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Examination of treatment dosage delivered through the Intervention Pathways Model

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Aims

To examine treatment dosage delivered to inmates under the Intervention Pathway (IP) model. We aimed to determine the intensity of dosage delivered across pathways and explore the relationships between dosage and risk of reoffending.

Methods

The sample included 12,047 male inmates who were either assigned to or had completed their intervention pathway before 31 March 2023. A combination of descriptive statistics, correlation analyses and trend analyses were employed to achieve the aims of this study.

Results

Inmates assigned an intervention pathway received an average of 95 hours of total dosage, which compares to 194 hours for those who had completed their pathways. Intensive criminogenic and education programs contributed the most to total intervention dosage across both cohorts. Aboriginal inmates received more criminogenic, non-criminogenic programs and case management services-related dosage than non-Aboriginal inmates. Pathways targeting short-sentenced inmates, younger adults and higher risk inmates enrolled in Macquarie Intensive Program (MIP) received the most intensive dosage per month relative to other pathways. A substantial proportion (77%) of inmates assigned to or completed their pathways were assessed as being at higher risk (Custody TRAS $\geq$ .35); within this cohort, dose-risk relationships were primarily weak and mixed across dosage categories and pathways.

Conclusion

This study demonstrated that dosage is a complex construct, and a number of dimensions are relevant to evaluating how the IP model, and individual intervention pathways, deliver outcomes. Important considerations include number of hours delivered as well as the intensity of dosage, attrition, types of intervention, and relationships with participant risk. We found promising indications that the IP model has potential to meet objectives to deliver adequate dosage to higher risk inmates while accounting for their sentence length and needs. Continuous development to address sources of participant attrition, including those related to the advent of COVID-19, would be beneficial to improve dosage delivery outcomes for the model across intervention pathways.

INTRODUCTION

Correctional centres offer various behavioural intervention programs developed on evidence-based best practice principles. In particular, Corrective Services New South Wales (CSNSW) correctional centres offer a range of interventions centred on the Risk Needs Responsivity (RNR) model, underpinned by three core principles (Bonta & Andrews, 2016). The risk principle states that interventions should match an inmate's risk of reoffending; the need principle states that interventions should address an inmate's criminogenic needs; and the responsivity principle states that interventions should be delivered in a manner that accommodates an inmate's learning style, abilities, and strengths.

One crucial element underpinned by the risk principle is the intensity of intervention or dosage of treatment. The risk principle proposes that a significant amount of intervention dosage should be directed to inmates assessed as being higher in risk (Bonta & Andrews, 2016). Considerable evidence exists in support of the risk principle, indicating that interventions are most effective at reducing reoffending and influencing behaviour change when higher risk inmates are provided with higher intensity treatment compared to lower risk inmates (Latessa et al., 2010; Sperber & Lowenkamp, 2017). To achieve favourable intervention outcomes related to reoffending, it has been suggested that 100 – 300 hours of dosage is sufficient for inmates with moderate to high risk of reoffending (Bourgon & Armstrong, 2005; Day et al., 2019; Markarios & Latessa, 2013).

Delivering sufficient intervention dosage to inmates can be challenging, however. A substantial number of individuals are sentenced to less than one year in custody, thereby limiting opportunities for interventions to achieve sufficient dosage (Mahajan et al., 2020; 2021). High program attrition rates are also typical of intensive correctional programs (Bosma et al., 2014; Brunner et al., 2019; Mahajan et al., 2022), which can significantly impact the delivery of intended dosage. Program literature indicates administrative exits (such as parole, sentence reduction on appeal, and security concerns) are often the primary reasons for non-completion and reduced dosage in intervention programs (Mahajan et al., 2022; Marques et al., 1994; Wormith & Olver, 2002). Recent evaluations on behaviour change interventions have also implicated logistical issues that affect treatment commencement, including the location of correctional centres where programs are delivered, insufficient time to deliver interventions, and inefficient use of eligibility and suitability criteria. These factors impact overall treatment dosage (Bower et al., 2023; Howard & Chong, 2019; Zhang & Howard, 2019). Hence, efficient use of resources, innovative program eligibility and suitability assessments, and appropriate program allocation are necessary to deliver adequate interventions (Bower et al., 2023). This could ensure higher risk inmates receive interventions and adequate dosage following the risk principle (Bonta & Andrews, 2016).

In 2020, CSNSW developed an initiative called the Intervention Pathways (IP) model to increase interventions for higher risk offenders and to improve intervention allocations. An intervention pathway can be described as a cluster of custody-based programs, services, and educational interventions. Utilising novel and innovative automated and non-automated decision-making tools, the IP model allocates newly sentenced offenders to different intervention pathways within the constraints of an inmate's sentence length, risk and needs, and other eligibility considerations. The IP model restructures the delivery of custody-based interventions and services and is supported by improvements in the classification and placement of offenders, case planning and assessment processes. To reduce reoffending, the IP model aims to align programs, services, and education to ensure

sufficient intervention dosage for higher risk offenders. Further, the IP model integrates existing interventions and is supported by the development of new intervention modalities, such as the Short Sentence Intensive Program (SSIP). The SSIP delivers offence-related interventions and reintegration services to higher risk inmates with less than five months to serve in custody and who have had historically fewer opportunities for intervention (Ross et al., 2023).

Once an inmate commences their custodial sentence, an algorithm (Criminogenic Program Eligibility Overview) incorporates time to serve in custody and their Custody TRAS score (calculated by an automated tool developed by CSNSW to determine risk of general recidivism; see Raudino et al., 2019 for details) to assess their eligibility for various intervention pathways. If found eligible, custodial staff use a pathway-specific assessment tool, the Most Appropriate Program Pathway (MAPP), to identify the most appropriate intervention for inmates based on their needs. A Pre-Program Suitability Assessment (PPSA) is then used to determine an inmate's suitability for a specific intervention indicated by the MAPP. Given the outcome of this assessment, the inmate is then enrolled in an intervention pathway that includes intensive criminogenic and non-criminogenic interventions, reintegration services, education programs and other offence-specific case management activities.

The current study

The IP model is complex in design as it aims to align multiple interventions, services and treatment modalities using several assessment tools for inmates across various pathways. Given the scope and multifaceted processes associated with the IP model, there are various challenges to successful implementation and efficiency. These challenges primarily relate to allocating higher risk inmates to different clusters of interventions and delivering interventions corresponding to their sentence length, risk, needs, and other considerations while ensuring the model's operational efficiency. One of the primary objectives of the IP model is to deliver intervention dosage to inmates, aligning with their risk and the constraints of their sentence length. To this end there is a need for comprehensive evaluation to understand the model's dosage delivery-related outcomes across intervention pathways.

The primary aim of the current study was to examine the amount and nature of dosage delivered to inmates by the IP model, including those who were assigned to and those who completed their intervention pathways. Given that an objective of the model is to improve intervention efficiency by integrating dosage from multiple sources, the current study explored the contributions of high-intensity criminogenic programs, non-criminogenic/other programs, reintegration services, case management activities, and education programs towards total dosage. Analyses intended to examine the delivery of dosage both as a function of the IP model overall and also by comparing and contrasting individual pathways that inmates were assigned to or completed. We also examined trends in dosage delivered across the operational period of the IP model.

Substantial evidence in support of the risk principle has demonstrated that interventions that allocate intensive programs, a greater number of services and other ancillary activities to higher risk inmates are most likely to have a positive impact (Lowenkamp et al., 2006; Lovins et al., 2007; Sperber et al., 2013). Thus, a secondary aim of this study was to examine the intensity of intervention dosage within the constraints of inmates' sentence length and how this relates to the risk profile of recipients. In particular, we explored relationships between dosage and risk of general reoffending to determine if higher risk offenders were amenable to specific interventions in the IP model.

The current study addresses the following key research questions:

1) What is the average dosage delivered across each intervention pathway, and what are the contributions of different types of dosage within the IP model?
2) What is the intensity of intervention dosage delivered across each pathway as a function of the length of participants' custodial sentences?
3) What is the relationship between the risk of reoffending and dosage delivered across various intervention pathways?

METHODS

Participants and intervention context

The sample comprised 12,047 male inmates who had an intervention pathway classification status and had finished their custodial sentence before 31 March 2023. Among this sample, 10,095 inmates were assigned an intervention pathway (assigned cohort), and 1,952 inmates had completed their pathway before leaving custody (completed cohort)[1].

Under the IP model, inmates are assigned to eight primary intervention pathways, which are identified in reference to the main intensive program(s) involved in the pathway. Two pathways target higher risk inmates serving shorter sentences. High Intensity Program Units (HIPU) deliver intensive interventions and services over 16 weeks to inmates serving less than one year in custody, and the SSIP delivers interventions to inmates with less than five months to serve. Inmates serving sentences for violent offences receive treatment under the Violent Offender Therapeutic Program (VOTP), and inmates with sexual offences are assigned to Sex Offender Programs (SOP). Inmates with serious substance abuse problems are delivered interventions through the Intensive Drug and Alcohol Treatment Program (IDATP). The Young Adult Offender Program (YAOP) is designed to deliver interventions to young male inmates under the age of 26 and serving between 5 months and 3 years. Like the HIPU, the Macquarie Intensive Program (MIP) delivers intensive interventions over 16 weeks at Macquarie Correctional Centre to inmates who are not able to be included in other interventions due to placement and suitability issues. The EQUIPS suite of programs consists of a foundation program (general offending) and three offence-specific programs related to aggression, domestic abuse and addiction, addressing inmates' criminogenic needs.

Table 1 provides the sample sizes across eight intervention pathways for assigned and completed cohorts. Of the total inmate sample, around one in five inmates assigned to pathways under the IP model completed their pathways.

Data sources

Data for the current study were extracted from the Offender Integrated Management System (OIMS). OIMS is the central operational database maintained by CSNSW to support management of people in custody and under supervision in the community. The variables extracted from OIMS were the inmate's demographic characteristics, sentence-related variables, and Custody TRAS score. Intervention-related data such as intervention pathway status, criminogenic and non-criminogenic/other program dosage, services and reintegration dosage hours and

[1] Inmates who commenced serving their custodial sentences prior to implementation of the IP model but had since been assigned an intervention pathway status were included in the sample. Also, there were instances where inmates were allocated multiple intervention pathways within the same custodial sentence. To avoid over-reporting dosage, we counted only the most recent intervention pathway status and dosage.

Table 1. Number of inmates across the assigned and completed cohorts

Pathway	HIPU	EQUIPS	SSIP	VOTP	SOP	IDATP	YAOP	MIP	Total
Assigned	2661	1716	3682	473	752	570	138	103	10095
Completed (%)	1182 (44%)	69 (4%)	257 (7%)	116 (25%)	151 (20%)	36 (6%)	83 (60%)	58 (56%)	1952 (19%)

education program hours delivered to inmates were also extracted from OIMS.

Analytical Plan

Intervention Pathway dosage analysis

Descriptive statistics were used to report inmates' total dosage for assigned and completed cohorts. The assigned cohort included inmates whose participation in a pathway that had either been completed, partially completed, or not completed due to reasons such as parole, additional convictions, transfer to another location and program unsuitability. The total dosage comprised the following categories of intervention programs and services[2]:

- *Criminogenic/Intensive Programs*: HIPU; VOTP; SOP; IDATP; EQUIPS; YAOP; SSIP, MIP
- *Non-criminogenic/Other Programs*: Real Understanding of Self-Help (RUSH); CONNECT; Cultural Strengthening Programs; Traffic intervention program; Well-being and parenting programs.
- *Services:* Case Management; HIPU Reintegration; In-Cell Programs; SOP- Community Based.
- *Reintegration*: NEXUS and its variants.
- *Education Programs*: Foundational; Vocational; Intensive Learning Centre.

Descriptive statistics were used to determine the contribution of different dosage categories to total dosage. To compare differences in intervention dosage delivered to Aboriginal and non-Aboriginal inmates, we used non-parametric Mann-Whitney U tests.

We analysed trends in total dosage per sequential month between July 2020 and March 2023 for each pathway. A non-parametric Mann-Kendall Trend test was employed to assess the significance and direction of dosage trends. Intervention dosage trends were fitted with non-parametric polynomial regression (quadratic lines).

In order to give additional nuance to understanding dosage delivered by the IP model, we also computed time-adjusted monthly dosage statistics by dividing the dosage delivered to each inmate by the sentence served in custody. The time-adjusted dosage represented an alternative index of the intensity of dosage received by inmates, taking into account the dependence between sentence length and opportunities to deliver intervention dosage.

Dose-risk relationships

Using percentile statistics, we first assessed the distribution of risk of general reoffending scores as assessed by the Custody TRAS across all pathways. We determined the proportion of higher risk inmates who were allocated to various pathways. We determined the relationships between risk of general

[2] The details of various categories of intervention programs and services are provided in CSNSW compendium of offender services and programs available publicly: https://correctiveservices.dcj.nsw.gov.au/documents/programs/CSNSW_Compendium_of_Offender-Behaviour_Change_Programs.pdf

reoffending assessed by the Custody TRAS and the average total dosage for individual intervention pathways using a series of bivariate correlation analyses (Pearson's product correlation). We also replicated the dose-risk relationships analyses with time-adjusted dosage figures as an alternative index of intensity. For this subset of analyses we also explored how dose-risk relationships varied as a function of intervention category; to do this, we computed time-adjusted dosage for the total, combined program (intensive and other programs) and combined reintegration and other services (SR) dosage.

RESULTS

Average intervention dosage across intervention pathways

When considering all pathways in aggregate, the average total dosage for the assigned cohort was 9 hours. This compares to 194 hours delivered to higher risk inmates who completed their pathways. Across individual pathways, the average total dosage ranged between 19 and 310 hours for the assigned cohort, and the total dosage ranged between 66 and 473 hours for the completed cohort (see Table 2).

Among these pathways and for both cohorts, the highest intervention dosage was delivered in the VOTP pathway, followed by the SOP and IDATP pathways. Inmates who completed the VOTP, SOP and IDATP pathways received more than 350 hours of total intervention dosage on average, relative to a range of 159 to 262 hours for the HIPU, YAOP, IDATP, and MIP pathways. Inmates in the SSIP pathway received the lowest average dosage, which is expected due to their shorter sentences.

Across all intervention categories, the dosage delivered to the completed cohort was, on average, higher than that of the assigned cohort. For example, the average intensive program dosage ranged between 25 and 240 hours for the completed cohort and between 5 and 127 hours for the assigned cohort (see Appendix 1 for details). Similarly, average education dosage across pathways ranged between 10 to 225 hours and 5 to 164 hours for the completed and the assigned cohort, respectively. High variation in average dosage was observed for the assigned cohort relative to the completed cohort.

Descriptive statistics for average dosage delivered by pathway and intervention category are given in Appendix 1. Across individual pathways for both cohorts, inmates assigned to the VOTP pathway received the highest intensive program dosage, followed by the SOP, and IDATP pathways. In contrast, for both cohorts, pathways targeting short-sentenced inmates, such as the HIPU and the SSIP, delivered more reintegration dosage relative to other pathways. The HIPU and MIP pathways also delivered more non-criminogenic/other program dosage. The average dosage for education was observed to be substantially higher for the SOP and VOTP pathways than other pathways. The IDATP pathway provided the greatest amount of services-related dosage, followed by the SSIP pathway, relative to other pathways.

Contributions of different intervention categories to total dosage

Figures 1 and 2 illustrate the contribution of intensive programs, non-criminogenic/other programs, reintegration, case management services, and education dosage to the total intervention dosage across all pathways for assigned and completed cohorts.

Table 2. Average (SD) total dosage (hours) for the assigned and completed cohorts across pathways.

Pathway/ Cohort	HIPU	EQUIPS	SOP	VOTP	SSIP	IDATP	YAOP	MIP
Assigned	97.5 (86.9)	122.8 (158.6)	226.0 (309.4)	310.2 (305.5)	19.2 (36.8)	137.0 (177.8)	126.2 (111.9)	118.7 (85.0)
Completed	159.1 (71.2)	262.7 (258.3)	473.2 (364.9)	457.3 (309.0)	66.2 (58.6)	386.0 (411.4)	167.4 (114.6)	166.1 (72.3)

Across pathways, the dosage of intensive programs contributed most to the total dosage (Assigned: 45%; Completed: 61%), followed by education programs (Assigned: 35%; Completed: 31%). The contribution of different categories of dosage varied between individual pathways, however. For the assigned cohort, while intensive program dosage contributed most to the total dosage for the HIPU (61%), YAOP (66%) and MIP (55%) pathways, education dosage contributed predominantly to the SOP (66%) and VOTP (53%) pathways. These dosage categories contributed equally to EQUIPS, SSIP and IDATP pathways (see Figure 1). For the completed cohort, intensive programs contributed to the total dosage for most of the pathways (HIPU, 66%; SSIP, 38%; YAOP, 70%; MIP, 59%; IDATP, 51%; VOTP, 53%) and education and intensive programs equally contributed most for EQUIPS and SOP pathways (see Figure 2).

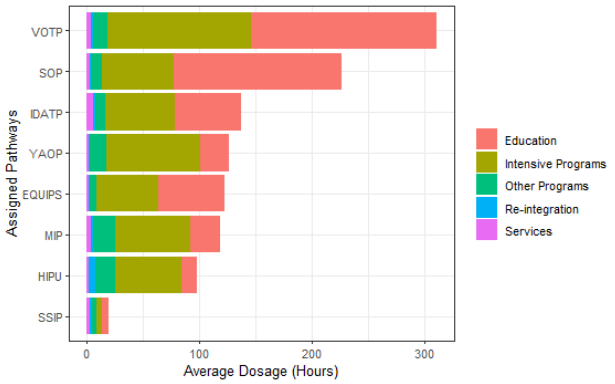

Figure 1. Contribution of intensive programs, non-criminogenic/other programs, reintegration, services, and education programs across various intervention pathways for the assigned cohort.

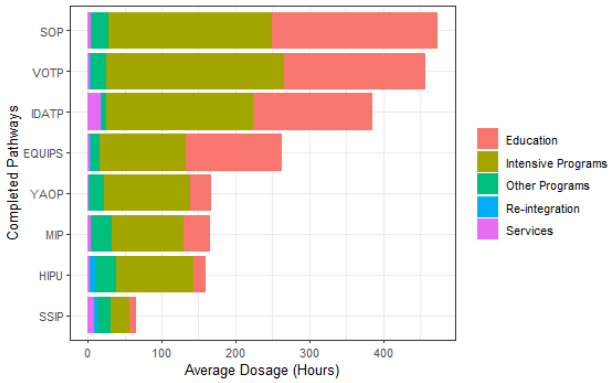

Figure 2. Contribution of intensive programs, non-criminogenic/other programs, reintegration, services, and education programs across various intervention pathways for the completed cohort.

Trends in intervention dosage

Analyses of trends examined intervention dosage for inmates in the assigned and completed cohorts since the implementation of the IP model in 2020. Figure 3 depicts the average total dosage delivered to inmates with assigned (left panel) and completed (right panel) intervention pathways per month between July 2020 and March 2023. Over this period, the average monthly rate of change in total dosage for the assigned cohort was −26.4%, concurrent with a significant declining trend ($\tau = -0.40$, $p = <.001$). In the completed cohort, the average monthly rate of change in total dosage was −35.5%, consistent with a significant decline ($\tau = -0.31$, $p = .009$).

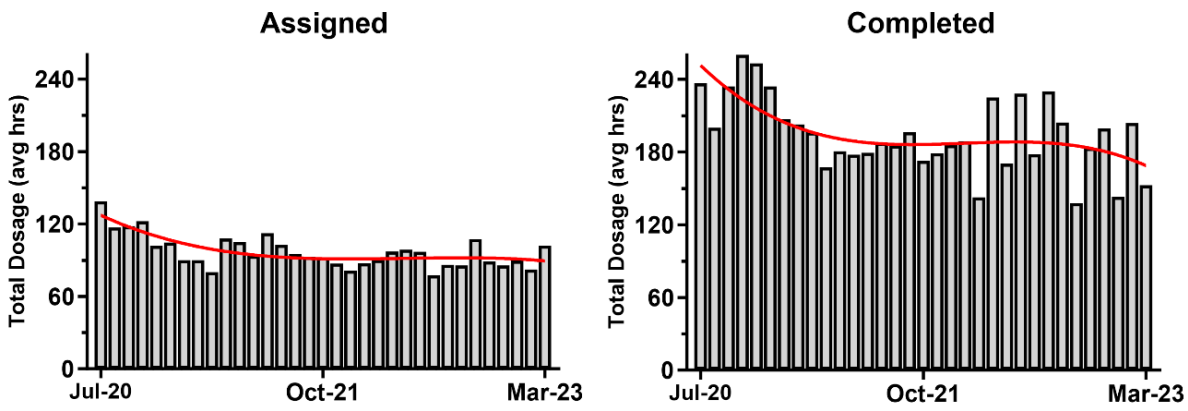

Figure 3. Trends in total dosage across all the intervention pathways for the assigned and completed cohorts.

For individual pathways, while HIPU showed a significant declining trend (τ = -0.42, p = <.001) in the assigned cohort, there was a significant increasing trend in total dosage across the SOP (τ = 0.41, p = <.001), SSIP (τ = 0.45, p = <.001) and IDATP (τ = 0.33, p = .009) pathways. In contrast, in the completed cohort, only the EQUIPS pathway (decline; τ = -0.50, p = <.001) and the MIP pathway (growth; τ = 0.33, p = <.001) showed significant trends in total dosage. All other trends observed for individual pathways were statistically non-significant.

Average intervention dosage and Aboriginal status

Figure 4 below and Appendix Tables 2 and 3 indicate the total dosage and dosage in various categories across pathways for Aboriginal and non-Aboriginal inmates. Among those in the assigned cohort, non-Aboriginal inmates (Mean (M) = 101 hours) received significantly higher total dosage than Aboriginal inmates (M = 85 hours; z = -5.92, p < .001). On average, non-Aboriginal inmates also received significantly higher education dosage than Aboriginal inmates; in contrast, no significant differences were observed between Aboriginal and non-Aboriginal inmates in terms of intensive programs, non-criminogenic/other programs, services-related dosage, and reintegration dosage. For assigned individual pathways, Aboriginal inmates received significantly more services-related dosage than non-Aboriginal inmates for the HIPU, EQUIPS and SOP pathways. There were no differences between the groups for the remaining pathways.

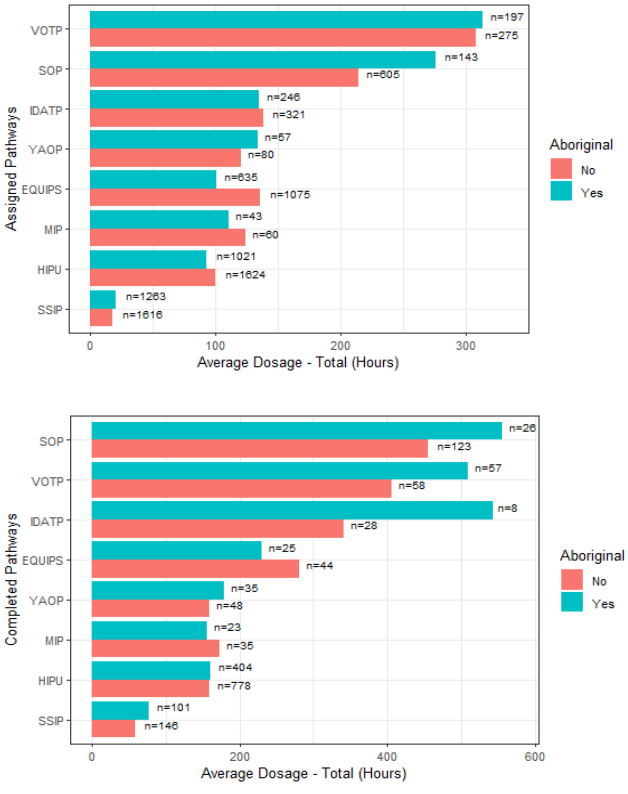

Figure 4. Average total dosage hours across intervention pathways for Aboriginal and non-Aboriginal inmates in the assigned and completed cohorts.

In the completed cohort, there was no statistically significant difference in total dosage delivered between Aboriginal (M = 196 hours) and non-Aboriginal inmates (M = 193 hours). No significant differences were found in the different categories of dosage received by Aboriginal and non-Aboriginal men in this cohort. For completed individual pathways, Aboriginal short-sentenced inmates received significantly more intensive program dosage in the HIPU and SSIP pathways compared to non-Aboriginal inmates. Furthermore, Aboriginal inmates received more services-related dosage in the HIPU, EQUIPS, MIP and YAOP pathways, and more non-criminogenic/other programs dosage in the SSIP pathway.

Distribution of risk of reoffending scores across intervention pathways

Overall, the average risk of reoffending was around .50 (corresponding to a 50% likelihood of general recidivism within two years) for both the assigned and completed cohorts. Except for the SOP pathway, inmates allocated to different pathways also had an average risk of around .50, ranging between .47 and .55 across both cohorts (see Table 3). Most inmates assigned to or who completed SOP pathways had a lower risk of general reoffending; this is expected, considering that allocation to the SOP pathway is uniquely determined by the assessed risk of sexual recidivism as compared to the Custody TRAS score. Figures 5 and 6 illustrate the distribution of the probability of risk based on Custody TRAS scores across inmates who were assigned to and completed intervention pathways, respectively.

The percentile statistics from these distributions revealed that, overall, 81% of inmates in the assigned cohort had Custody TRAS scores of ≥.35. Around 77% of inmates who completed their pathways had Custody TRAS scores of ≥.35. In contrast, around 20% of inmates across both cohorts had risk scores less than .25. These results indicate that substantial and comparable proportions of inmates who were assigned to and completed pathways were assessed as being at elevated risk of reoffending.

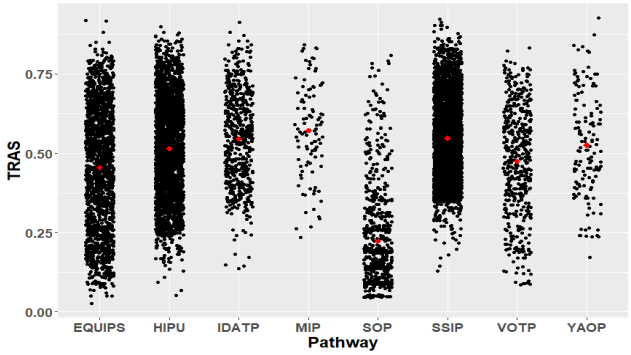

Figure 5. Distribution of risk of reoffending scores across intervention pathways for the assigned cohort. The red dot represents the mean Custody TRAS score.

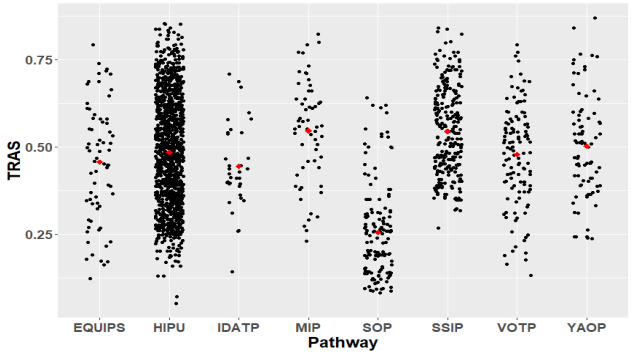

Figure 6. Distribution of risk of reoffending scores across intervention pathways for the completed cohort. The red dot represents the mean Custody TRAS score.

Table 3. Mean Custody TRAS scores across assigned and completed intervention pathways.

Pathway	HIPU	EQUIPS	SOP	VOTP	SSIP	IDATP	YAOP	MIP	Total
Assigned	.51	.45	.22	.47	.55	.55	.53	.57	.50
Completed	.48	.46	.25	.48	.54	.44	.50	.55	.49

Time-adjusted intensity of dosage delivered across intervention pathways

We computed the average time-adjusted dosage per inmate per month to represent the intensity of dosage as an alternate form of dosage, after taking into account the interdependency between sentence length and opportunities to deliver intervention dosage. Figure 7 represents time-adjusted calculations for assigned and completed cohorts across pathways for total dosage, as well as condensed categories of program (intensive and non-criminogenic/other programs) dosage and reintegration and services dosage.

Across both cohorts, the YAOP, HIPU, SSIP and MIP pathways delivered more intensive total dosage per month (average of 14 hours), relative to other pathways (average of 7 hours; see Figure 7). Comparable results were observed for time-adjusted total program dosage, with the YAOP, HIPU, SSIP, and MIP pathways delivering more dosage (average of 12 hours) than other pathways (average of 4 hours). The SSIP and HIPU pathways delivered more services and reintegration-related dosage per month (average of 2 hours) across both cohorts relative to other pathways (less than 1 hour).

Relationships between risk of reoffending and dosage

We first explored relationships between total dosage delivered to higher risk inmates across different pathways and their risk of reoffending (see Table 4). For inmates in the assigned cohort, analyses revealed significant weak negative relationships between total dosage and risk for the HIPU, EQUIPS, VOTP, IDATP and MIP pathways. These results indicate that an increase in risk was related to a decreasing delivered dosage to inmates assigned to these pathways. In contrast, no statistically significant dose-risk

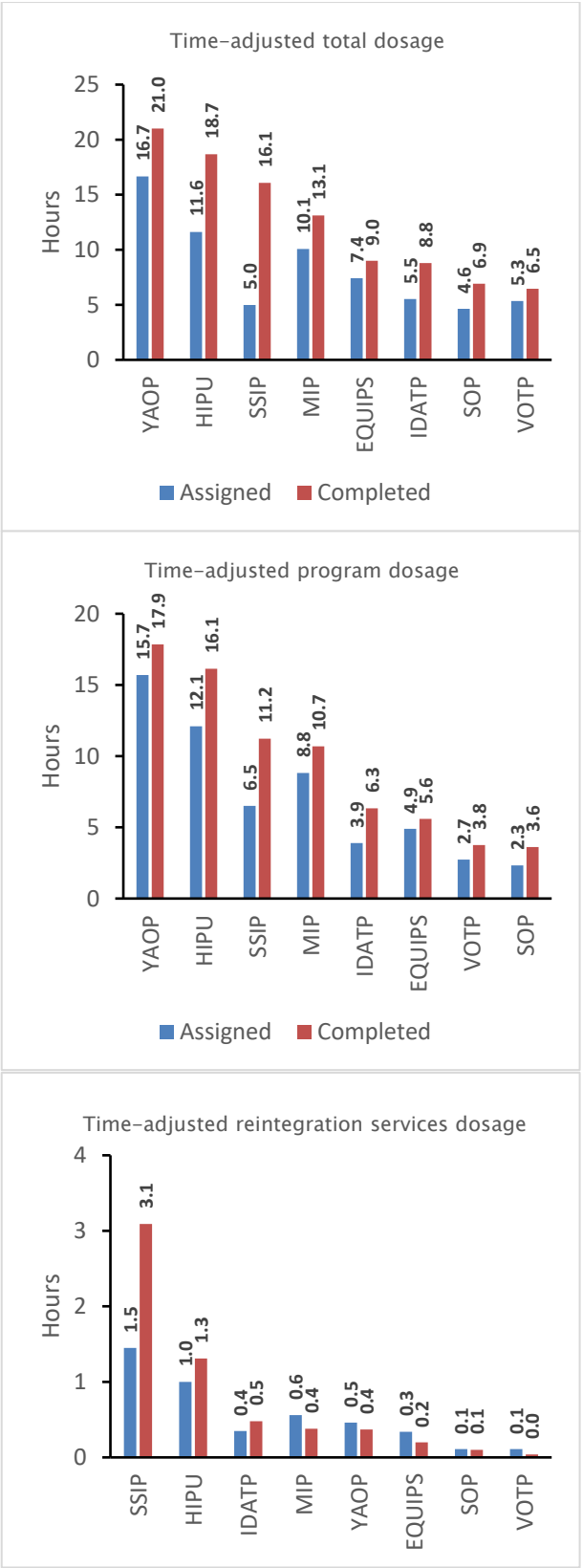

Figure 7. Total time-adjusted (dosage delivered per month) dosage, total program time-adjusted dosage and time-adjusted services and reintegration dosage across individual pathways for both cohorts.

relationships were found for inmates who completed their pathways.

An exception to this pattern of results was the SOP pathway, where a significant weak-moderate association between dosage and risk was found for both the assigned and completed cohorts. This indicates that as inmates' risk of general recidivism increased their dosage received also increased.

Table 4. Relationships between total dosage for assigned, completed intervention pathways and risk of reoffending.

Pathway	Assigned			Completed		
	r	N	*p*	*r*	N	*p*
HIPU	-.19	2647	<.001	-.007	1182	.82
EQUIPS	-.24	1714	<.001	-.24	69	.05
SOP	.10	747	.005	.29	148	.005
VOTP	-.16	470	<.001	-.07	116	.47
SSIP	.02	3529	.16	.01	247	.84
IDATP	-.01	564	.02	.05	35	.79
YAOP	-.14	138	.10	-.05	83	.69
MIP	-.20	102	.04	.08	58	.54

We replicated these correlation analyses using our time-adjusted calculation of dosage. For time-adjusted total dosage, we found a weak negative dose-risk relationship ($r = -.13$, $p < .001$) for the assigned HIPU pathway and a weak positive dose-risk relationship ($r = .16$, $p < .001$) for the assigned SOP pathway. There were no significant relationships for the completed cohort.

Additional analyses explored patterns of associations between time-adjusted dosage and risk for combined categories of intervention. For programs, we found a weak to moderate positive dose-risk relationship for inmates assigned to the SOP pathway ($r = .17$, $p < .001$) and those who completed EQUIPS pathway ($r = .27$, $p < .05$). The time-adjusted total program dosage for those assigned to the HIPU pathway ($r = -.13$, $p < .001$) and those assigned to ($r = -.06$, $p < .05$) or who completed the SSIPs ($r = -.16$, $p < .05$) was negatively related to risk.

For reintegration and services-related time-adjusted dosage, we found significant positive dose-risk relationships for assigned ($r = .16$, $p < .001$) and completed cohorts in the EQUIPS pathway ($r = .33$, $p < .01$) and for inmates assigned to the SOP pathway ($r = .15$, $p < .001$). For the rest of the pathways, correlations between time-adjusted dosage and risk were not significant.

CONCLUSIONS

The IP model represents an innovation in correctional practice by developing an integrated system that allocates higher risk inmates who are more likely to reoffend to various intervention pathways as per their sentence length, risk, and needs. This study raised insights about a number of dimensions that are relevant to the success by which pathways of intervention deliver dosage, including the total hours of dosage received; the intensity of delivery; the nature or type of intervention; the role of attrition; and associations with risk.

Our results indicated that the IP model is well structured to achieve objectives relating to delivering prescribed hours of dosage to higher risk inmates. For those who completed pathways, average total hours of intervention of more than 350 hours were observed for the VOTP, SOP and IDATP pathways; more than 250 hours for the EQUIPS pathway; and 150-170 hours for the HIPU, YAOP, and MIP pathways. These outcomes are broadly aligned with existing empirical literature informing recommendations for the duration of effective behaviour change interventions (e.g., Bourgon & Armstrong, 2005; Day et al., 2019; Markarios & Latessa, 2013). Lower hours of dosage were

observed for the SSIP pathway, averaging at 66 hours; however, this is consistent with the design and intended function of this intervention to service individuals who have short custodial sentences, which will be discussed in greater detail later.

While these outcomes demonstrate the potential for the IP model to deliver dosage, the results demonstrated that a critical moderating factor for dosage outcomes is pathway completion. Inmates in the completed cohort consistently received greater dosage on average than those in the assigned cohort. High program attrition rates among inmates in the assigned cohort likely contributed substantially to the differences in dosage between these cohorts. Correctional programs often have high attrition and low participation rates, with various administrative, logistical and motivational factors being influential (Howard & Chong, 2019; Mahajan et al., 2022; Zhang & Howard, 2019). Consistent with this, we found that only 24% of inmates in our sample completed their intended pathways. An implication is that whereas the IP model may have the capacity to deliver the intended dosage to individuals who remain in pathways, overall dosage outcomes at the population level are diluted as rates of attrition increase. There is a need for ongoing development of operational and therapeutic processes to support participation engagement in order to optimise dosage outcomes of the IP model. This may be particularly relevant given that Aboriginal participants were found to receive lower dosage than non-Aboriginal participants in the assigned but not completed cohorts, suggesting that attrition may be a factor in disparate cross-cultural therapeutic outcomes.

Differences in the gross hours of dosage delivered across pathways highlight that such outcomes are also inherently influenced by the window of opportunity for intervention, which in this case is characterised by the length of inmates' custodial sentence. We accounted for this by developing an alternative time-adjusted index of the intensity of dosage delivered. In contrast to those pathways that delivered the highest total hours of dosage (e.g., VOTP, SOP, IDATP), inmates tended to receive the most intensive dosage in the HIPU, SSIP, YAOP and MIP pathways after adjusting for time to serve. While there is a dearth of empirical literature about therapeutic impacts of differing levels of intervention intensity, in terms of hours or sessions per week as opposed to total hours, these findings give insights into the importance of both designing and evaluating intervention pathways in reference to their delivery of dosage within the constraints of participants' sentence length.

An innovative feature of the IP model is that overall dosage is a function of the integrated delivery of multiple categories of intervention, reflecting the often complex and multimodal needs of higher risk inmates. Our findings showed that participants tended to receive the most substantial dosage from intensive programs across all pathways, which is consistent with the IP model's prioritisation of behaviour change interventions to address criminogenic needs as the core components of each pathway. Education was the second largest contributor to overall dosage and tended to accumulate among inmates allocated to the longer-term SOP, VOTP, and IDATP pathways, whereas contributions of reintegration and case management services tended to be highest for inmates serving shorter sentences in the HIPU and SSIP pathways. These global patterns are aligned with model objectives to tailor delivery of dosage to the duration and stage of inmates' time in custody. Whereas education has been established as an important dynamic risk factor for reoffending (Andrews et al., 2006) and there is a developing literature on impacts of reintegration services (e.g. Berghuis et al., 2018), there is currently little study into the relative and cumulative effects of multiple types of intervention on inmate outcomes. Planned future evaluations of the IP model are intended to expand on this evidence base by examining how intervention pathway dosage

and categories of dosage are associated with recidivism.

Another important consideration is how delivery of dosage aligns with the risk principle more broadly. Our results showed that the IP model has consistently met objectives to deliver dosage to higher risk inmates, with more than three quarters of the study sample having a Custody TRAS score corresponding to a recidivism risk of 35% or higher (Raudino et al., 2019). Within this high risk cohort, however, we found small albeit significant negative associations between risk and the level of dosage received. This could be indicative of reduced participant engagement with interventions as their risk of recidivism increases. Previous research has found that risk is often a predictor of treatment attrition (e.g., Brunner et al., 2019); consistent with this, negative associations between risk and dosage outcomes observed in the current study were more pronounced for the assigned cohort than the completed cohort. One exception to this pattern was that inmates allocated to the SOP pathway tended to receive greater dosage as their general recidivism risk increased. It is possible that past findings for an effect of CSNSW custodial sex offender programs on general reoffending outcomes (Halstead, 2016) may reflect relatively effective management of responsivity matters for those with higher nonspecific recidivism risk. We also found a positive relationship between ancillary categories of dosage and risk in some cases, which suggests that some higher risk participants may be amenable to these alternative forms of intervention in the event that their engagement in intensive programs is poor.

Some limitations of this study are noted. Critically, it is important to acknowledge that implementation of the IP model coincided with the COVID-19 pandemic, which had extensive impacts on all aspects of intervention delivery and correctional centre support systems. These impacts extend to initial establishment of the IP model in practice as well as key outcomes measured here such as total dosage and attrition. There would be value in continuing to monitor performance of the model as it matures into business as usual operations over time. Relatedly, the sample size for the completed cohort was relatively small for some intervention pathways and other sub-categories, which may have affected the statistical power of inferential analyses.

In sum, the current study demonstrates that in the context of interventions to address recidivism, dosage is a complex construct that requires consideration of more than total hours alone. This reflects the complexity of the IP model's objectives in delivering several streams of multimodal interventions within the constraints of participants' sentence length, risk and needs. Our results gave some promising indications about the IP model's potential to deliver intended amounts of dosage to higher risk inmates. Ongoing management of sources of attrition from intervention pathways, including those related to the impacts of COVID-19 over recent years, would be particularly beneficial towards optimising dosage outcomes and contribute to the IP models' aims in reducing reoffending among people in custody at both the individual and the population level.

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APPENDIX 1

Average dosage for assigned and completed cohorts

Cohort	Pathway	Total Dosage	Intensive	Others	Services	Reintegration	Education
Assigned	HIPUs	97.4 (86.9)	59.0 (54.3)	17.5 (18.8)	2.2 (3.9)	5.3 (6.5)	13.2 (46.7)
	EQUIPS	122.7 (158.6)	55.0 (51.4)	5.6 (20.5)	2.1 (3.0)	1.2 (1.7)	58.6 (135)
	SOP	225.9 (309.4)	63.7 (97.5)	9.4 (19.1)	2.6 (5.2)	1.3 (1.5)	148.8 (269)
	VOTP	310.1 (305.5)	127.2 (98.9)	13.2 (39.3)	3.6 (6.7)	1.8 (3.1)	164.3 (259)
	SSIP	19.2 (36.8)	4.7 (14.1)	4.3 (10.7)	3.0 (4.3)	1.7 (2.7)	5.3 (26.2)
	IDATP	136.9 (177.8)	60.9 (68.3)	9.6 (23.6)	5.5 (10.3)	1.8 (3.3)	59.0 (135)
	YAOP	126.2 (111.9)	83.1 (57.1)	14.4 (12.5)	2.0 (2.7)	1.1 (2.0)	25.5 (87.6)
	MIP	118.7 (85.0)	65.6 (45.9)	20.1 (17.1)	3.7 (3.7)	1.9 (2.7)	27.2 (54.2)
Completed	HIPUs	159.1 (71.2)	105.1 (35.7)	27.2 (16.7)	2.3 (4.4)	8.7 (7.2)	15.6 (55.1)
	EQUIPS	262.6 (258.3)	117.1 (50.5)	11.0 (17.0)	3.1 (4.0)	1.9 (2.2)	129.5 (232)
	SOP	473.1 (364.9)	220.2 (98.7)	22.1 (26.0)	4.8 (7.6)	1.6 (1.4)	224.5 (329)
	VOTP	457.2 (309.0)	240.1 (88.7)	20.6 (54.7)	3.7 (8.0)	1.3 (1.7)	191.5 (242)
	SSIP	66.2 (58.6)	25.4 (27.8)	17.6 (12.3)	8.3 (8.1)	5.2 (3.3)	9.7 (41)
	IDATP	386.0 (411.4)	197.9 (62.6)	5.9 (11.5)	18.4 (19.2)	1.0 (0.7)	162.7 (379)
	YAOP	167.4 (114.6)	117.4 (33.6)	19.1 (11.6)	1.8 (1.6)	1.1 (2.2)	28.0 (102)
	MIP	166.0 (72.3)	97.2 (25.6)	26.9 (16.6)	3.9 (3.5)	1.5 (1.9)	36.4 (63)

APPENDIX 2

Average dosage for assigned cohorts across various intervention pathways by Aboriginal status

Cohort	Pathway	Total Dosage	Intensive	Others	Services	Reintegration	Education
Aboriginal	HIPU	100.3 (89.5)	56.6 (54.8)	16.1 (17.3)	2.6 (4.3)*	4.9 (6.0)	12.6 (43.8)*
	EQUIPS	135.6 (171.6)*	47.1 (45.2)	5.2 (15.6)	2.3 (2.9)*	1.3 (1.7)	44.7 (110.6)*
	SOP	214.1 (308.9)	78.7 (105)	10.0 (17.6)	3.0 (3.7)*	1.4 (1.9)	182.8 (260.7)*
	VOTP	308.1 (305.8)	128.6 (100.0)	13.2 (35.0)	4.0 (8.3)	1.9 (3.2)	165.2 (237.4)*
	SSIP	17.8 (32.8)	5.0 (15.4)	4.7 (10.4)	3.1 (4.2)	1.6 (2.6)	6.3 (30.4)*
	IDATP	138.5 (148.3)	53.8 (61.8)	8.4 (19.3)	5.2 (9.8)	2.0 (3.5)	65.9 (180.9)*
	YAOP	120.6 (68.5)	84.2 (58.4)	12.7 (13.6)	2.3 (3.6)	0.9 (1.1)	33.6 (131.3)*
	MIP	124.2 (89.6)	63.3 (43.0)	20.9 (16.6)	4.6 (4.2)	1.8 (2.8)	20.4 (45.1)*
Non-Aboriginal	HIPU	97.4 (86.7)	60.6 (53.9)	18.4 (19.6)	2.0 (3.7)	5.6 (6.7)	13.6 (48.5)
	EQUIPS	122.7 (158.6)	59.7 (54.2)	5.9 (23.0)	1.9 (3.1)	1.1 (1.6)	66.8 (147.5)
	SOP	225.9 (309.4)	60.1 (95.3)	9.3 (19.5)	2.5 (5.5)	1.3 (1.4)	140.8 (270.8)
	VOTP	310.1 (305.5)	126.1 (98.2)	13.2 (42.2)	3.3 (5.2)	1.6 (3.1)	163.6 (274.5)
	SSIP	19.1 (36.8)	4.4 (12.9)	4.1 (10.9)	2.9 (4.5)	1.7 (2.8)	4.4 (22.3)
	IDATP	136.9 (177.8)	66.4 (72.5)	10.4 (26.4)	5.7 (10.7)	1.6 (3.1)	54.2 (100.7)
	YAOP	126.2 (111.9)	82.3 (56.4)	15.5 (11.6)	1.8 (1.9)	1.1 (2.5)	19.7 (30.4)
	MIP	118.7 (85.0)	67.3 (48.3)	19.6 (17.6)	3.3 (3.2)	2.0 (2.7)	31.9 (59.8)

* $p < .05$ between Aboriginal and non-Aboriginal inmates based on Mann-Whitney U-test.

Average dosage for completed cohorts across various intervention pathways by Aboriginal status

Cohort	Pathway	Total	Intensive	Others	Services	Reintegration	Education
Aboriginal	HIPU	160.2 (55.0)	109.3 (35.1)*	26.9 (16.1)	2.6 (3.8)*	8.5 (6.8)	12.7 (37.8)
	EQUIPS	229.5 (221.9)	109.2 (51.2)	11.0 (14.9)	3.6 (3.2)*	1.9 (1.8)	103.6 (208.8)
	SOP	555.8 (300.8)	252.0 (98.2)	24.9 (22.7)	4.5 (4.2)	1.5 (1.3)	272.6 (280.4)
	VOTP	509.9 (392.2)	235.2 (97.4)	22.5 (59.2)	4.3 (10.9)	1.4 (2.2)	246.3 (305.7)
	SSIP	76.6 (66.7)	30.0 (32.5)*	21.0 (13.7)	8.6 (6.6)	4.8 (3.4)	11.5 (41.4)
	IDATP	542.7 (757.1)	189.7 (42.3)	8.4 (13.6)	24.9 (17.4)	0.8 (0.4)	61.4 (73.8)
	YAOP	178.7 (169.8)	121.3 (37.3)	18.9 (13.3)	2.0 (1.5)*	0.9 (0.9)	35.4(152.5)
	MIP	155.8 (70.4)	92.0 (25.0)	27.2(14.8)	5.1 (4.1)*	1.1 (1.6)	30.2 (58.3)
Non-Aboriginal	HIPU	158.5(78.4)	103.0 (35.9)	27.3 (17.0)	2.2 (4.7)	8.8 (7.5)	17.1 (61.9)
	EQUIPS	281.5 (277.5)	121.6 (50.1)	10.9 (18.3)	2.8 (4.5)	1.9 (2.5)	144.1 (245.4)
	SOP	455.7 (375.8)	213.4 (97.9)	21.5 (26.7)	4.8 (8.2)	1.6 (1.5)	197.5 (284.3)
	VOTP	405.4 (185.0)	244.9 (79.8)	18.7 (50.4)	3.1 (3.4)	1. 0 (1.0)	135.2 (137.7)
	SSIP	59.0 (51.2)	22.1 (23.6)	15.2 (10.7)	8.1 (9.0)	5.4 (3.3)	7.9 (39.4)
	IDATP	341.2 (247.9)	200.3 (67.7)	5.2 (11.0)	16.5 (19.6)	1.0 (0.7)	118.1 (196.7)
	YAOP	159.1 (43.2)	114.4 (30.8)	19.1 (10.4)	1.6 (1.7)	1.2 (2.9)	22.6 (32.7)
	MIP	172.7(73.8)	100.5 (30.6)	26.7 (17.9)	3.1 (2.8)	1.7 (2.2)	40.5 (66.4)

* $p < .05$ between Aboriginal and non-Aboriginal inmates based on Mann-Whitney U-test.

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