

Research Brief

Reducing reoffending through intervention diversity: Evidence from the Intervention Pathways model

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AIMS To examine how dosage from distinct categories of intervention delivered under the Intervention Pathways (IP) model contribute to reoffending outcomes. We also examined whether diversity in dosage, or the extent that total dosage received came from single or multiple categories of intervention, had a role in reoffending outcomes.

**FINDINGS
AND
CONCLUSIONS** Dosage data across categories of intensive criminogenic, education, and other interventions from 2095 individuals who completed their allocated intervention pathways were analysed to explore associations with general and serious reoffending outcomes.

Results showed that dosage from individual intervention categories did not explain unique variance in reoffending outcomes, after controlling for the effects of total dosage received. Additional analyses indicated that increasing diversity in the combinations of interventions contributing to dosage, including intensive programs and education, and education and other interventions, explained significant variance in reduced odds of reoffending, after adjusting for total dosage received.

This study indicated that beyond the metrics of overall dosage received, strategically integrated and complementary interventions can improve rehabilitative outcomes. Models of correctional intervention may benefit from adopting multifaceted approaches that leverage the synergistic effects of education, intensive criminogenic programs and support services.

INTRODUCTION

Research indicates that interventions delivered within correctional facilities can positively influence individuals' post-release outcomes (Bourgon & Armstrong, 2005; Hsieh et al., 2022; Mahajan et al., 2025). For example, interventions such as cognitive behavioural therapy (CBT; Bower et al., 2024; Makarios et al., 2014), education (Wilson et al., 2000), and vocational training (Mohammed & Mohamed, 2015) have been shown to significantly reduce reoffending. More targeted approaches such as prison-based drug treatment (Proctor et al., 2012), sex offender programs (Halstead, 2016), therapeutic programs for violent offenders (Rahman et al., 2018), and ancillary services like custodial case management and reintegration support (Mahajan et al., 2025), have also shown promising results.

In practice, many individuals will not receive a single, standalone intervention while they are in custody. Instead, they typically engage in a combination of programs and services tailored to their assessed needs, which are often complex and multifaceted (Frölich, 2022). Despite this, research has typically examined intervention dosage - defined as the intensity, duration, or frequency of an intervention - in isolation, with a predominant focus on intensive CBT-based therapeutic programs (Bourgon & Armstrong, 2005; Makarios et al., 2014). This narrow perspective overlooks the complexities of correctional service delivery, where multiple interventions may be delivered concurrently or in sequence. The interactions among multiple interventions, such as their cumulative dosage and potential synergies, remain largely unexplored.

Limited empirical evidence suggests that combining different types of interventions may be more effective than delivering them individually. For example, Hsieh et al. (2022) found that individuals who engaged in a combination of CBT-based, vocational training, and basic education programs were less likely to reoffend than those who participated in basic education alone. However, this study did not account for the cumulative effects of total dosage received, whereby participants of multiple programs and services may have received a greater amount of intervention compared to those in education only. This makes it unclear whether the observed effects stemmed from the range of intervention categories or merely from receiving greater amounts of dosage. Hence, for a nuanced evaluation, it is important to disentangle the type and variety of interventions received from cumulative overall dosage.

A more recent evaluation found that total dosage accumulated across multiple categories of intervention over the course of a custodial sentence was associated with reductions in both general and serious reoffending (Mahajan et al., 2025). Interestingly, this study found that the dosage required to effect measurable change in reoffending outcomes was lower than previous studies which looked at standalone interventions (e.g., CBT only; Bourgon & Armstrong, 2005; Makarios et al., 2014), which could suggest that combinations of interventions may provide additive or synergistic effects. These findings also underscore the importance of understanding how the nature and diversity of interventions may interact with gross dosage levels to influence outcomes, reinforcing the need for further examination of holistic and integrated models of service delivery.

Exploration of the dynamics of standalone and diverse dosage requires a model that incorporates a comprehensive approach to allocating, delivering and recording multiple interventions in correctional settings. An example of this is the Corrective Services NSW's Intervention Pathway (IP) model. The IP model delivers tailored intervention dosage to higher risk individuals in custody through an integrated assessment system that allocates participants to intervention pathways comprising a diverse set of interventions. These include core interventions, such as intensive criminogenic programs and education programs (basic education and vocational training), as well as other ancillary interventions, including non-criminogenic programs, reintegration services, and case management activities (Mahajan et al., 2024a). As such, the IP model provides a valuable opportunity to study not only the contribution of dosage from individual interventions but also the impact of dosage from diverse combinations of interventions on reoffending outcomes.

The aims of the current study were two-fold. First, we aimed to examine the relative contributions of individual categories of intervention, by assessing whether dosage from primarily CBT-based intensive programs, education programs, and other interventions has a unique effect on reoffending outcomes after controlling for the contribution of total dosage received. Second, we aimed to explore the effects of intervention diversity by examining whether reoffending outcomes varied as a function of the extent that dosage was contributed to by single or multiple interventions. In both analyses, total dosage was statistically controlled for to isolate the unique contributions of intervention type and diversity on outcomes. This approach reflects the complexity of correctional programming in practice and contributes to a more integrated understanding of effective strategies for reducing reoffending.

METHODS

The sample comprised a total of 2095 individuals (1909 males and 186 females) who had completed their allocated interventions under the IP model before 31 December 2023. Data for the current study were extracted from the Offender Integrated Management System (OIMS), including individuals' demographic characteristics, sentence-related variables, and Custody Triage Risk Assessment Scale score (Custody TRAS)¹. Dosage hours from various intervention categories delivered under the IP model were also extracted from OIMS. Individuals' reoffending data were extracted from the Reoffending Database (ROD), maintained by the NSW Bureau of Crime Statistics and Research (BOCSAR). For the current study, data on all finalised convictions for the current sample were extracted up to 31 December 2024.

Intervention dosage delivered through various intervention pathways were grouped and aggregated into three main intervention categories. First, the intensive programs category included dosage from intensive criminogenic behaviour change programs across various pathways delivered by the IP model (see Mahajan et al., 2024a for details). The second category consisted of education programs, including dosage from foundational skills and vocational programs. Lastly, dosage from various non-criminogenic programs, case-management, and reintegration services were grouped into the 'other interventions' category². To remove the confounding effects of extreme dosage values across all intervention categories in our analyses, we winsorised extreme values to the nearest non-outlier dosage for all distinct intervention categories and total dosage³.

The current study considered two reoffending outcomes: general reoffending and serious reoffending. General reoffending was defined as any finalised instance of conviction for a new offence during the 12 months following release from custody. Serious reoffending was defined as any new finalised conviction within 12 months post-release for certain offences, including homicide, acts intended to cause injury, sexual assault, abduction and kidnapping, robbery, extortion, unlawful entry with intent, theft, fraud, deception, and illicit drug-related offences. Of the total sample, 63% (n = 1320) were recorded as being reconvicted for a general offence, and 42% (n = 884) were reconvicted for a serious offence within 12 months post-release.

¹ The Custody TRAS is an automated actuarial risk assessment tool that estimates risk of reoffending. It defines reoffending as any return to custody with a new conviction within two years of release from custody (Raudino et al., 2019).

² Dosage from these programs and services were grouped due to their relatively low contribution to gross dosage levels.

³ Winsorising is a statistical method that reduces the impact of outliers on the mean and variance by substituting extreme values with less extreme ones from the same dataset (Blaine, 2018).

FINDINGS

Does dosage from different categories of intervention have unique contributions to reoffending outcomes?

To explore this research question, separate binary logistic regression models were developed for each of the three intervention categories to estimate their relationships with general and serious reoffending. In each model, intensive program, education, or other intervention dosage was used as the primary predictor. Individuals' age, Aboriginal status, Custody TRAS score, and months served in custody were included as covariates in the model. Dosage, age, Custody TRAS scores, and months in custody were treated as continuous variables, and Aboriginal status was considered as a categorical variable, with non-Aboriginal status as the reference category. Importantly, total dosage received over the course of participation in the intervention pathway was also included as a covariate in the models, to isolate variance associated with a particular intervention category by simultaneously adjusting for overall dosage. Table 1 summarises the results of these logistic regression models.

The results indicated that none of the intervention categories were significantly associated with general or serious reoffending outcomes, after controlling for total dosage received. Across models, several covariates, including Custody TRAS score, time spent in custody and Aboriginal status, were significant. Notably, in all models except the one for education effects on general reoffending, increasing total dosage was significantly associated with lower odds of reoffending.

Table 1. Logistic regression modelling of different intervention categories and reoffending outcomes.

Variable	General reoffending				Serious reoffending			
	B	OR	95% CI	p	B	OR	95% CI	p
Intensive Programs								
Intensive Program Dosage	0	0.99	[.99 1.00]	.72	0	1	[.99 1.00]	.86
Total Dosage	-0.002	0.99	[.99 1.00]	.008	-0.002	0.99	[.99 1.00]	.05
Age	0.006	1	[.99 1.02]	.10	0	1	[.99 1.02]	.94
Aboriginal Status (Y)	0.23	1.26	[1.04 1.53]	.01	0.11	1.12	[.93 1.35]	.09
TRAS Score	3.52	34.04	[15.1 76.3]	<.001	3.32	27.83	[13.12 59.0]	<.001
Months in Custody	-0.01	0.98	[.98 .99]	<.001	-0.008	0.99	[.99 1]	.003
Education Programs								
Education Dosage	-0.001	0.99	[.99 1.00]	.38	0	1	[.99 1.00]	.94
Total Dosage	-0.001	0.99	[.99 1.00]	.12	-0.002	0.99	[.99 1.00]	.04
Age	0.006	1	[.99 1.02]	.10	0	1	[.99 1.02]	.94
Aboriginal Status (Y)	0.23	1.26	[1.04 1.53]	.01	0.11	1.12	[.93 1.35]	.09
TRAS Score	3.52	34.98	[15.6 78.3]	<.001	3.32	27.83	[13.12 59.0]	<.001
Months in Custody	-0.01	0.98	[.98 .99]	<.001	-0.009	0.99	[.98 .99]	.01
Other Interventions								
Other Dosage	0.004	1.004	[.99 1.00]	.10	0.001	1	[.99 1.00]	.52
Total Dosage	-0.002	0.99	[.99 1.00]	<.001	-0.002	0.99	[.99 1.00]	.003
Age	0.005	1.005	[.99 1.02]	.36	0	1	[.99 1.02]	.94
Aboriginal Status (Y)	0.23	1.26	[1.04 1.53]	.01	0.11	1.12	[.93 1.35]	.21
TRAS Score	3.52	34.01	[15.1 76.3]	<.001	3.32	27.68	[13.12 59.0]	<.001
Months in Custody	-0.008	0.99	[.98 .99]	.001	-0.008	0.99	[.98 .99]	.01

Is there a relationship between the diversity of interventions and reoffending outcomes?

The above findings indicate that dosage received from any single intervention category may not explain unique variance in reoffending outcomes, after accounting for total dosage received across all interventions. This suggests that observed effects of total dosage may be associated with the cumulative or combined effects of the multiple interventions received, as compared to the action of single or specific types of intervention. To further explore these effects, the following analyses examined how the composition of multiple interventions, with a focus on the level of diversity in dosage, relates to reoffending outcomes. The effects of intervention diversity on reoffending were assessed across three combinations: intensive and education dosage, intensive and other interventions dosage, and education and other interventions dosage.

We used a ratio-based method to understand how dosage from different intervention categories were combined and how this mix was related to reoffending outcomes. The ratio-based approach allowed us to assess how the combined effect of two intervention categories influences reoffending outcomes, relative to the effect of receiving dosage that was delivered by either one of the intervention categories alone. We first calculated ratios to indicate the extent to which overall dosage received was predominantly comprised of one intervention category or a combination of two intervention categories. To give an example, the ratio of intensive program hours to the combined hours of intensive and education programs ranged from 0 to 1. A ratio of 0.5 means both interventions were delivered equally (high diversity), while a ratio close to 0 or 1 means that an individual predominantly received a single intervention dosage (low diversity).

Application of this ratio-based method was initially intended to give a bidirectional assessment of the effects of two intervention categories; in this case, ranging from exclusively intensive program dosage to exclusively education dosage, with varying levels of diversity in contribution from each category in between. However, this was complicated by sampling factors whereby most participants in the IP model typically received substantially more hours of intensive programs compared to education or other interventions. This results in an imbalance in dosage ratios, with most individuals receiving disproportionately high intensive program dosage, while relatively few receive predominantly education or other intervention dosage. Consequently, the distribution of dosage ratios is skewed, leading to underrepresentation of individuals receiving predominantly education or other intervention dosage. This imbalance also reduces statistical power when examining the effects of combined interventions on reoffending outcomes.

Hence, to overcome this statistical limitation, we collapsed each of the ratios so that they functioned as a unidirectional index of intervention diversity. Ratios like 0 and 1 were treated as 0 (no diversity), while ratios like 0.1 and 0.9 were both treated as 0.1, and so on. This provided us with a scale ranging from 0.0 to 0.5, where higher values indicate more diversity in the combination of the two intervention categories.

We then developed binary logistic regression models for each of the three intervention combinations to estimate the effects of intervention diversity on reoffending. In each model, the simplified ratios were used as the primary predictor. Participants' total dosage received, age, Aboriginal status, Custody TRAS score, and months served in custody were included as covariates in the model. Tables 2-4 summarise the results of covariate-controlled logistic regression models examining the relationship between intervention diversity and two reoffending outcomes. The relationships between various combinations of interventions and reoffending outcomes are described below.

Intensive program and education dosage

After adjusting for covariates, we found a significant relationship between the level of diversity from the combination of intensive programs and education dosage and general reoffending. The odds of general reoffending were reduced by 9% with every 0.1 increase in diversity comprising CBT-based intensive behaviour change programs and education programs⁴. To clarify this finding, the ratio indicates that

⁴ The odds ratios were expressed and interpreted in different standard units, with the ratio increased by 0.1 rather than the standard 1-unit. Hence, the estimated odds of reduction in reoffending were computed using the formula ' $\exp(B * 0.1)$ '.

receiving an increasingly equal combination of both intensive programs and education programs is associated with significantly lower odds of general reoffending, when compared to receiving dosage that is proportionally more biased towards intensive programs or education alone⁵. We did not find a significant relationship between intervention diversity and serious reoffending.

We also found that increasing total dosage was significantly associated with reductions in the odds of both general and serious reoffending. Several other covariates, including Custody TRAS score, time spent in custody and Aboriginal status, were also significant.

Table 2. Logistic regression modelling of combination of intensive program and education dosage, and reoffending.

Variable	General reoffending				Serious reoffending			
	B	OR	95% CI	p	B	OR	95% CI	p
Ratio	-0.84	0.43	[.20 .92]	.03	-0.36	0.69	[.32 1.50]	.35
Total Dosage	-0.001	0.99	[.99 1.00]	.02	-0.002	0.99	[.99 1.00]	.02
Age	0.01	1.005	[.99 1.02]	.36	0	1	[.99 1.02]	.93
Aboriginal Status (Y)	0.24	1.27	[1.04 1.54]	.01	0.12	1.12	[.93 1.35]	.20
TRAS Score	3.51	33.56	[14.9 75.2]	<.001	3.31	27.5	[13.0 58.4]	<.001
Months in Custody	-0.01	0.99	[.98 .99]	<.001	-0.01	0.99	[.98 .99]	.003

Intensive program and other intervention dosage

After adjusting for covariates, we did not find a significant relationship between the level of diversity from the combination of intensive programs and other interventions dosage and the odds of both general and serious reoffending outcomes. Several covariates, including total dosage as well as Aboriginal status, TRAS score and months in custody, were significantly associated with outcomes.

Table 3. Logistic regression modelling of combination of intensive program and other interventions dosage, and reoffending.

Variable	General reoffending				Serious reoffending			
	B	OR	95% CI	p	B	OR	95% CI	p
Ratio	0.27	1.31	[.67 2.54]	.41	0.09	1.1	[.58 2.08]	.77
Total Dosage	-0.002	0.99	[.99 1.00]	<.001	-0.002	0.99	[.99 1.00]	.004
Age	0.005	1.005	[.99 1.02]	.36	0	1	[.99 1.02]	.93
Aboriginal Status (Y)	0.23	1.27	[1.04 1.54]	.01	0.12	1.12	[.93 1.35]	.20
TRAS Score	3.52	33.9	[15.1 76.2]	<.001	3.32	27.7	[13.0 58.7]	<.001
Months in Custody	-0.01	0.99	[.98 .99]	<.001	-0.01	0.99	[.98 .99]	.004

Education and other intervention dosage

After adjusting for covariates, we found a significant relationship between the level of diversity from education and other intervention dosage and both general and serious reoffending outcomes. The odds of both general and serious reoffending reduced by 6% with every 0.1 increase in intervention diversity comprising education and other intervention dosage. We also found a significant association between several covariates, including total dosage, and both general and serious reoffending outcomes.

⁵ Given our method of calculating ratios and associated statistical challenges, it was not possible to assess whether the effects of differing levels of diversity varied according to whether proportions were increasingly biased towards intensive programs or education specifically.

Table 4. Logistic regression modelling of combination of education and other interventions dosage, and reoffending.

Variable	General reoffending				Serious reoffending			
	B	OR	95% CI	p	B	OR	95% CI	p
Ratio	-0.58	0.55	[.31 .99]	.04	-0.57	0.56	[.31 1.01]	.05
Total Dosage	-0.002	0.99	[.99 1.00]	.002	-0.002	0.99	[.99 1.00]	.02
Age	0.005	1.005	[.99 1.02]	.38	-0.001	0.99	[.99 1.02]	.88
Aboriginal Status (Y)	0.24	1.27	[1.04 1.54]	.01	0.12	1.13	[.93 1.35]	.20
TRAS Score	3.5	33.09	[14.7 74.2]	<.001	3.3	27.12	[12.7 57.5]	<.001
Months in Custody	-0.01	0.99	[.98 .99]	<.001	-0.01	0.99	[.98 .99]	.003

In summary, these results indicate when compared to receiving dosage predominantly in the form of a single category of intervention, increasing diversity of interventions stemming from a combination of intensive and education program dosage, as well as a combination of education and other interventions, was associated with significant reductions in the odds of general and serious reoffending. These relationships were significant after adjusting for the effects of total dosage, which were also significantly associated with reoffending outcomes in all models.

CONCLUSIONS

The IP model delivers tailored intervention dosage to higher risk individuals, comprising a diverse set of programs and services that participants receive while in custody. While total intervention dosage under the IP model has been associated with reduced reoffending (Mahajan et al., 2025), the specific contributions of dosage from individual intervention categories, as well as the impact of variation in dosage composition and combinations, were unclear. This study provides insights into two key questions: whether dosage from specific intervention categories can be independently associated with reoffending outcomes, and whether diversity as indicated by combinations of intervention categories is relevant to effectiveness in reducing reoffending among individuals who have completed their allocated intervention pathways.

Our results indicated that dosage received from any single category of intervention did not appear to be associated with reoffending outcomes, after cumulative dosage received from multiple interventions were taken into consideration. That is, receiving greater amounts of intensive programs, education or other interventions specifically did not explain additional variance in participants' outcomes, over and above the effects of receiving higher amounts of intervention dosage in total. This suggests that overall engagement in programs and services to accumulate increasing dosage, with the notable caveat that these fell within IP model metrics of what constitutes suitable interventions to address reoffending risk (see Mahajan et al., 2024a), may have been more relevant to reoffending outcomes than the specific type of programs and services received. An implication is that case planning may benefit from approaches that optimise the potential for dosage delivery, such as allocating interventions according to individual relevancy and likelihood of engagement, as compared to privileging certain types of intervention. We also acknowledge that null effects of individual interventions may be related to statistical limitations in isolating category-specific dosage from total dosage received.

Extending on these results, our analysis also indicated that after controlling for variation in the total amount of dosage, receiving a more diverse combination of dosage from two categories of intervention was associated with lower reoffending compared to predominantly receiving a single category of intervention. These findings suggest that the benefits of increasing total dosage may be augmented by delivering this in a variety of intervention types. These results build on previous empirical evidence, which found incremental improvements in reoffending outcomes when individuals engage in multiple interventions compared to a single intervention (Hsieh et al., 2022), and indicate such findings may be a function of both increased variety of interventions as well as increased overall dosage received. Diverse combinations of interventions may have the potential to reduce a greater range of criminogenic needs, in turn reducing the likelihood of reoffending; this may particularly be the case for higher risk individuals who tend to have a more complex

and intersecting presentation of dynamic risk factors. Theoretical frameworks such as social learning theory and the normalisation hypothesis offer insight into why diverse and integrated interventions may be more effective than standalone approaches. Social learning theory suggests that combining cognitive restructuring techniques (e.g., CBT) with skill-building programs (e.g., vocational training) can reduce reoffending by encouraging prosocial behaviours (Gruman et al., 2017). Similarly, Harer's (1995) normalisation hypothesis posits that integrated interventions can help to foster prosocial norms that promote desistance from crime.

Considering the pattern of results from our analyses of diversity ratios across combinations of interventions, it appears that those involving education were more consistently associated with reoffending outcomes than those involving intensive programs or other interventions. This could suggest a potentially important role of education in a more holistic or diverse set of interventions. Education programs could help to develop cognitive and other skills that augment the benefit of CBT-based programs (Hsieh et al., 2022; Vansteenkiste et al., 2004) or could in turn become more effective when combined with other interventions that promote self-regulation or support reintegration (Eccleston & Sorbello, 2002). Interpretation of how specific categories of intervention function within diverse combinations is limited, however, by statistical factors associated with imbalance in the amounts and ratios of dosage contributed by different categories under the IP model. For example, the null finding for diversity in intensive programs and other interventions may be attributable to the substantially higher dosage delivered by intensive programs relative to other interventions for almost all participants. Similar statistical factors necessitated a simplified ratio-based approach to testing combinations of interventions which gave insights about diversity effects overall, although did not allow us to estimate whether these effects varied when ratios were more or less biased towards specific categories of intervention such as education.

A notable strength of this study was our comparison of people who had all completed their intervention pathway. This mitigated the confounding effect of attrition on variance in how much dosage participants received, and improved equivalence in important unobserved factors such as ability and motivation to engage in interventions. However, it remains possible that effects of both intervention dosage and intervention diversity could be partly explained by variance in the propensity of participants to engage in both voluntary components of intervention pathways, particularly education and vocational training, as well as mandatory components.

We acknowledge that this is an exploratory study in an under-researched area, and it identifies a number of challenges about how to assess the effects of dosage from different types of interventions in combination. Nonetheless, our findings indicate that mechanisms of change in custody-based interventions may be related to these effects in important ways. Results suggest accumulation of greater overall dosage is more reliably related to reoffending, as compared to the contribution of any specific category of intervention. Additionally, higher risk individuals show more pronounced reductions in reoffending when they receive dosage from a more balanced or diverse combination of interventions rather than a single intervention alone. Our findings appear to support the notion that integrating various interventions and engaging in multiple programs and services can improve the efficacy of correctional programming. While this study provides novel insights about the comparative, cumulative and interactive effects of interventions on reoffending outcomes, there is ample scope for further research in this area to better inform best practice principles of holistic and person-centred rehabilitative case management of people in custody.

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