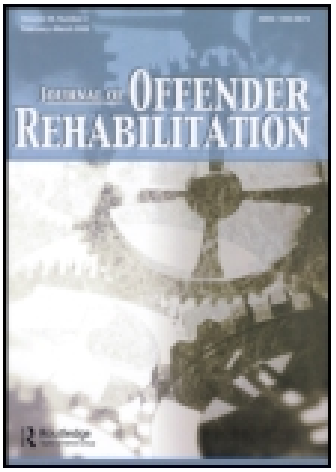

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Treatment Dosage and the Risk Principle: A Refinement and Extension

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Treatment Dosage and the Risk Principle: A Refinement and Extension

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The risk principle of effective intervention suggests that the intensity of treatment dosage should match the risk level of the individual offender. The current research uses a sample of over 900 male adults who completed a community-based correctional facility to examine how offender risk level moderates the relationship between treatment dosage and recidivism. The results suggest that 1) risk moderates the relationship between treatment dosage and recidivism, 2) the relationship between treatment dosage and recidivism is not linear, and 3) the greatest reductions in recidivism were seen in medium/high risk cases that received between 200 and 249 hours of treatment.

KEYWORDS evidence-based corrections, risk principle, treatment dosage

INTRODUCTION

There is a substantial amount of support for the risk principle, which suggests that offender risk level should correspond to the intensity of the programming that is provided (Lowenkamp & Latessa, 2004). Programs that seek to adhere to the risk principle must first identify the risk level of each offender and then provide increasing levels of service as risk level increases. Although

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there is substantial guidance in the literature on the assessment of criminogenic risk (Andrews, Bonta, & Hoge, 1990; Bonta, 2002), there is limited research that has examined the levels of dosage that should correspond to different risk levels (for a review see Sperber, Latessa, & Makarios, 2013a).

Research that has examined the relationship between treatment dosage and recidivism provides preliminary support for the suggestion that higher risk offenders should receive more treatment dosage (Lowenkamp, Latessa, & Holsinger, 2006). This research suggests that greater length and intensity of treatment produces larger reductions in recidivism for high-risk cases (Lipsey, 1999; Lipsey, Landenberger, & Wilson, 2007; Lowenkamp, Latessa, & Holsinger, 2006). Still, only a few studies that have looked at the relationship between treatment dosage, risk, and recidivism have been able to provide guidelines that practitioners can use in order to effectively match correctional interventions to the risk level of the offender (for exceptions see Bourgon & Armstong 2005; Sperber, Latessa, & Makarios, 2013b).

A recent study by Sperber, Latessa, and Makarios (2013b) examined the relationship between treatment dosage and recidivism at different risk levels, but because of a limited sample size, it only provided guidelines based on broad dosage categories. This study seeks to extend Sperber et al. (2013b) by using a larger sample and more narrowly defined dosage categories. In doing so, it will help to clarify how the level of risk and amount of treatment dosage work together to affect recidivism in a "real world" setting.

Treatment Dosage and the Risk Principle

The risk principle suggests that correctional programs should identify the risk level of potential clients and work to ensure that high risk cases receive the most intensive services and that low risk cases receive little, if any, services (Cullen & Gendreau 2000; Gendreau, 1996). Since the risk principle suggests that those that pose the highest probability of recidivism have the greatest treatment potential, one means of adhering to the risk principle is to target primarily moderate and high risk cases (Lowenkamp et al., 2006). Although programs that target higher risk cases have been shown to be more effective than those that do not, many correctional programs have little control over the risk level of the clientele they receive. Fortunately, another effective means of adherence to the risk principle is to increase the intensity of treatment services as risk level increases (Lowenkamp, Holsinger, & Latessa, 2006).

To date, a large body of research has demonstrated empirical support for the risk principle (for reviews see Dowden & Andrews, 2000; Lipsey, 2009). Collectively, these studies have demonstrated that treatment programs that utilize risk assessment instruments to identify appropriate clients have been found to be more effective at reducing recidivism (Andrews, Zinger, et al., 1990; Lowenkamp, Latessa, & Smith, 2006; Lowenkamp & Latessa, 2005) and

that correctional interventions are more likely to have a positive impact on moderate and high risk offenders (e.g., Lowenkamp & Latessa, 2004; Latessa, Brushman-Lovins & Smith, 2010). Support for the risk principle has been shown for a wide variety of offender populations, such as juvenile offenders (Dowden & Andrews, 1999b; Lipsey, 2009, Lowenkamp, Makarios, Latessa, Lemke, & Smith, 2010), adult offenders (Andrews et al., 1990; Lowenkamp, Flores, Holsinger, Makarios, & Latessa, 2010), female offenders (Dowden & Andrews, 1999a; Brushman-Lovins, Lowenkamp, Latessa, & Smith, 2007), sex offenders (Hanson, Bourgon, Helmus & Hodgson, 2009; Lovins, Lowenkamp, & Latessa, 2009), and violent offenders (Dowden & Andrews, 2000).

Although a relatively large body of research has been produced to help guide practitioners in the assessment of criminogenic risk (see Andrews et al., 1990), much less research has focused on how to vary treatment dosage by risk level. That is, very little guidance is available to help agencies establish policies regarding how much more treatment should be provided to higher risk offenders. Some individual studies of treatment programs have found that longer durations of treatment tend to produce stronger treatment effects (Abrams, Terry, & Franke, 2013; Hser, Grella, Chou, & Anglin, 1998; Peters, Haas, & Hunt, 2008; Simpson, Joe, & Brown, 1997; Zerger, 2002), but some suggest that extended lengths of stay can negatively impact success (Loughran et al., 2009).

Prior research that has examined differences between multiple correctional interventions provides support for providing higher levels of dosage to higher risk offenders. For example, Lowenkamp, Latessa, and Holsinger (2006) conducted a study of 97 correctional treatment programs. They found correctional interventions were more effective at reducing recidivism when they increased the intensity and duration of treatment for higher risk offenders. Likewise, Lipsey et al. (2007) conducted a meta-analysis of 40 cognitive behavioral programs and found that interventions produced larger effect sizes when they targeted moderate and high-risk cases, provided more treatment sessions per week, and provided more hours of treatment.

Although these studies provide general support for the hypothesis that increasing dosage for higher risk offenders will reduce recidivism, they do not provide practical information for treatment administrators regarding the specific number of hours of service that programs should provide to high risk offenders. To date, three studies have sought to identify quantifiable guidelines for treatment dosage based on risk level. Lipsey's (1999) meta-analysis of treatment programs for serious juvenile offenders examined the effectiveness of over 200 correctional interventions. The results suggest that larger effect sizes were attributed to programs that lasted a minimum of 6 months when compared to programs of shorter length.

Bourgon and Armstrong (2005) examined the relationship between treatment dosage and risk level in a sample of incarcerated adult offenders. They compared the likelihood of recidivism of inmates receiving different

treatment dosages to a comparison group of inmates receiving no treatment while in prison. In doing so, the authors were able to come to several conclusions regarding the effect of different dosage levels for different risk levels of offenders. First, Bourgon and Armstrong (2005) found that moderate risk offenders or those with few criminogenic needs were less likely to recidivate when they received 100 hours of treatment. Second, they found that offenders who were designated as high risk with few criminogenic needs or moderate risk with multiple criminogenic needs recidivated at lower levels when they received 200 hours of treatment. Third, they found that offenders who were designated as both high risk and high need did not experience reductions in recidivism when provided with 300 hours of treatment when compared to the no treatment group.

Although Bourgon and Armstrong's (2005) study provides a good starting point for identifying specific dosage cutoffs based on risk/need levels, its generalizability is limited to adults in a prison setting. Sperber et al. (2013b) sought to examine whether Bourgon and Armstrong's (2005) findings could be replicated using a sample of offenders whom were treated at a residential community correctional facility. Offenders were identified as receiving low (less than 100 hours), moderate (100 to 199 hours), or high levels of dosage (200 or more hours). The results suggest that when dosage increased from low to moderate for low risk offenders, recidivism dropped by 13 percentage points. The rates of recidivism for moderate risk offenders dropped by 9 percentage points as dosage increased from the low range to high. Finally, recidivism dropped by 24 percentage points for high risk cases that received high dosage when compared to those who received moderate dosage. This suggests that the highest risk offenders demonstrated the largest reductions in recidivism when dosage moved into the highest range. These findings provide additional support for matching dosage to risk for offenders in a community corrections setting and indicate that increased dosage produces the strongest effects for high risk offenders.

The current study is a replication and extension of Sperber et al. (2013b). It seeks to replicate the findings from the original study using a larger sample that includes new cases that have completed the program since data collection ended in the original study by providing an extended follow-up period. The extended follow-up period provides a minimum of 18 months at risk and an average follow-up period of more than 3.5 years. The extended follow-up period helps to reduce the number of censored cases that would have recidivated within a shorter follow-up period.

A major concern with the body of research on the relationship between dosage and recidivism is that empirical studies have only examined broad categories of treatment dosage that utilize increments of 100 hours to categorize dosage levels (Sperber et al., 2013a). In response to this concern, this research also seeks to extend the body of research by operationalizing dosage using more narrowly defined dosage categories. The increased

sample size provides an opportunity to examine refined dosage categories that increase in increments of 50 hours instead of 100 hours as used in prior research. In doing so, it provides a more detailed look at the relationship between treatment dosage and recidivism by risk level using a large data set of over 900 cases that have been successfully discharged from a community-based correctional facility (CBCF) in Ohio. Furthermore, the increased representation of cases along the dosage spectrum allows for an examination of the functional form of the relationship between the number of treatment hours and recidivism by risk level.

METHODS

Participants

Sperber et al. (2013b) originally utilized a sample of 689 adult male non-sex offenders successfully discharged from a CBCF in Ohio between August 30, 2006 and August 30, 2009. The current research has extended the discharge date to December 31, 2010 and includes 215 more cases for a total sample size of 980. Of the total number of cases in the study, exclusions were made based on a lack of available cases in the low and high risk levels ($n = 39$). As a result, the current research only examines cases that are low-medium risk, medium risk, and medium-high risk. Further, preliminary examination of the data indicated that there were low numbers of cases in certain categories when risk and dosage was cross-classified.

For example, very few low-medium risk cases received high levels of dosage and very few medium-high risk cases received low levels of dosage. In instances where categories of risk by dosage had less than 20 cases, these categories were excluded ($n = 38$). Cases that fell into the following risk by dosage categories were excluded: low-medium risk cases receiving 200 to 249 ($n = 6$) hours, 250 to 299 hours ($n = 2$), or 30 or more hours ($n = 3$); medium risk cases that received 300 or more hours ($n = 6$); and medium-high risk cases that received either 0 to 99 hours ($n = 10$) or 100 to 149 hours ($n = 11$). These exclusions leave a total sample size of 903. It was necessary to exclude cases in the categories where representation was low in order to avoid unstable coefficients, however, care should be taken to avoid generalizing the findings from this study to these groups of excluded individuals. Table 1 presents descriptive statistics for the sample.

Setting

At the time of data collection, the CBCF in this study served as a diversionary program for those convicted of felony charges without mandatory prison time in Southwestern Ohio. It was a secure residential treatment facility that serves felony probationers from three rural counties. The major focus of the

TABLE 1 Descriptive Statistics ($n = 903$)

Variables	*n*	%
Race		
White	806	89.3
Non-White	97	10.7
Offense type		
Violent	117	13.0
Property	254	28.1
Drug	394	38.6
Other	179	19.7
Missing	5	0.5
Risk level		
Low-medium	184	20.4
Medium	581	64.3
Medium-high	138	15.3
Dosage categories		
Minimum (0–99)	138	15.3
Low (100–149)	180	19.9
Low-medium (150–199)	245	27.1
Medium-high (200–249)	228	25.2
High (250–299)	88	9.7
Maximum (300+)	24	2.7
Incarceration		
Yes	341	37.8
No	562	62.2
	M (*SD*)	Range
Age	31.1 (9.2)	18.2–61.4
Months at risk	44.8 (13.3)	18.3–67.5
Months to incarceration	12.3 (9.2)	.7–51.8

program is the provision of cognitive behavioral treatment to reduce the likelihood of recidivism. The program attempts to change criminogenic needs such as antisocial attitudes, anger management, substance abuse, and employment. The average length of stay is four months. All core treatment groups use manualized curricula that focus on teaching cognitive skills and restructuring antisocial thinking errors, values, and attitudes. At the time of the study, the CBCF in question was actively attempting to implement a dosage strategy based on risk levels. Although specific cut points were not used, case managers attempted to increasing programming and dosage for higher risk cases and provide less dosage for lower risk cases. In this sense, the current study used a prospective design that targeted dosage based on risk level. As a result, this study can be thought of as a real world attempt to match dosage based on risk (see Bourgon & Armstrong, 2005; Lowenkamp, Hubbard, Makarios, & Latessa, 2009).

Measures

Measures for the current study come from three sources. The Ohio Department of Rehabilitation and Correction provided the dependent variable using

a state database that tracks prison intakes. Independent variables were gathered from both electronic treatment records and hard copy case files maintained by the facility.

Control variables

Table 1 presents descriptive statistics for the sample. Demographic data indicate that the sample is predominately Caucasian (89.3 percent) and the average age is 31.1 years. For those sent to prison postdischarge, the average time to failure was 12.3 months, with a range of less than 1 month to more than 51 months. Overall, the minimum follow-up period for recidivism was 18 months, with an average follow-up period of 45 months.

Risk level

At intake, all offenders admitted into the program were assessed for risk using the Level of Service Inventory–Revised (Andrews & Bonta, 1995). The LSI-R is a risk and needs assessment instrument that has been consistently found to predict recidivism across a variety of correctional settings and offender populations (for a review see Gendreau, Goggin, & Smith, 2002; Lowenkamp & Bechtel, 2007; Lowenkamp, Lovins, & Latessa, 2009). It is an actuarial risk assessment instrument that consists of 54 items that measure risk factors across 10 social, psychological, and legal domains. The assessment produces a composite risk score that delineates an offender's probability of reoffending as low, low-medium, medium, medium-high, or high. Risk levels were determined using national cutoffs recommended by the developers of the instrument (Andrews & Bonta, 1995). Specifically, risk scores of 0 to 13 were assigned as low risk, 14 to 23 were assigned low-medium risk, 24 to 33 assigned medium risk, 33 to 40 were assigned medium high risk, and over 40 were assigned high risk. As noted previously, because of limited representation of low and high risk offenders, the current research only examines low-medium risk, medium risk, and medium-high risk cases. Table 1 indicates that 20% of the current sample was low-medium risk, 64% was medium risk, and 15% were medium-high risk.

Treatment dosage

Treatment dosage is measured using categories that identify the number of hours of group treatment each offender received by 50-hour increments, except in the minimum dosage category, which included cases that had between 0 and 99 hours of treatment. The number of hours that each participant spent engaging in cognitive behavioral treatment activities was counted as dosage. Consistent with prior research, other activities, such as case management or mental health treatment were not counted as dosage (Sperber

et al., 2013b). The minimum dosage group had 138 cases that received between 0 and 99 hours of treatment. The low dosage group consisted of 180 cases that received between 100 and 149 hours of treatment. The low-medium dosage group consisted of 245 cases that received between 150 and 199 hours. The medium-high dosage group consisted of 228 cases that received between 200 and 249 hours of treatment. The high dosage group consisted of 88 cases that received between 250 and 299 hours of treatment. The maximum dosage group consisted of 24 cases that received over 300 hours of treatment.

Recidivism

The measure of recidivism used in the current study is being sent to prison during the follow-up period. This measure was chosen because it was the most reliable and valid measure available. Arrest data were available only at the county level, which involved collecting data from agencies with different reporting practices. County level arrest records also were problematic when offenders moved out of the reporting counties. On the other hand, conviction resulting in incarceration in Ohio is consistently tracked statewide and available through the Ohio Department of Rehabilitation and Correction's reporting database. Although incarceration data can include non-criminal technical violations, it provides a valid measure of recidivism because CBCFs in Ohio are designed to reduce prison crowding by diverting offenders out of prison. Thus, a valid outcome measure is whether the CBCF achieved its goal by keeping offenders out of prison.

Data Analysis

This study seeks to extend prior research by providing an examination of the impact of treatment dosage on recidivism by risk level using the refined dosage categories and a larger sample. First, to examine the impact of dosage on recidivism overall, Cox proportional hazard models are used to examine whether the level of treatment dosage predicts recidivism while controlling for the level of risk. Cox models are a class of survival analyses that allow for the unbiased estimation of coefficients in cases such as this when there is a time dependent binary outcome that is censored (e.g., Henning & Freuh, 1996). Tests of the proportional hazards assumption revealed a nonsignificant result (chi square = 10.10; $p = .18$), suggesting that this key assumption of Cox modeling has been met.

Second, in order to examine how the impact of dosage varies by risk, Cox models are used to examine the impact of treatment dosage on the hazard rates of recidivism by risk level. To help illustrate the relationship, figures are presented that show the rates of recidivism for each dosage category by risk level. Finally, to better understand the functional form of the relationship

between treatment dosage and recidivism, a series of Cox models are presented that examine the relationship between different specifications of the number of treatment hours and recidivism by risk level. Log transformation of the slopes were conducted to produce the hazard ratios, or the change in odds associated with a one-unit change in the dependent variable.

RESULTS

Table 2 presents Cox proportional hazard models that examine the relationship between treatment dosage and recidivism while controlling for risk level. All coefficients in Table 2 are in the expected direction. Both risk levels were associated with increases in the hazard ratio of recidivism. The exponent (B) for risk levels suggest that medium and medium-high risk offenders were 90% and 155% more likely to go to prison than low-medium risk offenders. The coefficients for dosage categories are all in the expected direction, but increases in dosage categories does not result in stepwise decreases in the odds of going to prison. Instead, the hazard ratio is lowest for the dosage categories of 100–149, 200–249, and 300+ and highest for 0–100, 150–100, and 250–299. This is likely because of differences in the relationship between dosage categories and recidivism by risk level.

To examine the relationship between dosage categories by risk level, Table 3 presents Cox models for each risk level. For low-medium risk cases, the hazard ratio for recidivism is 66% lower for those cases that received 100–149 hours of treatment, but only 15% lower for cases that received 150–199 hours of treatment. For medium risk cases, the likelihood of recidivism is reduced for cases that received 100–149 hours, 150–199 hours, and 200–250 hours, but the likelihood of recidivism actually increases for cases that received 250–299 hours. For medium-high risk cases, compared to cases

TABLE 2 Cox Regression Model Examining the Relationship Between Dosage Categories and Recidivism ($n = 903$)

Variables	Slope	*SE*	Wald	Exp(B)
Risk level (Low-medium = 0)				
Medium	0.64**	0.18	12.53	1.90
Medium-high	0.93**	0.26	12.65	2.55
Dosage categories[a]				
100–149	−0.52**	0.19	7.05	0.60
150–199	−0.30*	0.17	3.17	0.74
200–249	−0.38**	0.18	4.66	0.68
250–299	−0.36	0.26	1.90	0.69
300+	−0.56	0.41	1.85	0.57
Model chi-square	27.91**			

[a]Dosage category 0–99 = 0.

*$p < .05$. **$p < .10$.

TABLE 3 Cox Regression Models Examining the Relationship Between Dosage Categories and Recidivism by Risk Level

	Low-medium risk		Medium risk		Medium-high risk	
Dosage categories	Slope	Exp(B)	Slope	Exp(B)	Slope	Exp(B)
0–99	Reference		Reference		—	—
100–149	−1.08**	0.34	−0.24	0.79	—	—
150–199	−0.16	0.85	−0.32*	0.73	Reference	
200–249	—	—	−0.30	0.74	−0.54	0.58
250–299	—	—	0.26	1.25	−0.69*	0.49
300+	—	—	—	—	−0.69*	0.50
Model chi-square	10.83**		5.82		4.98	
N	184		581		138	

*$p < .05$. **$p < .10$.

that received 150–199 hours of treatment, the hazard ratio for recidivism is 42% less for cases that received 200–249 hours. The medium-high hazard ratio is reduced by a very similar amount for cases that received 250–299 and 300+ hours.

To more clearly illustrate the impact of different levels of dosage on the likelihood of recidivism by risk level, Figure 1 provides a bar chart that presents the percent of cases incarcerated by dosage category and risk. The bar charts suggest that some increases in dosage result in reductions in recidivism for all risk levels, but that the dosage categories with the lowest rates of incarceration vary by risk level. For example, for low-medium risk cases, increasing dosage from under 100 hours to 100–149 results in a 23 percentage point reduction (from 37% to 14%) in recidivism, but the rate of recidivism increases 16 percentage points (to 30%) when the number of treatment hours increases to 150 to 200 hours.

A similar pattern is shown for medium risk cases. Initial increases in dosage result in reductions in recidivism, but further increases (especially from

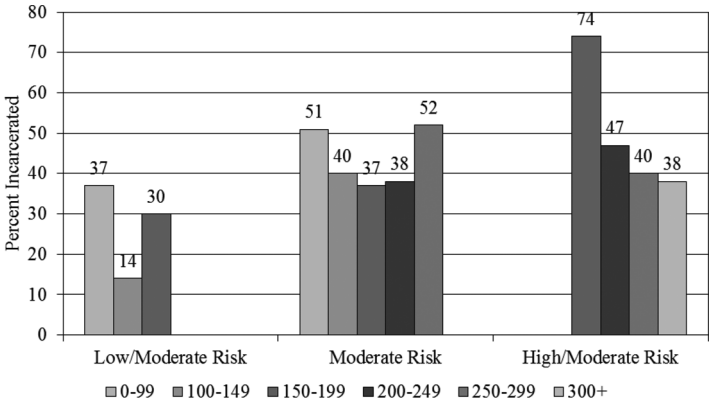

FIGURE 1 Rates of Recidivism by Refined Dosage Categories and Risk Level ($n = 903$)

200–249 to 250–299) result in increases in recidivism. For medium-high risk cases, the effects of increasing dosage results in reductions in recidivism for each increase in dosage category. Still, the effects of dosage are largest when dosage increases from 150–199 to 200–249 (a reduction of 27 percentage points) and further reductions in recidivism are substantially smaller when dosage increases to 250–299 (an additional 7 percentage point reduction) and even smaller when dosage increases to 300 or more hours (an additional 2 percentage point reduction).

The results presented thus far suggest that the relationship between treatment dosage and recidivism is non-linear and moderated by risk. In order to better understand the functional form of the relationship between dosage and recidivism, Table 4 presents a series of Cox regression models that use a continuous dosage variable (rather than categorical dosage variables as in the previous models) to examine the functional form of the relationship between the number of dosage hours and recidivism by risk level. Transformations of the independent variable were used to estimate different functional forms of the relationship between dosage and recidivism.

The first two rows in the table present results from models examining a traditional linear relationship between treatment hours and recidivism. The results suggest that the number of treatment hours is significantly related to recidivism for only medium-high risk cases. The next two rows use the natural log of treatment hours to predict recidivism. A log transformation of the independent variable provides an examination of a curvilinear relationship (Hanusheck & Jackson, 1977). The results again indicate that the coefficient is significantly related to recidivism for medium-high risk cases only. Of interest, the larger chi square suggests a better model fit for medium-high risk cases when the curvilinear relationship is estimated.

The last three rows present statistics that measure a parabolic relationship between treatment dosage and recidivism by entering the number of

TABLE 4 Cox Regression Models Examining the Relationship Between the Number of Treatment Hours and Recidivism by Risk Level

	Low-medium risk		Medium risk		Medium-high risk	
Dosage variables	Slope	Exp(B)	Slope	Exp(B)	Slope	Exp(B)
Tx hours	−0.01	0.99	−0.00	0.99	−0.01*	0.99
Model chi-square	1.43		0.59		3.82*	
LnTx hours	−0.37	0.69	−0.17	0.85	−1.26**	0.28
Model chi-square	1.18		1.56		4.45**	
Tx hours	−0.29*	0.97	−0.15**	0.99	−0.25	0.97
Tx hours^2	0.00	1.00	0.00*	1.00	0.00	1.00
Model chi-square	4.40		6.71**		5.46*	
N	184		581		138	

Note. Tx hours = number of hours in treatment; Ln = natural logarithm.
*$p < .05$. **$p < .10$.

treatment hours as well as the number of treatment hours squared (Hanusheck & Jackson, 1977). The results indicate that for medium risk cases, both coefficients are significant and in the opposite direction, suggesting the relationship between treatment hours and recidivism for medium risk cases resembles an inverse parabola. The results presented in Table 4 failed to find a significant relationship between treatment hours and recidivism for low-medium risk cases.

DISCUSSION AND CONCLUSION

This study sought to examine the relationship between treatment dosage and recidivism by risk level in a sample of adult male offenders who attended a community based correctional facility that utilized a cognitive-behavioral approach. It extends prior research by providing a long term follow-up period for recidivism, using refined 50-hour categories of treatment dosage, and examining the functional form of the relationship between treatment hours and recidivism by risk level. Taken as a whole, the findings from this research suggest that the relationship between treatment dosage and recidivism is complex.

As the results indicate, the effect of dosage on recidivism varies by risk level and is not linear. Also, the largest changes in the likelihood of incarceration were observed at different dosage levels and for different risk levels. For example, as Figure 1 indicates, the largest reductions in recidivism observed for low-medium and medium risk cases occurred when the number of treatment hours moved from less than 100 to 100–149. For medium-high risk cases the largest reduction in recidivism was observed when moving from 150–199 to 200–249. Furthermore, in low-medium and medium risk cases, increasing dosage eventually resulted in increases in the rates of recidivism, suggesting a parabolic relationship between treatment dosage and recidivism. These results were confirmed for medium risk cases when examining the relationship between treatment hours and recidivism.

For medium-high risk cases, the likelihood of recidivism decreased for every additional increase in dosage, although the very small additional reductions at the high end of dosage (especially from 250–299 hours to 300 or more hours) indicate that the relationship is curvilinear. This also was confirmed when examining the relationship between the natural log of treatment hours and recidivism in medium-high risk cases. This implies that the risk principle is correct and that practitioners should seek to increase dosage levels in high risk clientele in order to reduce recidivism.

Although the findings presented here are compelling, it is important to note that this study is not without its limitations. The first limitation involves the generalizability of the findings. The sample used in this study consisted of men who were not sex offenders that completed a CBCF that served three rural counties in Ohio. Future research should seek to replicate these methods

using samples from other geographic regions, other types of programs, and with other populations. Still, the findings reported here are directly relevant to secure community correctional facilities that are attempting to reduce the recidivism of male offenders that are diverted from prison. Furthermore, by adding to the limited research on risk, dosage, and recidivism, the findings reported here are also likely to guide future research and inform practices at other types of correctional programs as well.

Relatedly, the findings presented here also fail to address a likely moderator of the dosage, risk, recidivism relationship: program quality. A large body of research has found that the quality of programming is an important factor in determining the effectiveness of treatment programs (see Lipsey, 2009; Lowenkamp et al., 2006). Given the importance of program quality in treatment effectiveness, it is logical to assume that the impact of dosage is dependent upon the quality of the treatment. Although the issue of treatment quality is important to incorporate into the literature on treatment dosage and recidivism, the current research only examined a single program and as a result, program quality was a constant. Future research should seek to examine the relationship between dosage and recidivism using multiple programs that vary in quality in order to better understand the role that program quality plays in this relationship.

The second limitation of this study is that the outcome variable was incarceration in state prison, which included new criminal behavior as well as technical violations. The presence of new criminal charges, rather than technical violations, would provide a substantively different measure of recidivism since it involves crime that poses a greater cost to society. Unfortunately, reliable measures of felony arrests were not available in the current study. Incarceration was chosen because it provided a reliable indication of recidivism given the limitations of available arrest data. Furthermore, since the overarching goal of CBCFs in Ohio is to avoid sending convicted felons to prison, the current outcome of return to prison does provide an answer as to whether the program was able to fulfill its intended mission.

The third limitation is how treatment dosage was operationalized in the study. Because the literature on treatment dosage and recidivism in corrections is relatively new, a standardized definition of dosage does not yet exist. Furthermore, other disciplines use different approaches to measure treatment dosage. The literature on psychotherapy has operationalized dosage by the number of sessions attended by the participant (Hansen, Lambert, & Forman, 2002). On the other hand, other studies in the fields of substance abuse treatment and prisoner reentry programming have operationalized treatment dosage as the number of days in treatment (e.g., Abrams et al., 2011; Hser et al., 1998). The current study operationalized dosage using the number of hours of participation in group treatment services for three reasons. First, within residential settings, it is common to utilize a variety of different curricula that call for treatment sessions of varying length. Since treatment at the CBCF in this study is based on risk and need, it is likely that two clients could attend

the same number of group sessions but spend a different number of hours in treatment groups because the length of group sessions varies by group. The second reason for operationalizing dosage using the number of hours was because the individualization of treatment based on risk could result in clients spending the same number of days in the facility but spending varying amounts of time in treatment services during their stay. Again, relying on the number of days alone could mask differences in the total amount of treatment received while in the program. The final reason to operationalize treatment dosage using the number of hours was because it is consistent with most of the limited research that has examined the dosage and recidivism relationship by risk level (see Bourgon & Armstrong, 2005; Sperber et al., 2013b). In sum, operationalizing dosage by using the number of hours of treatment provided the most valid and standardized measure of treatment dosage while maintaining consistency with prior research.

Despite the limitations of this research, the results presented here have several important implications for correctional programming and research. First, some increases in dosage did result in reductions in recidivism at all risk levels. This finding is consistent with prior research that demonstrates the benefit of providing increased dosage in correctional treatments that target offender populations (e.g., Lipsey et al., 2007). Still, the findings reported here suggest that the effect of dosage on recidivism varies by risk level and at some point for all risk levels, continued increases in dosage at best fails to provide meaningful reductions in recidivism and at worst, can actually work to increase recidivism. That is, the results presented here indicate that the relationship between treatment dosage and recidivism is not linear and that although increasing dosage can reduce recidivism at certain levels, there is a clear saturation point where dosage fails to continue to result in reductions in recidivism.

A second important finding is that the greatest reduction in recidivism from one category to the next occurred in offenders that were medium/high risk to recidivate and who received between 200 and 249 hours of treatment. Reductions in recidivism resulting from increasing dosage to relatively high levels such as these is consistent with prior research (Bourgon and Armstrong, 2005; Sperber et al., 2013a). Furthermore, the results presented here extend prior research in that they suggest that increasing dosage to very high levels (i.e., 300 or more hours), even for higher risk cases, produces limited reductions in recidivism. This finding is important, because Sperber et al. (2013b) and Bourgon and Armstrong (2005), both of which used 100 hour categories of treatment dosage, suggest that higher risk cases benefit from levels of treatment dosage that extends beyond 250 hours. This suggests that it is important to used refined dosage categories since large categories can mask the intricacies of the relationship between treatment dosage and recidivism.

Also of interest, the current results suggest that increasing dosage to 100–149 was effective at reducing recidivism in low-medium and medium risk cases. Sperber et al. (2013b), using large dosage categories of 100 hour

increments suggested that low and medium risk cases required between 100 and 200 hours of treatment. Providing upwards of 200 hours of treatment to low-medium risk offenders could pose a daunting task for community corrections facilities faced with limited resources. The current findings, using refined categories, suggest a maximum of only 150 hours of treatment are necessary to reduce recidivism for these cases.

Given the current findings and limitations of this study, there remain a substantial number of research questions regarding the relationship between dosage and recidivism that should be addressed in future research. These questions include, but are not limited to: further work in defining dosage and activities that count as dosage, examining the risk-dosage relationship across different settings and populations, examining the impact of sequencing dosage, examining possible mediators of the risk-dosage relationship, and examining the relative importance of various types of dosage (for a comprehensive review, see Sperber et al., 2013a).

Given these unanswered questions, it is clear that the body of literature on treatment dosage and recidivism is still developing, and there is much more to learn regarding the interrelationships between treatment dosage, risk, and recidivism. As a result, correctional scholars should seek to partner with practitioners and continue to examine how treatment dosage affects recidivism in real world settings. Doing so will help to move the field from a conceptual understanding of the risk principle to the practical and effective implementation of treatment dosage by risk level.

In sum, the current research suggests that the relationship between treatment dosage and recidivism is complex. Not only does risk moderate the relationship between dosage and recidivism, but the relationship is also curvilinear. Furthermore, the results presented here suggest that the largest reductions in recidivism occurred when dosage was increased in higher risk cases. Finally, this research provides quantifiable guidelines regarding the number of hours of treatment needed to reduce recidivism in a residential community corrections setting that serves offenders of varying risk levels.

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