Research report

The course of major depression during imprisonment – A one year cohort study

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ABSTRACT

Background: First longitudinal studies in prisoners point to improvements of depressive symptoms during imprisonment. The aim of the present study was to assess the course of major depressive disorder during imprisonment and to identify factors influencing remission.
Methods: Prisoners with major depressive disorder in a sample of consecutive admissions to the penal justice system in Santiago de Chile were reassessed after one year of imprisonment. Psychiatric diagnoses were established using the Mini-International Neuropsychiatric Interview; psychological symptoms were assessed with the Symptom-Check-List 90 Revised (SCL-90-R). Mean symptom scores were compared at baseline and follow-up using Student's t-test. Odds ratios (OR) of comorbid disorders and socio-demographic factors at baseline to predict depression at follow-up were calculated.
Results: $N=79$ out of 80 inmates (99%) with major depression at baseline were included. Thirty-five prisoners (44%) had major depression at follow-up. The mean global severity score and all mean subscale scores of the SCL-90-R improved. High suicide risk was present in 37 prisoners (47%) at admission and in 11 (14%) at follow-up. The comorbid diagnosis of PTSD (OR 6.3; $p < 0.001$) at admission and having been previously imprisoned (OR 2.5; $p=0.05$) predicted major depressive disorder at follow-up.
Limitations: The study could not account for temporary improvements between the assessments.
Conclusion: In spite of important symptom improvements, only about half of the prisoners with major depression at admission remit after one year of imprisonment. New interventions should target people with major depression and comorbid PTSD at admission.

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1. Introduction

Prison population rates have increased worldwide (Walmsley, 2013). The increase of prison population rates was associated with the decrease of psychiatric bed numbers (Mundt et al., 2015a). Psychiatric inpatient and prison populations are largely overlapping (Mundt et al., 2015c). In Chile, prison population rates more than doubled between 1990 and 2010. Even though the rates have gone down in the past four years to 247 per 100,000 people in 2014, prisons are still overcrowded with an occupancy rate of above 110% (www.prisonstudies.org). The conditions are poor compared to other high-income countries.

Rates of major depression were estimated to be 10.1% in male and 14.2% in female prisoners (Fazel and Seewald, 2012). Major depressive disorders in prisoners are an important risk factor for near-lethal suicide attempts (Marzano et al., 2010; Rivlin et al., 2010) and for suicide (Baillargeon et al., 2009). Especially at the moment of admission, prisoners are at high risk of severe mental and comorbid substance use disorders (Mir et al., 2015). A prevalence study in a random sample of consecutively admitted prisoners in the penal justice system in Chile had shown that almost half of the people (49%) had major depression (Mundt et al., 2015b). The rates were higher than previously reported for a study examining the point prevalence of depression in mostly long-term

convicts in Chile (Mundt et al., 2013). In most places, major depression at admission to prison remains untreated. However, little is known about the course of depression over time during imprisonment. It is unclear whether depressive disorders remit over time when adjustment to the prison environment has occurred or whether they show chronic courses. It is under debate to what degree major depression at admission is related to social adversities and traumatic experiences prior to imprisonment or a consequence of the adverse conditions in the prison environment.

Very few studies have assessed the course of mental health symptoms or mental disorders over time during imprisonment. A recent systematic review included 15 studies (Walker et al., 2014). It pointed to the paucity of evidence and concluded that there was need for further high quality studies (Walker et al., 2014). The studies are still inconclusive but suggest an improvement of mental health symptoms over time during imprisonment, especially depression and anxiety symptoms. Several of the studies have methodological shortcomings. Most studies examined the course of psychological symptoms over time with self-report instruments. The few studies that used standardized diagnostic interviews to also establish diagnoses used self-rated screening prior to the application of the structured interview (Hassan et al., 2011; Hurley and Dunne, 1991), which may have limitations in terms of representativeness depending on the validity of the screening instrument. Most of the studies had rather short follow-up periods that may not have been sufficiently long to account for meaningful adjustment processes. Hassan et al. (2011) showed that female prisoners may have less symptom improvement during imprisonment. Predictors of the course of depression during imprisonment at admission could help identify people for mental health interventions. Socio-demographic characteristics, especially those relating to adjustment during imprisonment and co-morbidities of depression could be candidates to be such predictors.

Aim of the present study was to reassess people with major depression at admission to the penal justice system after one year of imprisonment with respect to diagnoses and symptom levels. The study aimed to establish the rate of remission from major depression during imprisonment and to identify factors influencing remission.

2. Method

2.1. Sample

We conducted a longitudinal observational study of consecutively admitted prisoners with major depression at admission to the penal justice system. The study included baseline and one-year follow-up assessments. Inclusion criteria were current major depression in a representative sample of newly admitted prisoners at baseline and imprisonment at one year follow-up. The baseline assessments took place in the three central remand prison facilities in Santiago. At baseline, $N=427$ prisoners were randomly selected from lists of newly committed prisoners. They were assessed for mental health symptoms and disorders within their first weeks of imprisonment (mean 7 days after imprisonment). All females admitted between February and September 2013 were approached for inclusion; every third male on the daily printed admission lists was approached for inclusion. Prisoners with all types of verdict such as detention, remand prisoners and sentenced prisoners were included in the study. Exclusion criteria were the inability to communicate in the Spanish language and a lack of capacity to provide informed consent. Further details on the sampling were described elsewhere (Mundt et al., 2015b). $N=210$ had major depression at baseline. All prisoners with major

depression at baseline and still imprisoned after one year in the metropolitan area of Santiago de Chile ($N=80$) were approached for the follow-up assessment after one year. Follow-up assessments were held from April to June 2014 in five different prison facilities for remand and sentenced prisoners in the metropolitan region of Santiago de Chile: Centro de Detención Preventiva (CDP) Santiago Uno, Centro Penitenciario Femenino (CPF) San Joaquín, CPF San Miguel, CDP Santiago Sur and CDP Puente Alto.

2.2. Instruments

Age, marital status, background of migration, educational level and the legal status in prison were assessed using structured questions. The marital status was categorized in the not mutually exclusive categories single, married, co-residing, separated, divorced, widowed. The educational level was categorized according the International Standard Classification of Education (ISCED), comprising levels 5 and 6 (university and doctorate degrees) to one level (UNESCO Institute for Statistics, 2011). The legal status was dichotomized to sentenced and pre-trial remand prisoners. The type of criminal offense and having had previous imprisonment(s) were recorded. Information on psychiatric or psychological treatments in prison was obtained.

The Spanish version of the Mini-International Neuropsychiatric Interview (MINI) was administered to establish diagnoses in accordance with the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). The MINI is a fully structured lay administered interview schedule with good interrater and test-retest reliability (Lecrubier et al., 1997; Sheehan et al., 1998). Its first use in a prison population was in 2004 (Black et al., 2004). Since then, it has been administered in several countries to assess mental disorders in prisoners (Fotiadou et al., 2006; Gunter et al., 2008; Maccio et al., 2015; Ponde et al., 2011). The MINI covers the antisocial personality disorder as the only one of the personality disorders. The module for borderline personality disorder of the Structured Clinical Interview for DSM-IV (SCID II) was added to the interview schedule (First et al., 1990).

The Spanish revised version of the self-reporting 90-item symptom checklist (SCL-90-R) was used to assess symptoms of psychological distress. The instrument is scored on a 5-point Likert scale, ranging from 0 (not at all) to 4 (extremely). The 90 items are grouped into nine dimensions that assess *Somatization*, *Obsessions-Compulsions*, *Interpersonal Sensitivity*, *Depression, Anxiety*, *Hostility*, *Phobic Anxiety*, *Paranoid Ideation*, and *Psychoticism*. The Global Severity Index (GSI) is the average item score and an indicator for general psychological distress (Derogatis, 1977). The SCL-90-R is suitable to measure change of psychological distress over time. Thresholds for 'caseness' and clinically meaningful differences for the GSI and each subscale were established for the general population in Chile (Gempp Fuentealba and Avendaño Bravo, 2008). The SCL-90-R has been used in longitudinal studies of prison populations before (Gibbs, 1987, 1991; Taylor et al., 2010).

2.3. Procedure

Procedures for the baseline assessment are described in detail elsewhere (Mundt et al., 2015b). At both time points, potential interviewees were first approached by the prison staff on call assisting in the logistics of the study and led to the interview area of the institution for information on the study. During the interview sessions, only the interviewer and the prison inmate were present in a separate study room to ensure confidentiality. The interviews lasted 45–60 min. Four clinical psychologists conducted the interviews at baseline. One of the psychologists and one doctorate student conducted the interviews at follow-up. All interviewers were trained and supervised by a senior consultant psychiatrist.

Participation was voluntary. Written and oral informed consent was obtained from all participants prior to inclusion in the study at baseline and again at follow-up. The study was approved by the Ethics Board of the University of Chile (Acta de Aprobación 01 from 25.01.2012, amended 13.12.2013) and by the Ministry of Justice of the Republic of Chile (reference: Subsecretaria de Justicia 15.03.2012 and Oficio 599 from 24.01.2014).

2.4. Analyses

Socio-demographic characteristics and prevalence rates of mental disorders were calculated as per cent values. The age and the SCL-90-R scores were calculated as mean and standard deviations of the mean (M $\pm$ SD). Comorbidities of depression were calculated as per cent values at baseline and at follow-up. Chi-square tests were conducted to test whether the frequency of comorbidities differed between baseline and follow-up. A two-sided paired sample t-test was used to assess the difference between the mean GSI and subscale scores on the SCL-90-R at baseline and follow-up. p-Values < 0.05 were considered statistically significant. Changes of symptom levels between baseline and follow-up were assessed against thresholds for clinical meaningfulness established in a validation study in the general population in Chile (Gempp Fuentealba and Avendaño Bravo, 2008). Odds ratios to predict depression at follow-up were calculated for socio-demographic variables and comorbidities. The selection of socio-demographic variables was guided through hypotheses that the variables may have an impact on adjustment processes during imprisonment. We included gender, educational level, which was dichotomised for this purpose in low (ISCED 0-1) and the rest (ISCED 2-6), and we included previous imprisonment(s). Ninety-five percent confidence intervals (95% CI) were calculated for odds ratios. Mean scores on the SCL-90 *Depression* subscale and standard deviation of the means at baseline were calculated for the groups who had major depression at follow-up and for those who had remitted from depression at follow-up. Baseline variables associated with major depression at follow-up on a 90% probability level were retained as independent variables for a multivariate binary logistic regression model with major depression at follow-up as dependent variable. The exponential of the regression coefficient (B) was calculated. Ninety-five per cent CI and p-values were calculated for the coefficients. Multicollinearity among the predictors was assessed using variable inflation factor (VIF) statistic. Chi-square tests were conducted with the cross table calculator in Stata 12. All other statistical data analyses were conducted using SPSS version 22.

3. Results

3.1. Recruitment

At one year follow up, $n=80$ out of 210 (38%) of the prisoners with major depression were imprisoned in the metropolitan region of Santiago de Chile. Of $n=80$ prisoners eligible for the follow-up, one refused to participate (rejection rate 1%). Data were collected from 79 prisoners, of which $n=9$ had been temporarily out of prison and come back during the year. The time interval between the two examinations was one year (mean 12.4 months).

3.2. Socio-demographic characteristics of the sample

Socio-demographic characteristics of the sample are reported in Table 1. All prisoners were non-migrant Chileans. Most were male, single and had low educational levels. About half of the prisoners were one year after imprisonment still pre-trial remand

Table 1
Socio-demographic characteristics of the sample.

	Total sample $N=79$ (100%)
Mean Age ($\pm$ SD)	30.5 ($\pm$ 11.0)
Male	51 (65%)
Chilean	79 (100%)
Marital status	
Single	63 (80%)
Married	12 (15%)
Co-residing with partner	18 (23%)
Separated	10 (13%)
Divorced	0 (0%)
Legal status	
Pre-trial	43 (54%)
Sentenced	36 (46%)
Educational level	
ISCED 0	26 (33%)
ISCED 1	16 (21%)
ISCED 2	27 (34%)
ISCED 3	7 (8%)
ISCED 4	1 (1%)
ISCED 5 or 6	2 (3%)
Offense category	
Robbery	12 (15%)
Robbery with intimidation/violence	30 (38%)
Violence (Homicide)	4 (5%)
Drug possession/trafficking	24 (30%)
Sexual crime	5 (6%)
Possession of firearm	2 (3%)
Other	2 (4%)
Previous imprisonment(s)	42 (53%)

ISCED=International Standard Classification of Education.

prisoners. About half were charged or convicted for non-violent crimes. About half had been imprisoned before.

$N=21$ (27%) of the prisoners had consulted health services for their mental health problem during the year of imprisonment; $n=8$ (10%) had received mental health treatment for at least one month during imprisonment, mostly as outpatients; one had been hospitalized for several months. In the total cohort, $n=4$ (5%) were prescribed antidepressants and $n=2$ (3%) antipsychotic medication.

3.3. Major depression and psychiatric comorbidities at admission and at follow-up

Comorbid DSM-IV diagnoses at admission and at follow-up are reported in Table 2. $N=35$ out of 79 prisoners (44%) still had major depression after one year (Table 2). Comorbidities of major depression were common at baseline and at follow-up. About half of the prisoners had comorbid anxiety disorders at baseline and at follow-up. A majority of prisoners had comorbid illicit drug use disorders at baseline and at follow-up. Most of the prisoners had comorbid personality disorders at baseline and at follow-up. Comorbid alcohol use disorders, manic episodes (mixed states) and PTSD were less frequent at follow-up, whereas comorbid borderline personality disorder was more common among those still depressed at follow-up.

3.4. Course of psychological symptom levels

The mean values of the GSI and the 9 subscale scores at baseline and follow-up are reported in Table 3. Symptom scores of the GSI and all subscales decreased during imprisonment. The decrease on all subscales except on the subscale *Hostility* reached significance level.

Mean GSI scores and mean scores on the subscales *Depression* and *Anxiety* decreased on a clinically meaningful level. $N=53$ prisoners (67%) meaningfully improved on the GSI at follow-up as

Table 2
Numbers and per cent values of people with major depression and comorbid disorders at baseline and follow-up; Chi-square value; significance level.

	Baseline		Follow-up		Chi-square	p-Value
	N=79	%	N=35	%		
Current major depression	**79**	**100**	**35**	**100**		
Recurrent major depression	38	48	19	54	0.4	n.s.
Major depression with melancholic features	54	68	26	74	0.4	n.s.
Current manic episode	8	10	0		3.8	0.05
Current hypomania	1	1	0		0.4	n.s.
Any current anxiety disorder	**48**	**61**	**17**	**49**	1.5	n.s.
Current Panic Disorder	13	17	3	9	1.2	n.s.
Current Agoraphobia	19	24	10	29	0.3	n.s.
Social Anxiety Disorder	14	18	3	9	1.6	n.s.
Generalized Anxiety Disorder (GAD)	4	5	2	6	0.0	n.s.
Obsessive-Compulsive Disorder (OCD)	13	17	5	14	0.1	n.s.
Post-traumatic Stress Disorder (PTSD)	26	33	5	14	4.3	0.04
Any current psychotic disorder	**25**	**32**	**7**	**20**	1.6	n.s.
Current non-affective psychotic disorder	7	9	1	3	1.3	n.s.
Current psychotic mood disorder	18	23	6	17	0.5	n.s.
Any substance use disorder	**56**	**71**	**21**	**60**	1.3	n.s.
Alcohol dependence	25	32	1	3	11.4	0.001
Alcohol abuse	1	1	0		0.4	n.s.
Illicit drug dependence	45	57	20	57	0.0	n.s.
Illicit drug abuse	5	6	1	3	0.6	n.s.
Personality disorders	**60**	**76**	**33**	**94**	5.4	0.02
Antisocial Personality (APD)	42	53	22	63	0.7	n.s.
Borderline Personality (BPD)	59	75	33	94	6.0	0.01

n.s.=not significant.

Table 3
Mean Global Severity Index and mean subscale scores at baseline and at follow-up; significance level for the differences of the means.

	Mean (± SD) at baseline	Mean (± SD) at follow-up	p-Value (t-test)
GSI	1.97 (± 0.65)	1.35 (± 0.73)	< 0.001
Dimensions			
Somatization	2.06 (± 0.57)	1.38 (± 0.92)	< 0.001
Depression	2.56 (± 0.72)	1.65 (± 0.81)	< 0.001
Obsessions–compulsions	2.16 (± 0.75)	1.74 (± 0.92)	< 0.001
Interpersonal sensitivity	1.67 (± 0.67)	1.18 (± 0.73)	< 0.001
Anxiety	2.42 (± 0.95)	1.45 (± 0.93)	< 0.001
Hostility	1.2 (± 1.06)	0.96 (± 0.97)	0.06
Phobic Anxiety	1.25 (± 0.92)	0.66 (± 0.71)	< 0.001
Paranoid Ideation	1.89 (± 0.93)	1.44 (± 0.96)	< 0.001
Psychoticism	1.63 (± 0.87)	1.07 (± 0.81)	< 0.001

compared to baseline, $n=20$ (25%) remained unchanged and $n=6$ (8%) showed a meaningful deterioration. At baseline, 66 prisoners (84%) had symptom levels corresponding to 'cases', at follow-up $n=36$ (46%). The number of people with high suicide risk according to the MINI decreased from $n=37$ (47%) to $n=11$ (14%). During the year, $n=15$ (19%) had attempted suicide.

3.5. Predictors at baseline of depression at follow-up

The association of socio-demographic variables and comorbidities at baseline with major depression at follow-up is reported in Table 4. The two socio-demographic variables female gender and previous imprisonment were identified as possible risk factors for major depression at follow-up. Among the comorbidities, PTSD at admission was the strongest predictor of major depression at follow-up (OR 6.3; 95% CI: 2.2; 17.9). Illicit drug use disorders at admission showed an association with major depression at follow-up at the borderline of significance (OR 2.4; 95% CI: 0.9; 6.4). The four variables were retained in the multivariate binary logistic regression model. Previous imprisonment and PTSD at admission remained significant predictors of major depression at follow-up. There was a trend, close to significance, for female gender and comorbid drug use disorders to be associated with major depression at follow-up in the multivariate regression. VIF did not indicate any collinearity issues for the model. Severity of depression at baseline did not predict major depression at follow-up.

4. Discussion

4.1. Main findings

Even though most prisoners with major depression at admission show improved symptom levels over time, almost half still fulfill the criteria for this severe mental health condition after one year of imprisonment. Psychological symptom levels improve on average in most domains but remain on the level of 'caseness' for almost half of the sample. Comorbid PTSD at admission and previous imprisonment are associated with major depression at follow-up.

4.2. Strengths and limitations

This is the first longitudinal study of mental disorders in prison populations from South America and from an emerging country. It is the first study to follow-up the course of major depression identified in a random admission sample. The sample is representative for all newly admitted prisoners in the penal justice system who stay for at least one year. The study used standardized and validated diagnostic instruments applied by trained researchers.

The relatively small sample size of the study was not considered a limitation because the aim was to identify clinically important risk factors of depression at follow-up. In a larger sample more risk factors with questionable clinical importance may have come up as significant predictors. We cannot exclude that cases classified as having major depression at admission and at one-year follow-up had transitory improvements or remissions between the two assessments. It is unclear to what degree the data are generalizable beyond South American countries with other socio-economic and criminal justice contexts.

4.3. Interpretation and comparison against the literature

More than half of the prisoners remit from major depression at admission mostly without specific interventions during the first year of imprisonment. However, almost half still meet criteria for major depression after one year. In a naturalistic study on the course of depression in the community, 40% of the sample still had major depression after one year (Chin et al., 2015). If major depression at admission to prison was just a transitory phenomenon related to the immediate 'pain of imprisonment' and possibly substance withdrawal, one would have expected higher rates of remission in this naturalistic prison studies than in community samples after one year. Our study indicates that people with major depression at admission to prison show similar risks of persistent

Table 4
Social-demographic indicators and comorbidities at baseline related to major depressive disorder at follow-up.

	N	Depression at follow-up N	Remission at follow-up N	OR	95% CI	p-Value	Multivariate binary logistic regression with major depressive disorder at follow-up as dependent variable[a]		
							OR	95% CI	p-Value
Socio-demographic indicators									
Females	27	16	11	2.5	1.0; 6.6	0.06[*]	3.3	0.9; 11.7	0.06
Low-education (ISCED 0-1)	42	20	22	1.3	0.6; 3.3	0.53			
Previous imprisonment	42	23	19	2.5	1.0; 6.3	0.05[*]	4.3	1.3; 13.8	0.02
Comorbidity at baseline									
Dependence and abuse disorders	56	27	29	1.7	0.6; 4.8	0.28			
Alcohol use disorders	26	13	13	1.4	0.5; 3.6	0.48			
Illicit drug use disorders	50	26	24	2.4	0.9; 6.3	0.07[*]	3.3	0.9; 12.2	0.07
Anxiety disorders	48	24	24	1.8	0.7; 4.6	0.21			
Current panic disorder	13	7	6	1.6	0.5; 5.2	0.46			
Current agoraphobia	19	6	13	0.5	0.2; 1.5	0.21			
Social anxiety disorder	14	5	9	0.6	0.2; 2.1	0.48			
GAD	4	2	2	1.3	0.2; 9.5	0.82			
OCD	13	5	8	0.8	0.2; 2.5	0.65			
PTSD	26	19	7	6.3	2.2; 17.9	<0.001[*]	7.0	2.0; 24.0	0.002
Current non-affective psychotic disorder	7	3	4	0.9	0.2; 4.5	0.94			
Personality disorders	60	28	32	1.5	0.5; 4.3	0.46			
Antisocial personality disorder	42	19	23	1.1	0.4; 2.6	0.86			
Borderline personality disorder	59	28	31	1.7	0.6; 4.8	0.34			
	Mean (±SD) at baseline for the total sample	Mean (±SD) at baseline for the depressed at follow-up	Mean (±SD) at baseline for the remitted at follow-up	Difference of means					
Depression subscale SCL-90	2.56 (±0.72)	2.64 (±0.67)	2.49 (±0.76)	0.15 (±0.16)	−0.17; 0.48	0.36			

[*] Variables with $p < 0.1$ in bivariate analyses were retained as covariates for the multivariate analysis.
[a] Female gender, previous imprisonment, drug use disorder and PTSD at baseline as independent variables.

courses during imprisonment as untreated people in the community. Given that long duration of untreated depression can decrease the response to subsequent treatment (Bukh et al., 2013), it may be reasonable to offer treatment for major depression at imprisonment without waiting for natural adjustment processes to occur.

First longitudinal mental health studies of prisoners had indicated that levels of depressive symptoms are highest at admission and decrease during imprisonment (Hassan et al., 2011; Walker et al., 2014). One study from Canada showed a long-term follow-up period of 1.5 years without conducting structured diagnostic interviews. Clinically important levels of depression and/or anxiety were present on self-report symptom scales in 53% of the prisoners one month after imprisonment and in 21% after 1.5 years (Zamble and Porporino, 1990), which points to similar rates of improvement as in our study.

The risk of suicide in prison is high (Fazel et al., 2011) and related to clinical factors such as history of suicide attempts and suicidal ideation (Fazel et al., 2008). The decrease in rates of high suicide risk found in our study is in line with the decrease in rates of major depression. In spite of improvements with respect to suicide risk, almost one out of five in the cohort reported to have attempted suicide during the year. The rate of suicide attempts was surprisingly high in this study. The detection of major depression at admission to prison is clinically relevant because this population could be targeted with interventions to prevent suicide (Pratt et al., 2015).

Global distress and eight out of nine dimensions of psychopathology covered by the SCL-90-R improved significantly during the year of imprisonment. For the subscale *Hostility* the improvement almost reached significance level. For the GSI and the subscales *Depression* and *Anxiety*, the improvement was clinically meaningful according to the threshold established for the general population in Chile (Gempp Fuentealba and Avendaño Bravo, 2008). In a British study, the decrease of psychological symptoms in prisoners with depression, psychosis, other mental illness and no mental illness at confinement was compared (Hassan et al., 2011). Only the group with major depression in the first week of custody showed a significant decrease of symptom levels. A longitudinal study from the US using the SCL-90-R compared symptom levels in the week before arrest with those at confinement and in the first week after imprisonment. The study showed that the dimensions *Hostility*, *Phobic anxiety* and *Paranoid ideation* stayed nearly unchanged when entering and after being in prison for a week, while symptom severity of *Anxiety*, *Depression* and GSI substantially increased at imprisonment and decreased modestly after 5 days of imprisonment (Gibbs, 1987). In a British cohort study of prisoners, 72% were 'cases' on the SCL-90-R at one week after imprisonment and 50% four weeks after imprisonment (Taylor et al., 2010). Our study shows that the improvements of psychological symptoms indicated by previous research apply to a majority of people with major depression and represent a trend over a follow-up of one year. However, symptom levels improve from such high levels that almost half still fulfill criteria for major depressive disorders one year after the imprisonment.

People with comorbid major depression and PTSD at admission may be of special concern to develop persistent major depression during imprisonment. Especially for this comorbidity, unfavorable courses of symptoms over long-term follow up periods have been observed among traumatized people in the community (Priebe et al., 2013). PTSD receives increasing clinical recognition in prison populations (Wolff et al., 2015). Previous imprisonment and female gender could be further risk factors for persistent courses of major depression during imprisonment. Those risk factors are also linked in the general population: PTSD is more common in females and associated with the risk of incarceration (Anderson et al.,

2015). This supports the notion that prisoners already bring with them a range of risk factors that influence their mental health during imprisonment. People with those risk factors could also be more vulnerable to imprisonment or have reduced abilities to adjust to prison environment. Previous research had shown that prisoners with substance use disorders had higher rates of psychological symptom improvement (Andersen et al., 2003). It was hypothesized that the reduced access to substances during imprisonment causes the steeper curves of symptom improvements. Our study did not replicate this finding. To the contrary, people with major depression and comorbid illicit drug use disorders showed a trend to less frequently remit from major depression. This may depend on the degree different prison systems are enforcing the reduced access to substances and on the drugs that are predominantly used. The finding could be a characteristic of South American prison systems and cocaine based products being the most common substance of addiction in the region. People who maintain their addiction during imprisonment may have more severe forms of addiction and could be more vulnerable to the conditions of imprisonment.

4.4. Implications for research and health policy

Following up inmates with major depression at admission showed that important numbers do not recover from this condition during the first year of imprisonment. Major depression is a severe mental disorder that contributes to high suicide rates repeatedly reported for prison populations. Persistent major depression in prison populations gives rise to human rights concerns, especially in the South American context of poorly resourced prison systems. Effective interventions are needed. Given the low numbers of inmates who actually receive treatment, there is need to increase the capacities of existing services and to evaluate their effectiveness. Interventions should target especially people with comorbid PTSD and people with repeated imprisonments.

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