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Reducing recidivism using the Reasoning and Rehabilitation program: A pilot multi-site-controlled trial among prisoners in Switzerland

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Abstract

Objectives. This study evaluated whether the Reasoning and Rehabilitation (R&R2) program was effective in reducing recidivism, minimizing dropout rates, and improving outcomes related to attitudes, behaviors, and personality among people living in detention.

Methods. Data were collected in eight Swiss German-speaking prisons among males detained for violent offenses using a quasi-experimental controlled design (R&R2: n=129, treatment as usual [TAU]: n=84). Measures included recidivism, dropout rate, and self-report questionnaires (hostile attribution bias, aggressiveness, interpersonal problems, and willingness to accept responsibility). Data were analyzed using mixed-effect models.

Results. Participants in the R&R2 group were less likely to reoffend in comparison with the TAU group in the intention-to-treat (n=51, odds ratio=0.75, p=.060) and the per-protocol (excluding dropouts; n=38, odds-ratio=0.65, p=.068) analyses. They also had lower self-reported scores of spontaneous and reactive aggressiveness (p=.047 and p=.070) and excitability (p=.086).

Conclusions. The findings of this pilot project were promising, with the R&R2 program leading to reduced recidivism and dropout rate. Even though these results should be considered preliminary, the R&R2 program appeared to be a relevant approach in reducing recidivism after prison.

Keywords: intervention, mental health, psychotherapy, reoffending.

Reducing recidivism using the Reasoning and Rehabilitation program: A pilot multi-site-controlled trial among prisoners in Switzerland

Introduction

The main objective of most forensic treatment programs is to reduce recidivism. The effects of various therapies designed to enhance rehabilitation have been well studied and there is increasing evidence of a beneficial effect of cognitive-behavioral therapies on the recidivism rate (Koehler et al. 2013; Mpofu et al. 2018; Tong and Farrington 2006). One of the most commonly used cognitive-behavioral therapies designed to enhance rehabilitation is the Reasoning & Rehabilitation (R&R) program, which addresses antisocial, offending behaviors, and cognitive deficits by developing cognitive and social skills and competencies (Ross et al. 1988). A previous systematic review of the R&R program concluded that this therapy was effective in reducing recidivism among people living in detention (Tong and Farrington 2006). The R&R program is available in two formats: a long version, which comprises thirty-six 120-minute sessions, and a short version (named R&R2), consisting of fourteen 90-minute sessions (Ross et al. 2007). Some studies concluded that this short version has positive effects on a large range of outcomes, such as improved cognitive skills, reduced violent attitudes and anger, as well as decreased dropout rate, among different subgroups of people involved with the justice department (those having a mental disability and severe mental health disorders) (Cullen et al. 2011; Jotangia et al. 2015; Rees-Jones et al. 2012; Yip et al. 2013; Young et al. 2016; Young et al. 2015). However, to date, the effectiveness of the R&R2 program in reducing recidivism has not been tested.

People living in detention (PLD, Tran et al. 2018) who have committed violent offences are an important public health concern: prevention of recidivism is especially important in this population. Indeed, they are more likely to reoffend than PLD who did not commit violent

offenses (Lowenkamp et al. 2006). Previous studies have shown that rehabilitation programs are effective for "high-risk" PLD (Koehler et al. 2013). However, the term "high-risk" has no consensual definition and covers a heterogeneous population. It can mean people incarcerated in high-security prisons (e.g., Koehler et al. 2013), PLD with severe mental health disorders (e.g., Yip et al. 2013), or PLD who have committed sexual offenses (e.g., Mpofu et al. 2018). Data on well-defined subgroups of PLD are needed to achieve a better understanding of what works for whom on the path away from criminal involvement (Schmucker and Lösel 2015). In addition, "high-risk" PLD have high rates of treatment attrition (Olver et al. 2011). Therefore, improving treatment retention should be an important focus in this subgroup.

Finally, the R&R2 program has been widely adopted in several countries but has scarcely been empirically tested in Switzerland. To our knowledge, there has only been one small-scale study (n=11) conducted among incarcerated females and focusing on different psychosocial factors, but not on recidivism (Krammer et al. 2015).

This pilot project was a preliminary attempt to evaluate whether the R&R2 program was effective in reducing recidivism among PLD who had committed violent offences in Switzerland in comparison with a control group that received treatment as usual (TAU, individual psychotherapy). The study also investigated whether the program was associated with a reduced dropout rate over the study period and improved secondary outcomes related to attitudes and behaviors: hostile attribution bias, aggressiveness, interpersonal problems, and willingness to accept responsibility.

Methods

Participants and selection of participants

This quasi-experimental controlled study included 213 males detained for violent offending. Violent offenses were defined as: murder, homicide, bodily injury, assault, attack,

endangerment of life, incitement to duel, brawling, administration of hazardous substances to children, robbery, deprivation of liberty and abduction, hostage-taking, and violence and threats against authorities (Swiss Penal Code art. 111-113, 117, 122-123, 126, 129, 132-134, 136, 140, 183-185, 285) (Federal Statistical Office 2018). Participants were incarcerated in eight prisons in the German-speaking part of Switzerland (cantons of Aargau, Bern, Luzern, Zug, and Zürich, see details in Table 1). All of them were ordered to undergo therapy.

Participants were eligible for study participation if they were 18 or older and provided informed consent. Exclusion criteria included having an insufficient command of German, mental retardation, or suffering from acute alcohol or other drug intoxication. Participants were not randomly assigned to either the R&R2 (intervention) or the TAU (control) group. The selection was carried out by therapists and the research staff, who checked for eligible participants. Eligible participants were identified by the staff (usually psychotherapists) in charge of providing psychological care or by the research staff. However, neither researchers nor the PLD had an influence on group assignment. One week before the first session of the group therapy R&R2, potential participants were invited to an initial meeting providing information on the study. For PLD who agreed to participate, a written declaration of consent was signed. Participants in the TAU group were recruited analogous. They did not include participants who refused to participate in R&R2, but were recruited independently, again based on identification by treatment or research staff. Reasons for recruitment into the TAU group were for example, limited capacity in the R&R2 groups or prison entry outside a group starting date.

Intervention

In the R&R2 group, participants (n=129) underwent fourteen 90-minute sessions of group therapy, as recommended in the R&R2 manual. Sessions took place once a week and were conducted by two trained practitioners (one psychotherapist plus one member of prison staff

or else two psychotherapists) who were independent of the study. Ideally, the manual recommends a frequency of two to three sessions per week, but explicitly allows for adjustments to local circumstances as long as the group sessions are held regularly. Sessions were held with four to ten participants. The R&R2 program is designed for adults who lack essential prosocial skills and values and are likely to engage in illegal or antisocial behaviors. The R&R2 is a structured, manualized cognitive-behavioral therapy intervention program. Its main purpose is to improve cognitive and emotional skills. It is composed of five modules focusing on self-control (e.g., attentional control, impulse control), problem solving (e.g., problem identification, consequential thinking), emotional control (e.g., management of anger and anxiety), social skills (e.g., awareness of others' feelings, conflict management), and critical reasoning (e.g., assessment and evaluation of information). The R&R2 program was designed to meet the complex needs of PLD who committed violent offenses: reduced length, supplementary individual sessions, inclusion of a module addressing executive dysfunction (self-control). All these features that differ from other intervention programs have been included to improve treatment completion and to better support patients (Yip et al. 2013).

In the TAU group, participants (n=84) underwent individual standard psychotherapies at their institutions. The intervention also took place once a week. The TAU consisted in standard psychotherapy as provided by psychotherapists in collaboration with forensic psychiatrists in individual sessions. Usually, therapists blend elements from different approaches (cognitive behavioral therapy, psychodynamic therapy or systemic therapy) and tailor their treatment according to each patient needs in order to provide an integrative treatment that addresses the specific needs of patients.

Furthermore, it should be clarified that the intervention group, in addition to the manualized therapy according to R&R2, continued to receive TAU (i.e., regular psychotherapy). Thus, the

intervention group differed from the TAU group in that participants received additional standardized-manualized therapy according to R&R2.

Procedure

Data were collected before the beginning of the therapy (R&R2 or TAU). The pre-test took place between March 2010 and February 2014, and the post-test between May 2010 and June 2014 (on average 132.31 ± 36.69 days between pre- and post-tests for completers). A total of 167 participants were completers (see Figure 1). The intervention started on average one week after the pre-test and the post-test took place on average one or two weeks after the termination of the intervention. Data on recidivism were extracted from official criminal records in March 2014 and completed for 27 missing participants in May 2015. Data were extracted for participants who were still alive and lived in Switzerland (data not extracted for eight participants).

Measures

Recidivism. Data were extracted from the official Swiss criminal records. Recidivism was defined as having a new offense (criminal conviction) registered in the criminal record after the post-test. It was assessed for participants who had been released.

Dropouts. The dropout rate between pre- and post-test was also considered as an outcome variable. Unfortunately, the date of dropping out was not recorded.

Interpersonal distress. The inventory of interpersonal problems (IIP, Horowitz et al. 1988) is a self-report tool designed to identify interpersonal problems people may experience and associated distress. It is often used to assess changes following psychotherapy. The German version (IIP-D) is composed of 64 items assessed on a five-point scale (Horowitz et al. 2016).

We used a mean score of interpersonal distress ranging from 0 (no interpersonal distress) to 4 (very high interpersonal distress) (Cronbach alpha=.94).

Aggressiveness. Willingness to engage in aggressive behaviors was assessed with the German short questionnaire for aggressiveness (Heubrock and Petermann 2008). Five subscales are derived from the 49 items assessed on a six-point scale: spontaneous aggressiveness (12 items, Cronbach alpha=.82), reactive aggressiveness (11 items, Cronbach alpha=.84), excitability (10 items, Cronbach alpha=.89), self-aggressiveness (9 items, Cronbach alpha=.78), and aggression inhibition (7 items, Cronbach alpha=.55).

Hostile attribution bias (HAB). To assess hostile cognitive distortions, which are strongly related to aggressive behaviors (Orobio de Castro et al. 2002), we used twelve hypothetical vignettes derived from Tremblay & Belchevski (2004). Situations reflected either a clearly provocative intention (two situations), an ambiguous intention (eight situations), or a clearly non-provocative intention (two situations). For each situation, participants answered whether 1) it was provocative behavior and how they might have behaved, choosing from six possible reactions: 2) felt annoyed, 3) expressed anger, 4) behaved rudely, 5) yelled at the other, 6) threatened the other, and 7) used physical force. Each question was assessed on a five-point scale. A mean score of aggressiveness was computed for each type of situation: provocative, ambiguous, and non-provocative. The internal consistency, assessed with Cronbach alphas, was good (.92, .96, and .87, respectively).

Willingness to accept responsibility. The German questionnaire for assumption of responsibility assesses willingness to accept responsibility for one's own actions (Gabriel et al. 2005). Two four-point scale subscales investigated two forms of denying responsibility: excuses, i.e., denying the causal responsibility for the offense (ten items, Cronbach alpha=.73), and justification, i.e., endorsing responsibility, but denying the gravity of the offense (seven items, Cronbach alpha=.78).

Socio-demographics. Age at pre-test, nationality (Swiss or other), and level of education (compulsory school or higher) were assessed.

Mental health. Participants answered whether they had previous experience of psychotherapy (yes/no). We recorded the presence or absence of any psychiatric diagnosis in the prison medical records according to the ICD-10 classification (yes/no).

Statistical analyses

We first computed descriptive statistics (means and standard deviations or percentages). For all other analyses, as participants were clustered in different prisons, mixed-effect models with participants nested in prisons were used. For all models, we used logistic and linear Bayesian mixed-effect models because the mixed-effect models resulted in a singular fit, meaning that the random structure was too complex to be supported by the data (we obtained similar results with a simple logistic regression model) (Fong et al. 2010). We tested whether R&R2 and TAU participants were different at baseline by using bivariate analyses (linear and logistic mixed-effect models according to the distribution of the outcome variable). Then, we tested whether dropouts were different from completers. For these two sets of analyses, socio-demographics, mental health variables, and the self-report questionnaires (IIP, aggressiveness questionnaire, HAB, and willingness to accept responsibility) were tested. Missing values were handled using listwise deletion (see detail of missing values in Table 1). When there were one or two missing values on the self-report questionnaires, the mean score was computed using all available items.

Finally, we tested our main hypotheses, using the group (R&R2/TAU) to predict recidivism, dropout rate, and self-report questionnaires at post-test. We controlled for time between pre- and post-test (set to zero for dropouts, as the dropout date was not recorded) for all analyses (recidivism, dropout rate, and self-report questionnaires) and for the time between pre-test and

release for the recidivism analysis. Analyses were conducted twice for the recidivism analysis: first, as intention-to-treat (including all dropouts) and, second, a per-protocol analysis (excluding dropouts). We also reported the number needed to treat for both analyses. For self-reported questionnaires, three-level mixed effect models were used, with measures nested into participants nested into prisons. We also ran sensitivity analyses controlling for the pre-test level of variables related to attitudes and behaviors in the recidivism and dropout analyses (IIP, aggressiveness questionnaire, HAB, and willingness to accept responsibility). Because of the reduced sample size, variables were included one by one in separate models. The results were similar as those reported in the Results section. All analyses were performed with R 3.5.1.

Results

Among the 213 participants included in the study, a total of 167 completed both pre- and post-test assessments (see Figure 1), leading to a dropout rate of 21.6% (16.3% in the R&R2 group and 29.8% in the TAU group). A total of 71 participants were released at the end of the study (33.3% of the whole sample, consisting of 35.7% in the R&R2 group and 29.8% in the TAU group), but data from criminal records for 20 participants (n=51) could not be extracted after release.

Preliminary comparisons

Comparisons between the R&R2 and the TAU groups at pre-test are reported in Table 1. There was no significant difference between the R&R2 and TAU groups before the intervention.

Table 2 shows comparisons between dropouts and completers (regardless of group). There was only one significant difference: completers were younger than dropouts (p=.009).

Recidivism

Of the 51 released participants with available criminal records, 21.6% (n=11) reoffended. In the intention-to-treat analysis (n=51), group assignment had a marginal effect on recidivism: odds-ratio (OR)=0.75, p=.060. Participants in the R&R2 group were less likely to reoffend in comparison with the TAU group. A total of 18.9% reoffended in the R&R2 group and 28.6% in the TAU group. The number needed to treat to prevent one reconviction was 11. In the per-protocol analysis (n=38), group had a marginal effect on recidivism: odds ratio (OR)=0.65, p=.068. A total of 19.4% reoffended in the R&R2 group and 42.9% in the TAU group. The number needed to treat was 5.

Dropout rate

A total of 46 participants dropped out of the study: in the whole sample (n=213), group assignment significantly predicted the dropout rate: OR=0.37, p=.024. Participants in the R&R2 group were less likely to drop out than those in the TAU group (16.3% and 29.8%). In the subsample of released participants (n=51), we found a significant effect of group on the dropout rate as well: OR=0.72, p=.048. Again, participants in the R&R2 group were less likely to drop out than those in the TAU group (16.2% and 50%). Dropouts (regardless of group) were not more likely to reoffend than completers (OR=0.75, p=.181).

Attitudes and behaviors

Comparisons between the R&R2 and the TAU groups at post-test for the four self-report questionnaires are reported in Table 3. There was one significant difference between the groups: compared with the TAU group, participants from the R&R2 group had a lower score of spontaneous aggressiveness (p=.047) on the aggressiveness questionnaire. These effects corresponded to a small mean difference: 0.21. There were also marginal effects for reactive aggressiveness and excitability of the aggressiveness questionnaire (p=.070 and p=.086), with

participants from the R&R2 group reporting lower levels of aggressiveness in comparison with those in the TAU group.

Discussion

This pilot project investigated whether the R&R2 program resulted in a reduced recidivism rate, a lower number of dropouts, and improved attitudes and behaviors-related variables in comparison with TAU.

Recidivism

Overall, the findings were in favor of the R&R2 program among PLD who had committed violent offenses, with a marginally significant benefit of the program among completers (per-protocol analysis) and for all participants (including dropouts, intention-to-treat analysis). Participants in the R&R2 group were less likely to reoffend than participants in the TAU group, with an acceptable number needed to treat (11 for the intention-to-treat analysis and 5 for the per-protocol analysis). These results are in line with previous findings on the R&R program (Tong and Farrington 2006), but to our knowledge, such benefits of the R&R2 program have not yet been tested. However, the odds-ratios were of small magnitude (per-protocol: OR=0.65, intention-to-treat: OR=0.75) (Chen et al. 2010), meaning that the effect of the R&R2 program was modest. Most effects reported in the systematic review of Tong & Farrington (2006) were also small for the R&R program. Therefore, rehabilitation programs designed to reduce recidivism should not neglect other areas of intervention such as the provision of mental health treatment for those suffering from psychiatric disorders (e.g., substance use disorders) and the promotion of social reintegration by addressing the work, financial, and living situation of PLD (Klepfisz et al. 2017; Lee et al. 2018).

Dropout

Participating in the R&R2 program also led to a reduced dropout rate in comparison with TAU, with a medium effect size (OR=0.37). Dropout has been described as an important concern among "high-risk" PLD (Koehler et al. 2013), so improving treatment retention is important in this subgroup. In addition to the content of the R&R2 program, it was possible that participants in the R&R2 group were less likely to drop out because group therapy was more socially friendly or because it was less intrusive. Further studies should compare different group therapies to achieve a better understanding of the reasons why individuals drop out from (group) therapy. Indeed, PLD who fail to complete treatment have a higher rate of recidivism (Olver et al. 2011). In our study, participants who dropped out were not more likely to reoffend, but the low level of recidivism might have resulted in a lack of statistical power.

There was no difference between completers and dropouts, except for age. This finding contradicted those of a previous meta-analysis (Olver et al. 2011), reporting that dropouts are often younger.

Attitudes and behaviors

Few differences between the R&R2 and the TAU groups were identified in the self-report questionnaires related to hostile attribution bias, aggressiveness, interpersonal problems, and willingness to accept responsibility. There was a significant decrease of spontaneous aggressiveness in the R&R2 group in comparison with the TAU group. Two other subscales of the aggressiveness self-reported scale were also marginally significant. Therefore, the R&R2 program seemed to reduce aggressive responses. This was consistent with previous studies reporting decreased violent attitudes (Jotangia et al. 2015; Rees-Jones et al. 2012; Yip et al. 2013; Young et al. 2016; Young et al. 2015). However, the magnitude of the effects was small, with negligible means differences (≤ 0.4 on five and six-point scales). In addition, there was

no difference between groups for the ambiguous subscale of the HAB. Effects should be highlighted on this subscale, because ambiguous situations are especially sensitive to aggressive interpretations and a tendency to assume hostile intentions (Matthews and Norris 2002). Therefore, it seemed that the intervention had no clear effect on hostile attribution bias. The other dimensions (willingness to accept responsibility and interpersonal problems) did not change over the study period.

Limitations

This study also had several shortcomings. The first one was its small final sample size (51 participants released and with criminal record extraction). This might have reduced statistical power to identify a significant association between the intervention and recidivism. Future studies should collect more complete data from criminal records to provide further evidence of the beneficial (and long-term) effect of the R&R2 program. In addition, information on the number and character of recidivism should also be assessed to provide a stronger evidence of the benefits of the program. The marginal and significant effects in the intention-to-treat and per-protocol analyses suggested that there was a robust effect of the R&R2 program on recidivism. A second shortcoming was that we relied on the official criminal records, and thus undetected crime and offenses were not evaluated. In addition, some entries in the criminal records might have been delayed, meaning that some cases of recidivism might have preceded the intervention. However, this is – depending on the jurisdiction – a frequently encountered problem in the field of forensic therapy research. In addition, we lacked of information on participants who leaved Switzerland. Even if they did not committed new offenses in Switzerland, it might be the case in another country. Third, we had no information on the date of dropping out from the study (i.e., at the beginning of the intervention or rather at the end). This might have led to an underestimation of the benefits of the R&R2 program. Still, the

intention-to-treat analysis is the best way to assess the usefulness and efficacy of a treatment. Even if it provides a conservative picture of the impact of the intervention, it resembles real clinical practice, with patients who drop out and do not complete the whole treatment. Again, it increased confidence regarding the beneficial effect of the intervention. In future studies, information on the continuum between treatment completed, drop out during the intervention, and even pretreatment dropout should be collected to achieve a better understanding of treatment failure (Olver et al. 2011). Fourth, our study did not use random allocation. Randomized controlled trials are "gold standard" evaluations, and they would provide strong evidence for the effect of the R&R2 program. However, participants of both groups were comparable on all variables assessed at pre-test, so we believe that we can be quite confident in our conclusions. Despites these shortcomings, this study had high external validity. A fifth limitation was that we were unable to derive a response rate (i.e., potential participants who declined to participate). Therefore, we could not assess whether the sample was representative from the whole prison population. A sixth shortcoming was that TAU might have been heterogenous in the different prisons, so that what R&R2 was compared with remained somewhat unclear. However, this heterogeneity was taken into account in the mixed-effect models and all TAU were individual therapies. The intervention group received both TAU and additional standardized-manualized therapy according to R&R2. Having an additional therapy might have increased beneficial effects. However, in the absence of convincing evidence of the benefits of the R&R2 intervention, it was not possible to replace TAU and only rely on R&R2. Indeed, using an ineffective program to treat PLD who committed violent offenses might lead to catastrophic consequences. Another limitation was that the study might have relied on self-report questionnaires assessing quite stable characteristics. These dimensions are less likely to change over time in short-term studies (mean time between pre- and post-test: 131 days). Future studies should include other secondary outcomes more specifically related to the aims

of the R&R2 study, such as cognitive and social skills and competencies. In addition, one scale (aggression inhibition) had a low reliability, so this outcome had a limited evidence. Finally, future studies should also include females, as this study focused exclusively on male PLD.

Taken together, most of these limitations show that there were several barriers to carrying out high-quality research with sound methodology in prison (MacKenzie 2012; Schmucker and Lösel 2015). Several logistical (e.g., burden to the local staff, safety issues, attrition due to release or transfer, problems collecting data) and ethical challenges reduce researchers' chances of implementing rigorous evaluation designs that depend on isolating the effect of a single factor. Nonetheless, although prison research is challenging, there is a crucial need to achieve a better understanding of this vulnerable population, including identification of health needs in epidemiological studies and effective interventions in controlled studies. This would help to reduce health inequalities and to achieve the goal of healthcare equality.

Implications

Our study suggests that the highly structured group therapy program R&R2 could have an added value regarding criminal recidivism. Indeed, the fourteen additional group meetings of the R&R2 led to a reduction in recidivism. With an NNT of 5 for completers and 11 for intention to treat, R&R2 could thus be a cost-effective program that further reduces the risk of re-offense after release and can improve rehabilitation, when applied together with the treatment of an existing mental health disorder. Given the limitations of our study, it is nonetheless premature to derive general recommendations for further dissemination of this program. However, we believe our study shows that it is worth testing the R&R2 program in other prison settings and larger sample sizes to provide a robust empirical evidence of its efficacy.

Other benefits of a group therapy such as R&R2 are worth mentioning: First, a group therapy may be especially useful for patients who are reluctant to individual therapy and may thus improve access to mental health care and adherence to therapy. Second, as group therapy is more cost-effective than individual therapy, it would allow concentrating resources on the difficult patients (i.e., having severe mental health problems and non-adherence to treatment).

Conclusion

Overall, the findings of this pilot project are promising, with the R&R2 program leading to reduced recidivism and dropout rates. Therefore, the R&R2 program seems effective among PLD who had committed violent offenses in Switzerland. Even if these results are preliminary and should be confirmed by studies using sound research methods, the R&R2 program should be considered a relevant approach to reducing recidivism after prison. Receiving appropriate mental health care in prison, including effective psychotherapeutic treatment, might well set the stage for successful reintegration into society. The fact that R&R2 is relatively easy to implement and inexpensive compared to other methods also speaks for its continued use.

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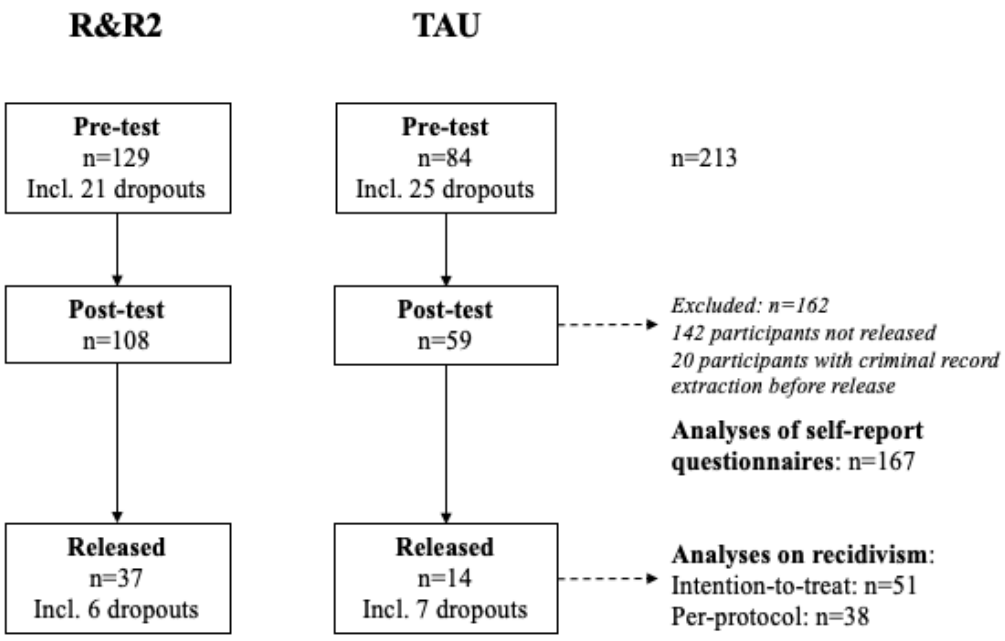
Figure 1. Study overview, Switzerland, 2010-2014



R&R2: Reasoning and Rehabilitation program (short version), TAU: treatment as usual

Table 1. Comparisons between groups at pre-test, Switzerland, 2010-2014

	Group			Missing values	
	R&R2	TAU	p-value	R&R2	TAU
Time between pre- and post-test[1]	131.40 (40.16)	131.30 (30.65)	.316	21	25
Prison[2]					
Bostadel, Zug	6	10	-	-	-
Lenzburg, Aargau	18	12	-	-	-
Pöschwies, Zurich	0	9	-	-	-
St. Johannsen, Bern	31	13	-	-	-
Thorberg, Bern	34	15	-	-	-
Schöngrün, Bern	0	6	-	-	-
Wauwilermoos, Luzern	0	10	-	-	-
Witzwil, Bern	40	9	-	-	-
Socio-demographics					
Age[1]	34.07 (9.37)	35.71 (11.96)	.151	0	1
Swiss nationality[3]	67.2	72.3	.235	1	1
Level of education (higher than compulsory)[3]	42.2	32.4	.531	8	10
Mental health					
Prior experience of psychotherapies[3]	58.9	42.3	.126	17	13
No psychiatric diagnosis[3]	12.7	22.9	.825	11	14
Inventory of interpersonal problems (0-4)[1]	1.26 (0.53)	1.33 (0.50)	.144	9	5
Aggressiveness questionnaire (0-5)[1]					
Spontaneous aggressiveness	1.00 (0.82)	0.94 (0.82)	.293	0	3
Reactive aggressiveness	1.91 (1.06)	1.91 (0.95)	.313	0	3
Excitability	1.99 (1.23)	1.84 (1.19)	.249	0	2
Self-aggressiveness	1.92 (1.04)	2.13 (1.10)	.109	0	3
Aggression inhibition	2.75 (0.87)	2.67 (0.87)	.179	0	3
Hostile attribution bias (0-4)[1]					
Provocative	1.94 (0.89)	2.04 (0.84)	..244	0	0
Ambiguous	1.41 (0.66)	1.43 (0.65)	.231	2	4
Non-provocative	0.57 (0.59)	0.54 (0.59)	.318	0	2
Willingness to accept responsibility (0-4)[1]					
Excuse	2.42 (0.58)	2.43 (0.58)	.306	4	3
Justification	1.92 (0.68)	1.81 (0.58)	.158	3	3

R&R2: Reasoning and Rehabilitation program, short version, TAU: treatment as usual.

[1] Means, standard errors, and p-values for linear Bayesian mixed-effects models with participants nested according to prisons are reported.

[2] n are reported.

[3] Percentages and p-values for logistic Bayesian mixed-effects models with participants nested according to prisons are reported.

Table 2. Comparisons between dropouts and completers, Switzerland, 2010-2014

	Dropouts	Completers	p-value
Prison[2]			
Bostadel, Zug	11	5	-
Lenzburg, Aargau	23	7	-
Pöschwies, Zurich	6	0	-
St. Johannsen, Bern	33	11	-
Thorberg, Bern	41	8	-
Schöngrün, Bern	9	1	-
Wauwilermoos, Luzern	9	0	-
Witzwil, Bern	35	14	-
Socio-demographics			
Age[1]	38.37 (11.03)	33.71 (10.11)	.041
Swiss nationality[3]	70.5	68.9	.850
Level of education (higher than compulsory)[3]	45.5	36.4	.560
Mental health			
Experience of psychotherapies[3]	53.9	52.1	.977
No psychiatric diagnosis[3]	20.0	15.5	.123
Inventory of interpersonal problems (0-4)[1]	1.22 (0.48)	1.30 (0.53)	.148
Aggressiveness questionnaire (0-5)[1]			
Spontaneous aggressiveness	0.92 (0.92)	1.00 (0.79)	.235
Reactive aggressiveness	1.79 (1.07)	1.95 (1.00)	.171
Excitability	1.88 (1.41)	1.95 (1.16)	.274
Self-aggressiveness	2.04 (1.19)	1.99 (1.03)	.293
Aggression inhibition	2.74 (0.79)	2.72 (0.89)	.301
Hostile attribution bias (0-4)[1]			
Provocative	1.88 (0.92)	2.01 (0.86)	.182
Ambiguous	1.41 (0.67)	1.42 (0.65)	.313
Non-provocative	0.55 (0.65)	0.56 (0.57)	.314
Willingness to accept responsibility (0-4)[1]			
Excuse	2.50 (0.53)	2.40 (0.59)	.167
Justification	1.86 (0.49)	1.88 (0.68)	.312

[1] Means, standard errors, and p-values for linear Bayesian mixed-effects models with participants nested according to prisons are reported.

[2] n are reported.

[3] Percentages and p-values for logistic Bayesian mixed-effects models with participants nested according to prisons are reported.

Table 3. Comparisons between groups at post-test, Switzerland, 2010-2014

	R&R2	TAU	Estimate interaction (group x time)	p-value
Inventory of interpersonal problems (0-4)	1.24 (0.53)	1.41 (0.54)	-6.81	.104
Aggressiveness questionnaire (0-5)				
Spontaneous aggressiveness	0.89 (0.72)	1.10 (0.82)	-2.84	.047
Reactive aggressiveness	1.58 (0.88)	1.98 (0.96)	-2.70	.070
Excitability	1.55 (1.03)	1.85 (1.04)	-2.29	.086
Self-aggressiveness	1.70 (0.96)	2.00 (1.09)	-0.24	.303
Aggression inhibition	2.89 (0.93)	2.68 (0.93)	1.01	.161
Hostile attribution bias (0-4)				
Provocative	1.68 (0.81)	2.03 (0.76)	-1.97	.128
Ambiguous	1.19 (0.61)	1.29 (0.54)	-6.22	.115
Non-provocative	0.50 (0.53)	0.48 (0.40)	-0.75	.213
Willingness to accept responsibility (0-4)				
Excuse	2.29 (0.57)	2.36 (0.60)	-0.31	.263
Justification	1.82 (0.68)	1.79 (0.53)	-0.36	.231

R&R2: Reasoning and Rehabilitation program, short version, TAU: treatment as usual.

Means and standard errors at post-test, estimates for the interaction between the group and time, and p-values for linear mixed-effects models with measures nested into participants nested into prisons are reported.