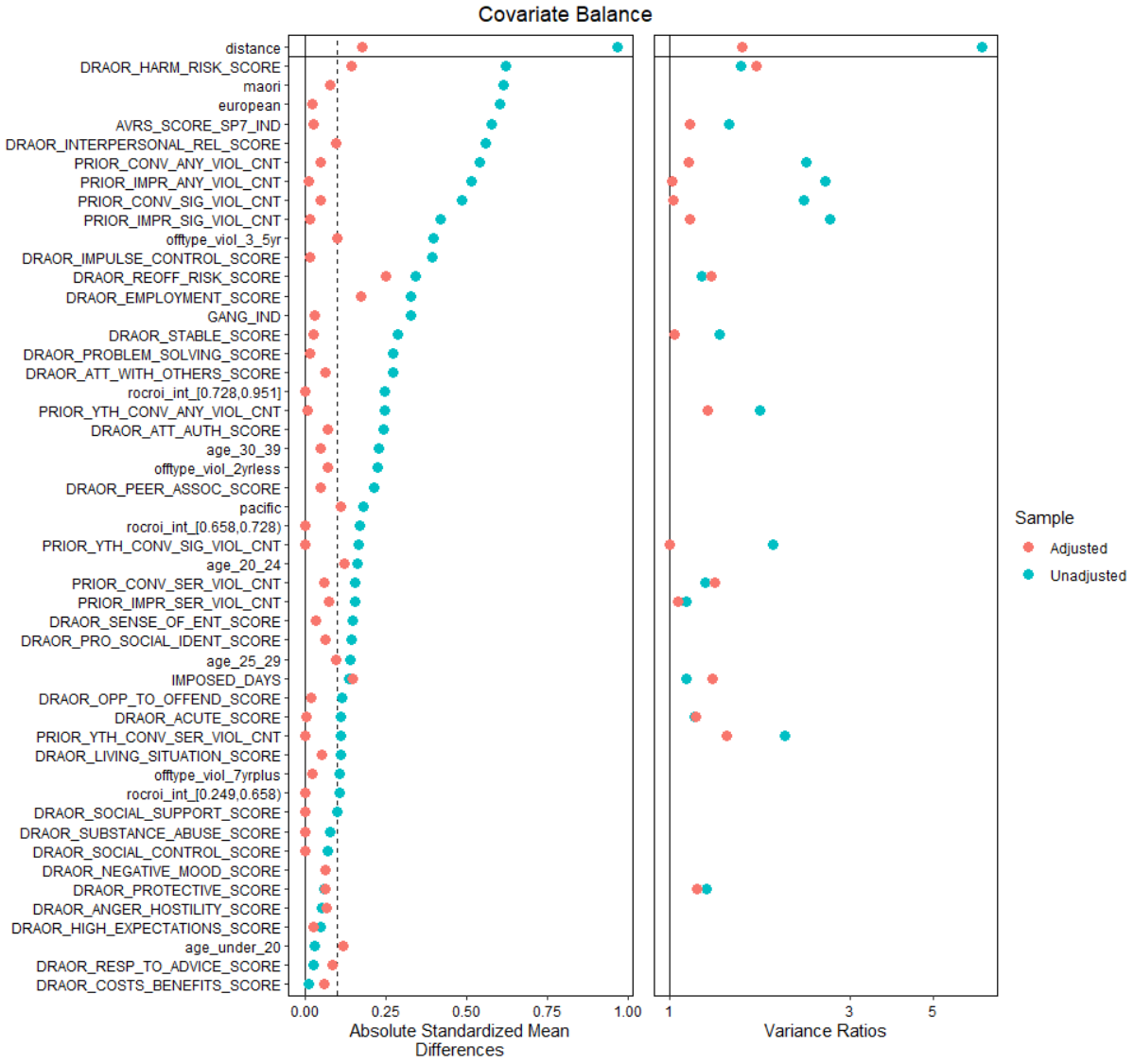

Figure 1 Covariate Balance pre- and post-matching for home detention 24-month Significant Violent Re-offending sample.

4. **Marginal Effect of treatment is measured through bootstrap methods-** We evaluate the effect of treatment on the outcome using a regression with a block bootstrap method. Ideally, the bootstrap method should perform matching and estimation in each bootstrap sample - but these tend to produce conservative estimates of the effect. We used a bootstrap method that uses samples from the matched population to perform analyses, and do not explicitly recompute matching logic- this may provide smaller confidence intervals and are less computationally intensive. We used "covariate adjustment" while looking at the effect of treatment on the outcome variable – this means that the unbalanced variables from the matching process are added as covariates in the regression to estimate the conditional effect of treatment on the outcome. This is done to control for the effect of this unbalanced variable in measuring the outcome.

   This covariate adjustment will give us the effect of treatment on the outcome controlling for the unbalanced variables, and we used the “G-computation” method to estimate a marginal

effect of treatment. This is done by using predictions from the outcome model in the presence and absence of treatment (i.e., we force the treatment to be true for everyone in the sample, and then force it to be false, and compute outcome predictions in each case) and then compute the contrast between these two outputs. The bootstrap method provides the confidence interval around the marginal effect.

The marginal effect of treatment on the reconviction/reimprisonment indicator outcomes is expressed in terms of Odds Ratio of treated to control. In the case of "Count" outcomes (i.e., outcomes that count the number of reconvictions or reimprisonments), we use a Poisson regression and use risk ratios to report the effect of treatment.

5. **Caution while interpreting average treatment effect on the treated-** As part of this analysis, several hypotheses are being tested with data that have significant overlap. For instance, the data being used to test 60-month outcomes will be a subset of the data being used for 12-month outcomes – this makes accounting for errors difficult. If any outcomes from this analysis are treated as statistically significant without the relevant corrections being applied, this would amount to cherry-picking results. One way to circumvent this would be to apply Bonferroni corrections (by dividing p-value for the bootstrap confidence intervals by the number of hypotheses being tested). Note that this might be a conservative estimate of the error.

   It is also worth noting that an a-priori power analysis was performed to determine the sensitivity of the statistical test assuming the following criteria –

   a) We plan to obtain 1:1 ratio between the treated and control populations to evaluate the effect on binary reconviction/reimprisonment outcomes,
   b) We have a sample size of 125 individuals each for treated & control, and a type-I error rate of 5%
   c) We assume 50% of those not treated to be reconvicted.
   d) We assume 95% power for the statistical test- this is the probability that the study can show an effect from Tai Aroha if an effect is present.

   Based on these assumptions, the statistical test would only be sensitive to an odds ratio (effect size) more than 2.6 (or less than 0.38) when comparing the treated & control populations. (*Note that this is an approximate analysis of power assuming testing inequality of proportions for 2 independent groups).* This does not account for multiple hypothesis being tested with the same data – which means that the sensitivity would be poorer. Hence, caution should be exercised when assuming that there is no effect from the Tai Aroha intervention – it cannot be distinguished if there is no effect, or if the effect is less than the size determined by the power analysis.

   Also note that the key assumptions of propensity matching technique apply to this study- the most important being the variables chosen in the propensity matching account for the selection bias for receiving treatment.

Outputs

1. **Interpreting the results –** Tables 1 & 2 below list the effect of Tai Aroha on the list of outcome variables while comparing the treated population with the Home Detention Control group. After accounting for testing multiple hypothesis, only 3 measures have been found to be statistically significant – these are REIMPR_12M_YN, REIMPR_24M_YN & REIMPR_12M_CNT outcomes. From these results, Tai Aroha completers have higher odds of being reimprisoned within 12 months and 24 months of follow-up and are likely to incur more instances of reimprisonment within 12 months as compared to a similar group who did not attend the programme. The "similar group" here is defined using the propensity matching technique.

   Tables 3 & 4 list the effect of Tai Aroha on the list of outcome variables while comparing the treated population with Prison Control group. No significant results have been found in this comparison.

   In general, these results indicate that either Tai Aroha is not effective in reducing recidivism on average for the whole treated population as compared to a similar group that did not receive the programme, or that the effect from Tai Aroha is smaller than what can be discerned from the current sample especially for the significant and serious reoffending outcomes.

2. Effect of Tai Aroha on selected outcomes-

Table 1- Effect of Tai Aroha on Indicator Outcomes (Home Detention Treated vs. Home Detention Control)

Outcome	Bootstrap Odds Ratio Estimate (Treat/Control)	Bootstrap Bias	Bootstrap Std. error	Bootstrap 95% CI-Lower	Bootstrap 95% CI-Upper	Bootstrap Bonf. Corr. CI-Lower	Bootstrap Bonf. Corr.CI-Upper	Bootstrap Count	Matched Sample Size-Control	Matched Sample Size-Treated
RECONV_12M_YN	1.337	0.028	0.330	0.851	2.168	0.661	2.966	5000	125	125
REIMPR_12M_YN	3.238	0.134	0.900	1.954	5.321	1.414	8.775	5000	125	125
RECONV_12M_SIG_VIOL_SEX_YN	0.951	0.053	0.378	0.462	1.928	0.252	3.504	5000	125	125
REIMPR_12M_SIG_VIOL_SEX_YN	1.530	0.122	0.696	0.736	3.332	0.414	7.992	5000	125	125
RECONV_24M_YN	1.765	0.142	0.664	0.929	3.344	0.506	5.692	5000	112	112
REIMPR_24M_YN	2.727	0.171	0.818	1.611	4.644	1.045	7.241	5000	112	112
RECONV_24M_SIG_VIOL_SEX_YN	1.698	0.085	0.561	0.941	3.164	0.634	4.452	5000	112	112
REIMPR_24M_SIG_VIOL_SEX_YN	1.962	0.098	0.737	1.012	3.841	0.524	6.888	5000	112	112
RECONV_24M_SER_VIOL_SEX_YN	1.366	0.170	0.840	0.515	3.489	0.214	7.444	5000	112	112
RECONV_36M_YN	0.924	0.199	1.053	0.232	3.379	0.034	19.208	5000	91	91
REIMPR_36M_YN	2.042	0.104	0.739	1.077	3.969	0.657	6.774	5000	91	91
RECONV_36M_SIG_VIOL_SEX_YN	1.014	0.065	0.364	0.531	1.927	0.233	3.034	5000	91	91
REIMPR_36M_SIG_VIOL_SEX_YN	1.266	0.093	0.459	0.654	2.380	0.370	3.962	5000	91	91
RECONV_36M_SER_VIOL_SEX_YN	1.275	0.146	0.577	0.568	2.655	0.156	4.822	5000	91	91
REIMPR_36M_SER_VIOL_SEX_YN	1.244	0.176	0.646	0.489	2.709	0.211	5.716	5000	91	91
REIMPR_48M_YN	1.836	0.134	0.709	0.927	3.557	0.532	6.622	5000	78	78
RECONV_48M_SIG_VIOL_SEX_YN	1.502	0.154	0.755	0.634	3.468	0.357	6.987	5000	78	78
REIMPR_48M_SIG_VIOL_SEX_YN	1.275	0.130	0.624	0.575	2.916	0.294	6.479	5000	78	78
RECONV_48M_SER_VIOL_SEX_YN	1.340	0.154	0.718	0.553	3.262	0.254	6.928	5000	78	78
REIMPR_48M_SER_VIOL_SEX_YN	1.244	0.147	0.765	0.480	3.493	0.188	8.152	5000	78	78
REIMPR_60M_YN	1.549	0.166	0.836	0.667	3.747	0.345	8.125	5000	64	64
RECONV_60M_SIG_VIOL_SEX_YN	1.419	0.128	0.552	0.701	2.741	0.420	4.945	5000	64	64
REIMPR_60M_SIG_VIOL_SEX_YN	1.266	0.090	0.522	0.626	2.615	0.394	5.565	5000	64	64
RECONV_60M_SER_VIOL_SEX_YN	1.473	0.197	0.719	0.667	3.119	0.366	6.311	5000	64	64
REIMPR_60M_SER_VIOL_SEX_YN	1.251	0.153	0.605	0.592	2.778	0.253	6.232	5000	64	64

Table 2- Effect of Tai Aroha on Count Outcomes (Home Detention Treated vs. Home Detention Control)

Outcome	Bootstrap Rate ratio (Treat/Control)	Bootstrap Bias	Bootstrap Std. error	Bootstrap 95% CI-Lower	Bootstrap 95% CI-Upper	Bootstrap Bonf.Corr. CI-Lower	Bootstrap Bonf.Corr.CI-Upper	Bootstrap Count	Matched Sample Size-Control	Matched Sample Size-Treated
RECONV_12M_CNT	1.182	0.034	0.257	0.797	1.808	0.602	2.543	5000	125	125
REIMPR_12M_CNT	2.222	0.145	0.533	1.426	3.307	1.125	4.734	5000	125	125
RECONV_12M_SIG_VIOL_SEX_CNT	1.050	0.049	0.378	0.569	2.092	0.323	3.689	5000	125	125
REIMPR_12M_SIG_VIOL_SEX_CNT	1.309	0.105	0.548	0.660	2.687	0.401	4.878	5000	125	125
RECONV_24M_CNT	1.263	0.020	0.204	0.950	1.744	0.752	2.301	5000	112	112
REIMPR_24M_CNT	1.680	0.057	0.301	1.204	2.320	0.894	3.231	5000	112	112
RECONV_24M_SIG_VIOL_SEX_CNT	1.511	0.046	0.421	0.912	2.602	0.663	4.086	5000	112	112
REIMPR_24M_SIG_VIOL_SEX_CNT	1.651	0.048	0.486	0.988	2.873	0.705	4.916	5000	112	112
RECONV_24M_SER_VIOL_SEX_CNT	1.585	0.251	1.017	0.601	3.841	0.239	11.636	5000	112	112
RECONV_36M_CNT	1.023	0.002	0.137	0.799	1.334	0.632	1.603	5000	91	91
REIMPR_36M_CNT	1.468	0.033	0.248	1.060	2.003	0.863	2.711	5000	91	91
RECONV_36M_SIG_VIOL_SEX_CNT	1.148	0.023	0.336	0.677	2.063	0.496	3.161	5000	91	91
REIMPR_36M_SIG_VIOL_SEX_CNT	1.122	0.071	0.334	0.649	1.871	0.429	2.755	5000	91	91
RECONV_36M_SER_VIOL_SEX_CNT	1.032	0.136	0.554	0.383	2.178	0.179	4.446	5000	91	91
REIMPR_36M_SER_VIOL_SEX_CNT	1.187	0.155	0.676	0.465	2.638	0.241	7.156	5000	91	91
RECONV_48M_CNT	1.155	0.007	0.145	0.893	1.453	0.677	1.730	5000	78	78
REIMPR_48M_CNT	1.414	0.026	0.232	1.039	1.929	0.786	2.367	5000	78	78
RECONV_48M_SIG_VIOL_SEX_CNT	1.111	0.005	0.359	0.624	2.120	0.412	3.131	5000	78	78
REIMPR_48M_SIG_VIOL_SEX_CNT	1.208	0.063	0.403	0.663	2.226	0.377	3.394	5000	78	78
RECONV_48M_SER_VIOL_SEX_CNT	1.381	0.185	0.832	0.572	3.331	0.281	9.217	5000	78	78
REIMPR_48M_SER_VIOL_SEX_CNT	1.129	0.192	0.764	0.425	2.793	0.000	8.305	5000	78	78
RECONV_60M_CNT	1.052	0.044	0.169	0.756	1.376	0.618	1.740	5000	64	64
REIMPR_60M_CNT	1.021	0.045	0.170	0.717	1.346	0.611	1.716	5000	64	64
RECONV_60M_SIG_VIOL_SEX_CNT	0.983	0.038	0.248	0.615	1.578	0.444	2.355	5000	64	64
REIMPR_60M_SIG_VIOL_SEX_CNT	1.115	0.056	0.291	0.673	1.754	0.401	2.584	5000	64	64
RECONV_60M_SER_VIOL_SEX_CNT	1.196	0.240	0.584	0.530	2.244	0.336	3.947	5000	64	64
REIMPR_60M_SER_VIOL_SEX_CNT	1.104	0.129	0.479	0.543	1.981	0.295	3.726	5000	64	64

Table 3 - Effect of Tai Aroha on Indicator Outcomes (Home Detention Treated vs. Prison Control Group)

Outcome	Bootstrap Odds Ratio Estimate (Treat/Control)	Bootstrap Bias	Bootstrap Std. error	Bootstrap 95% CI-Lower	Bootstrap 95% CI-Upper	Bootstrap Bonf.Corr. CI-Lower	Bootstrap Bonf.Corr.CI-Upper	Bootstrap Count	Matched Size-Control	Matched Size-Treated
RECONV_12M_YN	0.562	0.016	0.141	0.344	0.898	0.245	1.277	5000	125	125
REIMPR_12M_YN	0.913	0.035	0.240	0.566	1.486	0.415	2.145	5000	125	125
RECONV_12M_SIG_VIOL_SEX_YN	0.669	0.040	0.214	0.362	1.181	0.243	1.900	5000	125	125
REIMPR_12M_SIG_VIOL_SEX_YN	0.770	0.042	0.250	0.413	1.379	0.262	2.115	5000	125	125
RECONV_12M_SER_VIOL_SEX_YN	0.529	0.081	0.373	0.144	1.524	0.000	4.405	5000	125	125
REIMPR_12M_SER_VIOL_SEX_YN	0.603	0.107	0.469	0.150	1.730	0.000	6.960	5000	125	125
RECONV_24M_YN	0.607	0.042	0.258	0.272	1.271	0.142	2.168	5000	112	112
REIMPR_24M_YN	0.784	0.030	0.222	0.456	1.303	0.318	1.902	5000	112	112
RECONV_24M_SIG_VIOL_SEX_YN	1.071	0.062	0.341	0.587	1.869	0.380	3.011	5000	112	112
REIMPR_24M_SIG_VIOL_SEX_YN	0.989	0.049	0.342	0.529	1.878	0.291	2.778	5000	112	112
RECONV_24M_SER_VIOL_SEX_YN	1.218	0.187	0.690	0.480	2.814	0.209	6.612	5000	112	112
REIMPR_24M_SER_VIOL_SEX_YN	1.209	0.185	0.697	0.463	2.965	0.089	5.983	5000	112	112
RECONV_36M_YN	0.475	0.071	0.440	0.086	2.035	0.000	7.780	5000	91	91
REIMPR_36M_YN	0.692	0.049	0.256	0.345	1.304	0.182	2.167	5000	91	91
RECONV_36M_SIG_VIOL_SEX_YN	0.940	0.045	0.298	0.527	1.672	0.365	2.706	5000	91	91
REIMPR_36M_SIG_VIOL_SEX_YN	1.039	0.082	0.371	0.534	1.915	0.379	3.017	5000	91	91
RECONV_36M_SER_VIOL_SEX_YN	1.224	0.149	0.768	0.492	3.473	0.213	9.094	5000	91	91
REIMPR_36M_SER_VIOL_SEX_YN	1.736	0.411	1.786	0.597	5.456	0.187	26.040	5000	91	91
REIMPR_48M_YN	0.469	0.037	0.235	0.188	1.131	0.069	2.189	5000	78	78
RECONV_48M_SIG_VIOL_SEX_YN	0.950	0.062	0.316	0.512	1.699	0.306	2.895	5000	78	78
REIMPR_48M_SIG_VIOL_SEX_YN	0.936	0.068	0.365	0.462	1.864	0.241	2.860	5000	78	78
RECONV_48M_SER_VIOL_SEX_YN	0.870	0.090	0.392	0.406	1.855	0.228	3.302	5000	78	78
REIMPR_48M_SER_VIOL_SEX_YN	1.203	0.144	0.580	0.499	2.634	0.272	4.499	5000	78	78
REIMPR_60M_YN	0.903	0.156	0.641	0.292	2.530	0.088	7.296	5000	64	64
RECONV_60M_SIG_VIOL_SEX_YN	1.059	0.182	0.498	0.432	2.024	0.204	3.870	5000	64	64
REIMPR_60M_SIG_VIOL_SEX_YN	1.144	0.147	0.508	0.514	2.291	0.300	3.760	5000	64	64
RECONV_60M_SER_VIOL_SEX_YN	1.430	0.229	0.794	0.571	3.263	0.270	6.559	5000	64	64

REIMPR_60M_SER_VIOL_SEX_YN	1.581	0.294	0.929	0.580	3.565	0.315	7.057	5000	64	64

Table 4- Effect of Tai Aroha on Count Outcomes (Home Detention Treated vs. Prison Control)

Outcome	***Bootstrap Rate ratio (Treat/Control)***	***Bootstrap Bias***	***Bootstrap Std. error***	***Bootstrap 95% CI-Lower***	***Bootstrap 95% CI-Upper***	***Bootstrap Bonf.Corr. CI-Lower***	***Bootstrap Bonf.Corr.CI-Upper***	***Bootstrap Count***	***Matched Sample Size-Control***	***Matched Sample Size-Treated***
RECONV_12M_CNT	0.746	0.006	0.143	0.541	1.133	0.444	1.589	5000	125	125
REIMPR_12M_CNT	0.906	0.016	0.151	0.663	1.263	0.542	1.620	5000	125	125
RECONV_12M_SIG_VIOL_SEX_CNT	0.719	0.033	0.221	0.383	1.230	0.242	1.881	5000	125	125
REIMPR_12M_SIG_VIOL_SEX_CNT	0.687	0.040	0.211	0.376	1.175	0.229	2.028	5000	125	125
RECONV_12M_SER_VIOL_SEX_CNT	0.549	0.068	0.349	0.159	1.489	0.000	4.410	5000	125	125
REIMPR_12M_SER_VIOL_SEX_CNT	0.619	0.089	0.457	0.179	1.888	0.000	9.112	5000	125	125
RECONV_24M_CNT	0.919	0.006	0.111	0.737	1.175	0.639	1.444	5000	112	112
REIMPR_24M_CNT	0.853	0.005	0.112	0.664	1.108	0.555	1.371	5000	112	112
RECONV_24M_SIG_VIOL_SEX_CNT	1.016	0.029	0.265	0.641	1.680	0.447	2.493	5000	112	112
REIMPR_24M_SIG_VIOL_SEX_CNT	0.905	0.023	0.223	0.581	1.470	0.418	2.128	5000	112	112
RECONV_24M_SER_VIOL_SEX_CNT	1.086	0.149	0.649	0.430	2.717	0.207	6.223	5000	112	112
REIMPR_24M_SER_VIOL_SEX_CNT	1.009	0.150	0.565	0.386	2.232	0.124	4.649	5000	112	112
RECONV_36M_CNT	0.849	0.005	0.087	0.696	1.040	0.618	1.221	5000	91	91
REIMPR_36M_CNT	0.705	0.008	0.084	0.560	0.887	0.479	1.076	5000	91	91
RECONV_36M_SIG_VIOL_SEX_CNT	0.834	0.010	0.247	0.495	1.501	0.314	2.301	5000	91	91
REIMPR_36M_SIG_VIOL_SEX_CNT	0.879	0.054	0.246	0.505	1.400	0.355	1.965	5000	91	91
RECONV_36M_SER_VIOL_SEX_CNT	1.657	0.109	0.862	0.697	4.266	0.368	8.960	5000	91	91
RECONV_48M_CNT	0.817	0.014	0.112	0.613	1.048	0.514	1.249	5000	78	78
REIMPR_48M_CNT	0.818	0.010	0.117	0.618	1.074	0.517	1.320	5000	78	78
RECONV_48M_SIG_VIOL_SEX_CNT	0.758	0.011	0.170	0.514	1.202	0.414	1.966	5000	78	78
REIMPR_48M_SIG_VIOL_SEX_CNT	0.841	0.033	0.198	0.529	1.294	0.333	1.722	5000	78	78
RECONV_48M_SER_VIOL_SEX_CNT	0.967	0.065	0.387	0.478	1.985	0.256	4.205	5000	78	78

REIMPR_48M_SER_VIOL_SEX_CNT	1.194	0.104	0.492	0.597	2.319	0.323	5.050	5000	78	78
RECONV_60M_CNT	0.932	0.002	0.138	0.709	1.258	0.585	1.509	5000	64	64
REIMPR_60M_CNT	0.910	0.008	0.147	0.666	1.245	0.551	1.602	5000	64	64
RECONV_60M_SIG_VIOL_SEX_CNT	0.813	0.003	0.251	0.442	1.464	0.259	2.080	5000	64	64
REIMPR_60M_SIG_VIOL_SEX_CNT	1.045	0.021	0.258	0.664	1.684	0.460	2.353	5000	64	64
RECONV_60M_SER_VIOL_SEX_CNT	1.208	0.104	0.606	0.532	2.730	0.273	6.209	5000	64	64
REIMPR_60M_SER_VIOL_SEX_CNT	1.384	0.184	0.717	0.612	2.981	0.286	6.169	5000	64	64

3. **Data dictionary for the output tables –** The following table describes the columns listed in Tables 1, 2, 3 and 4 and how to interpret these columns.

Follow up Period	The cohort follow-up period under consideration- This is the number of months of follow-up for the cohort.
Outcome	The outcome variable - reconvictions/reimprisonment indicators or counts.
Bootstrap Odds Ratio Estimate (Treat/Control)	The relative odds of occurrence of the outcome in the presence of Tai Aroha intervention for the treated population, compared to the control population as estimated from the bootstrap method. The odds ratio can be interpreted in the following way - a value of 1 would indicate that there is no difference between the odds of the outcome in the treated vs. control population. A value < 1 indicates that the odds of the outcome (reconviction or reimprisonment) is lower in treated population as compared to the control, and vice versa for value > 1. Odds ratios are calculated when the outcome of interest is a binary outcome - i.e., does an individual get reconvicted/reimprisoned -Yes or No. *Odds of reoffending for treated = Probability of re-offending for treated / Probability of not re-offending for treated* *Odds of reoffending for control = Probability of re-offending for control / Probability of not re-offending for control* *Odds ratio = Odds of reoffending for treated/Odds of reoffending for control*
Bootstrap Rate ratio (Treat/Control)	The ratio between the probability of the outcome between the treated and control population. This can be interpreted as a multiplier by which the count of reconviction/reimprisonment changes in the presence of treatment.
Bootstrap Bias	This measures the difference of the bootstrap estimate of the effect from a sample estimate.
Bootstrap Std. error	Std. Deviation of the bootstrap sampling distribution
Bootstrap CI-Lower 2.5 perc	The lower bound of the effect of treatment, assuming at the 2.5^{th} percentile. Note that if the lower bound is less than 1 and the upper bound greater than 1, this effectively means that there is no statistically significant effect for Tai Aroha in this outcome.
Bootstrap CI-Upper 97.5 perc	The upper bound of the effect of treatment, assuming at the 97.5^{th} percentile. Note that if the lower bound is less than 1 and the upper bound greater than 1, this effectively means that there is no statistically significant effect for Tai Aroha in this outcome.
Bootstrap Bonf. Corr. CI-Lower	The lower bound of the effect of treatment, after applying a Bonferroni correction to account for testing multiple hypothesis on the same dataset. Since we are testing the effect of Tai Aroha on multiple outcomes using the same data, it is possible to randomly find an effect when there is actually none – this new lower bound takes into account this chance and corrects for it. The corrected confidence interval is 1 – (p/Number of hypothesis) = 1 – (0.05/120) = 0.9995. Note that this may be a conservative estimate.
Bootstrap Bonf. Corr. CI-Upper	The upper bound of the effect of treatment, after applying a Bonferroni correction to account for testing multiple hypothesis on the same dataset.

	Note that this may be a conservative estimate.
Bootstrap Count	Number of bootstrap samples that have been used in the estimate.
Matched Sample Size-Control	Size of the treated population after matching
Matched Sample Size-Treated	Size of the control population after matching

The following table lists the business descriptions for the covariates and the outcome variables used in this study. These descriptions have been supplied by Corrections.

Variables	Purpose	Detail
Observation_number	Reference	A unique number for each observation
GROUP_TYPE	Variable of interest	Variable distinguishing Treatment & Control Group candidates
ETHNICITY	Matching	European, Māori, Other, Pacific
AGE	Matching	Age at sentence start date
AGE_GROUP	Matching	Currently age at sentence start in following groups: <20, 20-24, 25-29, 30-39 & 40-49
IMPOSED_DAYS	Matching	Imposed sentence measured in days
FOLLOWUP_DATE	Matching	The threshold date for measurement of outcomes
Offence_Type_LEVEL_1	Matching	High level categorisation of offence types
Offence_Type_LEVEL_2	Matching	Medium level categorisation of offence types
ROCROI_SCORE	Matching	Actuarial measure of the risk of reimprisonment within five years
GANG_IND	Matching	Measure of gang association
AVRS_SCORE	Matching	An automated version of the static risk factors of the VRS
DRAOR_HARM_RISK_SCORE	Matching	Probation officer's assessment of the severity of harm if the offender offends again
DRAOR_REOFF_RISK_SCORE	Matching	Probation officer's assessment of the likelihood of the offender offending again
DRAOR_STABLE_SCORE	Matching	Sum of the scores on DRAOR stable risk factors
DRAOR_ACUTE_SCORE	Matching	Sum of the scores on DRAOR acute risk factors
DRAOR_PROTECTIVE_SCORE	Matching	Sum of the scores on DRAOR protective factors
DRAOR_PEER_ASSOC_SCORE	Matching	Negative peer associations
DRAOR_ATT_AUTH_SCORE	Matching	Attitude to authority
DRAOR_IMPULSE_CONTROL_SCORE	Matching	Impulse control
DRAOR_PROBLEM_SOLVING_SCORE	Matching	Problem solving
DRAOR_SENSE_OF_ENT_SCORE	Matching	Sense of entitlement
DRAOR_ATT_WITH_OTHERS_SCORE	Matching	Attitude to others
DRAOR_SUBSTANCE_ABUSE_SCORE	Matching	Substance abuse
DRAOR_ANGER_HOSTILITY_SCORE	Matching	Anger and hostility
DRAOR_OPP_TO_OFFEND_SCORE	Matching	Opportunity to offend
DRAOR_NEGATIVE_MOOD_SCORE	Matching	Negative mood
DRAOR_EMPLOYMENT_SCORE	Matching	Employment
DRAOR_INTERPERSONAL_REL_SCORE	Matching	Interpersonal relations
DRAOR_LIVING_SITUATION_SCORE	Matching	Living situation
DRAOR_RESP_TO_ADVICE_SCORE	Matching	Respnsivity to advice
DRAOR_PRO_SOCIAL_IDENT_SCORE	Matching	Pro-social identity
DRAOR_HIGH_EXPECTATIONS_SCORE	Matching	High expectations
DRAOR_COSTS_BENEFITS_SCORE	Matching	Costs and benefits

DRAOR_SOCIAL_SUPPORT_SCORE	Matching	Social supports
DRAOR_SOCIAL_CONTROL_SCORE	Matching	Social control
PRIOR_CONV_ANY_VIOL_CNT	Matching	Count of prior convictions for any violent offence
PRIOR_CONV_SIG_VIOL_CNT	Matching	Count of prior convictions for any significant violent offence
PRIOR_CONV_SER_VIOL_CNT	Matching	Count of prior convictions for any serious violent offence
PRIOR_IMPR_ANY_VIOL_CNT	Matching	Count of prior distinct terms of imprisonment for any violent offence
PRIOR_IMPR_SIG_VIOL_CNT	Matching	Count of prior distinct terms of imprisonment for any significant violent offence
PRIOR_IMPR_SER_VIOL_CNT	Matching	Count of prior distinct terms of imprisonment for any serious violent offence
PRIOR_YTH_CONV_ANY_VIOL_CNT	Matching	Count of prior convictions for any violent offence in the Yth Court
PRIOR_YTH_CONV_SIG_VIOL_CNT	Matching	Count of prior convictions for any significant violent offence in the Yth Court
PRIOR_YTH_CONV_SER_VIOL_CNT	Matching	Count of prior convictions for any serious violent offence in the Yth Court
RECONV_12M_YN	Outcome	Reconvicted for any offence committed within 12 months of completing the sentence
RECONV_12M_CNT	Outcome	Count of convictions for any offence committed within 12 months of completing the sentence
REIMPR_12M_YN	Outcome	Imprisoned for any offence committed within 12 months of completing the sentence
REIMPR_12M_CNT	Outcome	Count of distinct terms of imprisonment for any offence committed within 12 months of completing the sentence
RECONV_12M_SIG_VIOL_SEX_YN	Outcome	Reconvicted for any significant violent or sex offence committed within 12 months of completing the sentence
RECONV_12M_SIG_VIOL_SEX_CNT	Outcome	Count of convictions for any significant violent or sexual offence committed within 12 months of completing the sentence
REIMPR_12M_SIG_VIOL_SEX_YN	Outcome	Imprisoned for any significant violent or sex offence committed within 12 months of completing the sentence
REIMPR_12M_SIG_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any significant violent or sex offence committed within 12 months of completing the sentence
RECONV_12M_SER_VIOL_SEX_YN	Outcome	Reconvicted for any serious violent or sex offence committed within 12 months of completing the sentence
RECONV_12M_SER_VIOL_SEX_CNT	Outcome	Count of convictions for any serious violent or sexual offence committed within 12 months of completing the sentence
REIMPR_12M_SER_VIOL_SEX_YN	Outcome	Imprisoned for any serious violent or sex offence committed within 12 months of completing the sentence
REIMPR_12M_SER_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any serious violent or sex offence committed within 12 months of completing the sentence
SUM_MAX_12M_PRISON_LENGTH_DAYS	Outcome	Sum of days for all distinct terms of imprisonment for offences committed within 12 months of completing the sentence
RECONV_24M_YN	Outcome	Reconvicted for any offence committed within 24 months of completing the sentence
RECONV_24M_CNT	Outcome	Count of convictions for any offence committed within 24 months of completing the sentence
REIMPR_24M_YN	Outcome	Imprisoned for any offence committed within 24 months of completing the sentence
REIMPR_24M_CNT	Outcome	Count of distinct terms of imprisonment for any offence committed within 24 months of completing the sentence
RECONV_24M_SIG_VIOL_SEX_YN	Outcome	Reconvicted for any significant violent or sex offence committed within 24 months of completing the sentence
RECONV_24M_SIG_VIOL_SEX_CNT	Outcome	Count of convictions for any significant violent or sexual offence committed within 24 months of completing the sentence

REIMPR_24M_SIG_VIOL_SEX_YN	Outcome	Imprisoned for any significant violent or sex offence committed within 24 months of completing the sentence
REIMPR_24M_SIG_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any significant violent or sex offence committed within 24 months of completing the sentence
RECONV_24M_SER_VIOL_SEX_YN	Outcome	Reconvicted for any serious violent or sex offence committed within 24 months of completing the sentence
RECONV_24M_SER_VIOL_SEX_CNT	Outcome	Count of convictions for any serious violent or sexual offence committed within 24 months of completing the sentence
REIMPR_24M_SER_VIOL_SEX_YN	Outcome	Imprisoned for any serious violent or sex offence committed within 24 months of completing the sentence
REIMPR_24M_SER_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any serious violent or sex offence committed within 24 months of completing the sentence
SUM_MAX_24M_PRISON_LENGTH_DAYS	Outcome	Sum of days for all distinct terms of imprisonment for offences committed within 24 months of completing the sentence
RECONV_36M_YN	Outcome	Reconvicted for any offence committed within 36 months of completing the sentence
RECONV_36M_CNT	Outcome	Count of convictions for any offence committed within 36 months of completing the sentence
REIMPR_36M_YN	Outcome	Imprisoned for any offence committed within 36 months of completing the sentence
REIMPR_36M_CNT	Outcome	Count of distinct terms of imprisonment for any offence committed within 36 months of completing the sentence
RECONV_36M_SIG_VIOL_SEX_YN	Outcome	Reconvicted for any significant violent or sex offence committed within 36 months of completing the sentence
RECONV_36M_SIG_VIOL_SEX_CNT	Outcome	Count of convictions for any significant violent or sexual offence committed within 36 months of completing the sentence
REIMPR_36M_SIG_VIOL_SEX_YN	Outcome	Imprisoned for any significant violent or sex offence committed within 36 months of completing the sentence
REIMPR_36M_SIG_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any significant violent or sex offence committed within 36 months of completing the sentence
RECONV_36M_SER_VIOL_SEX_YN	Outcome	Reconvicted for any serious violent or sex offence committed within 36 months of completing the sentence
RECONV_36M_SER_VIOL_SEX_CNT	Outcome	Count of convictions for any serious violent or sexual offence committed within 36 months of completing the sentence
REIMPR_36M_SER_VIOL_SEX_YN	Outcome	Imprisoned for any serious violent or sex offence committed within 36 months of completing the sentence
REIMPR_36M_SER_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any serious violent or sex offence committed within 36 months of completing the sentence
SUM_MAX_36M_PRISON_LENGTH_DAYS	Outcome	Sum of days for all distinct terms of imprisonment for offences committed within 36 months of completing the sentence
RECONV_48M_YN	Outcome	Reconvicted for any offence committed within 48 months of completing the sentence
RECONV_48M_CNT	Outcome	Count of convictions for any offence committed within 48 months of completing the sentence
REIMPR_48M_YN	Outcome	Imprisoned for any offence committed within 48 months of completing the sentence
REIMPR_48M_CNT	Outcome	Count of distinct terms of imprisonment for any offence committed within 48 months of completing the sentence
RECONV_48M_SIG_VIOL_SEX_YN	Outcome	Reconvicted for any significant violent or sex offence committed within 48 months of completing the sentence
RECONV_48M_SIG_VIOL_SEX_CNT	Outcome	Count of convictions for any significant violent or sexual offence committed within 48 months of completing the sentence

REIMPR_48M_SIG_VIOL_SEX_YN	Outcome	Imprisoned for any significant violent or sex offence committed within 48 months of completing the sentence
REIMPR_48M_SIG_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any significant violent or sex offence committed within 48 months of completing the sentence
RECONV_48M_SER_VIOL_SEX_YN	Outcome	Reconvicted for any serious violent or sex offence committed within 48 months of completing the sentence
RECONV_48M_SER_VIOL_SEX_CNT	Outcome	Count of convictions for any serious violent or sexual offence committed within 48 months of completing the sentence
REIMPR_48M_SER_VIOL_SEX_YN	Outcome	Imprisoned for any serious violent or sex offence committed within 48 months of completing the sentence
REIMPR_48M_SER_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any serious violent or sex offence committed within 48 months of completing the sentence
SUM_MAX_48M_PRISON_LENGTH_DAYS	Outcome	Sum of days for all distinct terms of imprisonment for offences committed within 48 months of completing the sentence
RECONV_60M_YN	Outcome	Reconvicted for any offence committed within 60 months of completing the sentence
RECONV_60M_CNT	Outcome	Count of convictions for any offence committed within 60 months of completing the sentence
REIMPR_60M_YN	Outcome	Imprisoned for any offence committed within 60 months of completing the sentence
REIMPR_60M_CNT	Outcome	Count of distinct terms of imprisonment for any offence committed within 60 months of completing the sentence
RECONV_60M_SIG_VIOL_SEX_YN	Outcome	Reconvicted for any significant violent or sex offence committed within 60 months of completing the sentence
RECONV_60M_SIG_VIOL_SEX_CNT	Outcome	Count of convictions for any significant violent or sexual offence committed within 60 months of completing the sentence
REIMPR_60M_SIG_VIOL_SEX_YN	Outcome	Imprisoned for any significant violent or sex offence committed within 60 months of completing the sentence
REIMPR_60M_SIG_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any significant violent or sex offence committed within 60 months of completing the sentence
RECONV_60M_SER_VIOL_SEX_YN	Outcome	Reconvicted for any serious violent or sex offence committed within 60 months of completing the sentence
RECONV_60M_SER_VIOL_SEX_CNT	Outcome	Count of convictions for any serious violent or sexual offence committed within 60 months of completing the sentence
REIMPR_60M_SER_VIOL_SEX_YN	Outcome	Imprisoned for any serious violent or sex offence committed within 60 months of completing the sentence
REIMPR_60M_SER_VIOL_SEX_CNT	Outcome	Count of distinct terms of imprisonment for any serious violent or sex offence committed within 60 months of completing the sentence
SUM_MAX_60M_PRISON_LENGTH_DAYS	Outcome	Sum of days for all distinct terms of imprisonment for offences committed within 60 months of completing the sentence
RECONV_FIRST_OFFENCE_DATE	Outcome	Earliest offence date resulting in reconviction
REIMPR_FIRST_OFFENCE_DATE	Outcome	Earliest offence date resulting in imprisonment

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