

Suicide and suicides attempts in Italian prison epidemiological findings from the “Triveneto” area, 2010–2016

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ABSTRACT

The aim of this observational study was to assess rates of suicide and suicide attempts, in relation to gender, age, place of birth and security levels, in north-eastern Italian prisons during 2010–2016, and investigate associations with prison overcrowding, offence type and prior self-harm and suicide attempts. The study was based on individual data on suicides and suicide attempts from 16 prisons, with an average yearly number of 3900 inmates during the study period, for all prisons combined. Descriptive and binomial regression analyses were performed.

Rates of suicide and suicide attempts in Triveneto prisons were 1 and 15 per 1000 inmates, respectively. > 90% of suicides and suicide attempters were men aged between 21 and 49 years old, and most had committed violent offenses. Only half the prisoners who died by suicide and 30% of those who made a suicide attempt in custody were Italians. ‘Cooperative witnesses’ had the highest mean suicide attempt rate (30/1000 inmates). Fourteen per cent of suicides and 19% of attempters had a prior history of suicide attempts and self-injury. In binomial regression analyses, predictors of suicidal behaviour were being a male inmate in standard security conditions, with a mean age of 30 years.

The study highlighted that there is a need for suicide prevention policies in Triveneto; these should take into account predictors of suicidal behaviours and individual characteristics of suicidal inmates. More research is warranted in order to both evaluate the effectiveness of prevention plans and better assess risk of suicide in specific groups, such as cooperative witnesses.

1. Introduction

Suicidal behaviours in prison are a major global public health problem (Fazel, Ramesh, & Hawton, 2017; World Health Organization, 2007). Recent international research has shown that rates of suicide in prison are up to seven times higher than in the general population (Rabe, 2012). Suicide attempts have also been observed to be more frequent in inmates than non-inmates (Jenkins et al., 2005; Sarchiapone et al., 2009; Wichmann, Serin, & Motiuk, 2000). Previous suicide attempts and self-injury are among the main risk factors for suicide in inmates (Carli et al., 2011; Fazel, Cartwright, Norman-Nott, & Hawton, 2008; Fruehwald, Matschnig, Koenig, Bauer, & Frottier, 2004; Hawton, Linsell, Adeniji, Sariaslan, & Fazel, 2014; Humber, Webb, Piper,

Appleby, & Shaw, 2013; Roy, Carli, Sarchiapone, & Branchey, 2014; Verdolini et al., 2017). Other risk factors appear to be specifically related to the prison environment (Dye, 2010; Fazel et al., 2008; World Health Organization, 2007). Indeed, suicidal behaviours in prisons are likely due to complex interactions between individual-level (such as the types of crimes committed before incarceration (Fazel et al., 2008; Hawton et al., 2014; Rabe, 2012; Verdolini et al., 2017), and ecological factors (Jenkins et al., 2005), including the nature and quality of prison environments and regimes (Dye, 2010; Fazel et al., 2017). However, there remains little conclusive evidence in relation to the latter, and their role in precipitating or mediating suicidal behaviour in prisoners. For example, prison overcrowding has been shown to be both a risk factor for suicide (e.g. because associated with more restrictive regimes

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and reduced 'purposeful activity'(Leese, Thomas, & Snow, 2006) and a potentially protective factor (e.g. by reducing the likelihood of a vulnerable prisoner being housed in a single cell (Fazel et al., 2017).

The relationship between prisoner suicide and different levels of custodial security (e.g. whether an establishment is designated to hold prisoners for whom the very highest conditions of security are deemed necessary, versus those for whom less restrictive, or even 'open', conditions are considered appropriate) is also an especially important – but relatively unexplored - area for investigation, as different security levels are in turn associated with potentially key factors such as staffing levels, time out of cell and in solitary conditions, purposeful activity, and more or less austere built environments. Findings from United States (Dye, 2010) and Canada (Wichmann et al., 2000) suggest that maximum security conditions may be associated with a higher risk of suicidal acts, possibly due to higher levels of deprivations and isolation. However, these findings are yet to be replicated in other countries, including ones such as Italy, where special security levels exist (e.g. those provided to inmates as part of witness protection programmes).

In Italy, suicide deaths were recently reported to be 12 times more likely in prisoners than in the general population (Fazel et al., 2017). These findings echo earlier data relating to 1990–2002 (Preti & Cascio, 2006). Unfortunately, despite such high rates of suicide in Italian prisons, few individual-based studies have been carried out in Italy in order to investigate suicide risk factors in inmates (Carli et al., 2011; Roy et al., 2014; Sarchiapone, Carli, Di Giannantonio, & Roy, 2009; Sarchiapone, Jovanovic, et al., 2009; Verdolini et al., 2017). Nonetheless, efforts to enhance prevention strategies in prisons were recently carried by the Italian government through the approval of a national action plan on suicide prevention in prisons (Conferenza Unificata Stato-Regioni, 2017). This has also led to existing regional action plans being updated, and new regional action plans being developed, tailored to local needs and realities. For example, the Veneto region is currently updating its regional suicide prevention plan (Giunta Regionale regione Veneto, 2012) and Friuli Venezia Giulia (FVG) recently approved its own plan (Giunta regionale Regione Friuli Venezia Giulia, 2017). These regions belong to the so called "Triveneto" area, which is made up of three regions: Veneto, Trentino Alto Adige and FVG, and has a population of approximately 7,200,000 inhabitants.

As rates of suicide and suicide attempts in FVG (Giunta regionale Regione Friuli Venezia Giulia, 2017) and Veneto (Giunta Regionale regione Veneto, 2012) prisons appear to be high compared to the rest of the country, the Triveneto Penitentiary Department has released for analysis epidemiological and individual-level data on inmate suicidal behaviour. Furthermore, it is of particular interest to enhance knowledge of potential risk and protective factors related to the prison environment, such as security level. Such data can help improve identification of inmates at high risk of suicide and inform the design and implementation of effective suicide prevention strategies (Barker, Kolves, & De Leo, 2014; Marzano et al., 2016), with potentially important implications nationally as well as internationally (Fazel et al., 2017).

Thus, with the present study we aimed to: 1) assess rates of suicide and suicide attempts, in relation to gender, age, place of birth and security levels, in Triveneto prisons during 2010–2016; 2) investigate levels of prison overcrowding and offence type in all suicides and suicide attempts occurred during the study period; and 3) assess whether suicides and suicide attempters had previous episodes of suicide attempts and self-injury in prison.

2. Material and methods

We analysed data from the 16 prisons in the Triveneto area, which during 2010–2016 had a yearly average overall number of 3900 inmates (for all prisons combined). Each prison in the region has up to four separate sections, with different security levels. All prisons have an "ordinary" section for inmates whose crimes do not require specific

security measures. Four prisons have a "protected" section, housing sex offenders, former police officers and anybody who should be kept separated from 'ordinary' inmates for safeguarding reasons. Three prisons have a "high-security" section, usually reserved for inmates who must be completely isolated, such as criminal organizations' affiliates or terrorists. Two prisons also host a section for inmates under witness protection (hereinafter called "cooperative witnesses"). These individuals require specific imprisonment conditions, such as being isolated from other inmates and having heavily restricted and supervised access to phone calls, mail, and family contact more generally. Three prisons also provide a section for women prisoners, and one establishment only houses female inmates (two more prisons in Veneto had female sections, but only until 2012 and 2013, respectively). The security level in women's sections is usually ordinary.

The database of the National Penitentiary Department of the Italian Ministry of Justice was used to retrieve data on the total number of inmates per year in each prison section, the statutory capacity of each prison section, as well as individual data on inmates who made fatal and non-fatal suicide attempts. The database allowed to link data from prisons records of Triveneto, using a unique anonymous identifier.

In the database, self-harm acts are registered as "suicide" when they resulted in the inmate's death, and as "suicide attempts" when suicidal intent was expressed. "Self-injury" was registered in cases involving non-lethal or unknown to be lethal means (Preti & Cascio, 2006). This classification of self-harm acts is routinely done by penitentiary staff, after the intervention of a physician. No individual data on inmates who self-injured were available.

Data on suicide in the general population were retrieved from the Italian Institute of Statistics (Istat; available at <http://dati.istat.it>). Male suicides aged 20 to 59 years old from North-East Italy were selected, for comparison with data on suicides in Triveneto prisons. Data were available only for 2010–2014 and no data on suicide attempts were available. General population data for 20–59 year old males in North-East Italy were obtained from the same web address, based on the 2011 Italian census.

2.1. Individual data on suicides and suicide attempters

Annual data on inmates who died by suicide or attempted suicide from 1st January 2010 to 31st December 2016 were selected from the Penitentiary Department database of Triveneto. Only inmates whose suicide or suicide attempt took place in prison (as opposed to, for example, shortly after release) were registered (Preti & Cascio, 2006).

Gender, age, place of birth, offence type, prison density and custody type were linked to each selected inmate using a unique anonymous identifier. Age was divided into nine categories (decades from 18 till 69 years). Place of birth data were categorized as: Italy, Europe, Africa, Asia or America.

Where more than one index offence was committed by an inmate, only the first crime registered in the database was used. Crimes were then divided into 15 categories: abetment, assault and battery, criminal organization affiliation, damage and fire, drug offenses, escape, exploitation of prostitution, extortion, homicide, indecent and persecutory acts, kidnapping, sexual offenses, theft and robbery, violation of immigration rules, violation of weapons' rules (data on the percentage of inmates in whole Triveneto prison population in custody for each offence type were not available).

Prison density was calculated as a percentage of overcrowding, which was in turn derived as follows (Leese et al., 2006):

$$\frac{\text{Total number of inmates in each prison} - \text{statutory capacity of each prison}}{\text{statutory capacity of each prison}} \times 100$$

The number of inmates in each prison and the statutory capacity of each prison were those of 31st December of each year considered

(2010–2016), and were considered separately for male and female prison sections. Although it would be more precise to measure prison population on a monthly basis, our data provided a measure of prison population only on yearly basis, in line with Van Ginneken et al. ((van Ginneken, Sutherland, & Molleman, 2017). A prison establishment was deemed to be overcrowded when the percentage of overcrowding was > 1%.

Security levels were divided in ordinary, protected, high security and cooperative witnesses, following the classification used by the Italian Penitentiary Department.

The individual number of previous suicide attempts and self-injury episodes in the five years prior to the death by suicide or last suicide attempt was also obtained from the database. Numbers were both treated as continuous variables and categorized into three groups for previous suicide attempts (0; 1; ≥1) and four groups for previous self-injury (0; 1–2; 3–10; ≥11).

2.2. Statistical analysis

Yearly suicide rates and suicide attempts rates per 1000 inmates from Triveneto prisons were calculated. The mean rate per 1000 inmates of suicide and suicide attempts during the 7-years period was calculated as the mean of the yearly suicide rate and suicide attempts rate per 1000 inmates for each year considered (2010–2016).

Gender, age, place of birth and security level were treated as dichotomous or categorical variables and tabulated into contingency tables for testing significant associations through chi-square statistics (χ^2). Continuous variables (i.e. number of previous suicide attempts and self-injuries) were summarized using the median as a measure of central tendency and the range as a measure of dispersion.

A binomial regression was performed for suicide attempt rates. The following yearly aggregated predictors were examined: average age (treated as a continuous variable), proportion of males and females, proportion of “ordinary” security level vs. other security levels, overcrowding (treated as a continuous variable) and proportion of Italians vs. other nationalities.

A *p*-value (*P*) of 0.05 was set as the threshold for statistical significance.

Descriptive and inferential analyses were conducted using the statistical software R, version 3.4.1.

3. Results

3.1. Rates of suicide

The mean detention population in the Triveneto area during 2010–2016 was 3900 inmates, of which 96% were men.

The total number of inmate suicides during the study period was 29 (all by male prisoners). The mean rate was 1.12 per 1000 inmates. In comparison, the mean suicide rate during 2010–2014 in the male north-eastern Italian general population, aged 20 to 59 years old, was 0.1 per 1000 inhabitants. This means that suicides were eleven times more frequent among inmates than in the general population. Most inmate suicides (60%) were aged 35 to 49 years old, and > 50% were Italians (Table 1). Suicide rates were also higher among Italian and African inmates, compared to other birthplaces (Table 1).

3.2. Rates of suicide attempts

During the study period there were 402 suicide attempts among male inmates (96.2%) and 16 among females. The mean rate was similar in men and in women (approximately 15 suicide attempts per 1000 inmates) (Table 1). > 60% of those who attempted suicide were aged 21 to 34 years old. Rate of suicide attempts decreased from younger to older age groups (Table 1). Most suicide attempts were made by African inmates (54.3%), who had also the highest mean rate

Table 1

Numbers (N), percentages (%) and rates of suicides and suicide attempts in Triveneto prisons, according to gender, age groups and place of birth. Period 2010–2016.

	Mean detention population (years)	Suicide Attempts (N = 418)		Suicides (N = 29)			
		N	%	Mean Rate/1000 inmates	N	%	Mean Rate/1000 inmates
Gender							
Male	3734.1	402	96.2	15.4	29	100	1.1
Female	158.3	16	3.8	14.5	–	–	–
χ^2 (P)		NS			NS		
Age groups							
18–20	71.4	24	5.7	50.9	1	3.4	0.6
21–24	337.3	70	16.7	31.0	3	10.3	2.8
25–29	643	107	25.6	24.8	3	10.3	7.2
30–34	664.1	78	18.7	17.9	3	10.3	1.5
35–39	595.7	49	11.7	12.5	8	27.6	11.0
40–44	522	43	10.3	11.4	4	13.8	3.3
45–49	411.1	22	5.3	7.6	5	17.2	5.0
50–59	480.1	19	4.5	5.7	2	6.9	0.6
≥60	152	6	1.4	5.4	–	–	–
χ^2 (P)		< 0.001			NS		
Place of Birth							
Italy	1656.4	124	29.7	10.7	16	55.2	1.4
Europe	915.3	40	9.6	6.2	3	10.3	0.5
Africa	1120.7	227	54.3	28.9	10	34.5	1.2
Asia	116.4	18	4.3	22.1	–	–	–
America	82	9	2.2	15.7	–	–	–
χ^2 (P)		< 0.001			NS		
Security level							
Ordinary	3326.7	386	92.3	17.3	28	96.5	1.2
Protected	275.1	20	4.8	10.4	1	3.5	3.3 ^a
High security	86.4	4	1.0	11.8	–	–	–
Collaborative	39.3	8	1.9	30.1	–	–	–
Witnesses							
χ^2 (P)		< 0.05			NS		

NS: not significant.

^a Since the only inmate who committed suicide was in year 2010, rate was calculated on the inmate population in protected security level of year 2010 (N = 302).

of suicide attempt (28.9 per 1000 inmates) (Table 1).

3.3. Offence type

Theft, robbery, and drug offenses were the most common crimes of those who died by suicide and made suicide attempts (in relation to both, approximately 30% of total crimes committed -Table 2). A history of homicide was present in 24% of suicides, compared to only 8% of suicide attempts (Table 2).

3.4. Prison overcrowding

Of all male prison sections, 12 were overcrowded during the study period, and 3 were not overcrowded. Among the five female prison sections, one was overcrowded. Overall, the mean percentage of overcrowding was 25%. The majority of both suicides (N = 25; 86.2%) and suicide attempts (N = 351; 84.0%) occurred in overcrowded conditions.

3.5. Security level

Twenty-eight suicides were inmates in “ordinary” security sections, and one was in a “protected” security section.

Table 2

Numbers (N) and percentages (%) of suicides and suicide attempts in Triveneto prisons, according to offence type. Period 2010–2016.

Offence type	Suicide attempts (N = 418)		Suicides (N = 29)	
	N	%	N	%
Abetment	2	0.5	–	–
Assault and battery	27	6.5	3	10.3
Criminal organization affiliation	5	1.2	–	–
Damage and fire	8	1.9	2	6.9
Drug offenses	130	31.1	8	27.6
Escape	4	1.0	–	–
Exploitation of prostitution	2	0.5	–	–
Extortion	10	2.4	–	–
Homicide	33	7.9	7	24.1
Indecent and persecutory acts	4	1.0	–	–
Kidnapping	3	0.7	–	–
Sexual offenses	19	4.5	–	–
Theft and robbery	145	34.7	9	31.0
Violation of immigration rules	22	5.3	–	–
Violation of weapons' rules	4	1.0	–	–

In men, nearly 90% of suicide attempts (N = 370) involved 'ordinary' inmates (Table 1).

Cooperative witnesses had the highest mean rate of suicide attempts during the study period (30.1 per 1000 inmates). The rate was double the one observed among ordinary inmates and almost three-times higher than rates among inmates in protected or high security (Table 1).

In women, all 16 suicide attempts observed during the study period were in ordinary security conditions.

3.6. Previous suicide attempts and self-injury

In the five years prior to their suicide, 7 inmates had attempted suicide and 9 had self-injured (mean number of self-injury episodes = 6.7; median = 4; range = 1–18) (Table 3). Four suicides (13.8%) had a history of both attempted suicide and self-injury.

In the five years prior to their last suicide attempt, 97 inmates had attempted suicide in prison at least once (mean = 6.6; median = 4.5; range = 1–17), while 154 had self-injured at least once (mean number of self-injury episodes = 38.2; median = 30; range = 1–26) (Table 3). Seventy-four suicide attempters (19%) had both previously attempted

Table 3

Numbers (N) and percentages (%) of suicides and suicide attempts in Triveneto prisons, according to number of previous suicide attempts and self-injuries. Period 2010–2016.

	Suicide attempts (N = 389 ^a)		Suicides (N = 29)	
	N	%	N	%
Previous suicide attempts ^b				
0	292	75.1	22	75.9
1	52	13.4	6	20.7
≥ 2	45	11.6	1	3.4
Previous self-injury ^b				
0	235	60.4	20	69.0
1–2	74	19.0	4	13.8
3–10	68	17.5	3	10.3
≥ 11	12	3.1	2	6.9

^a Only last suicide attempt during years 2010–2016 was considered.

^b Number of suicides attempts and self-injuries in the 5 years prior to last suicide attempt and death by suicide.

Table 4

Binomial regressions results predicting the suicide attempts rates (Beta (β) coefficients reported). Significant results are reported in bold.

Variables	Model for suicide attempts		
	Estimate (β)	SE	P
Intercept	–13.72	4.12	< 0.001
Age ^a	0.30	0.14	0.03
Females ^b	–7.25	3.32	0.03
Ordinary security level ^c	2.21	0.84	0.008
Overcrowding ^d	0	0	NS
Italians ^d	–1.69	1.34	NS

SE: standard error; P: p-value; NS: not significant.

^a Continuous variable.

^b Proportion of females vs. males.

^c Proportion of ordinary security levels vs. other security levels (i.e. protected, high security and cooperative witnesses).

^d Proportion of Italians vs. other places of birth (i.e. African, Asians, Americans).

suicide and self-injured.

3.7. Binomial regressions

As summarized in Table 4, age and ordinary security level were positively associated with the logit probability of annual suicide attempts, while the proportion of females was negatively associated with them. Overcrowding and place of birth were not significantly associated with rates of suicide attempts.

Trends for suicide attempt rates and the estimated average rate obtained from the binomial model are displayed in Fig. 1. The estimated average rate across years (dashed line) is a good estimate for the yearly suicide attempt rates.

Due to the relatively small numbers involved, the analysis was underpowered in relation to completed suicides.

4. Discussion

Our seven-year observational study of prisons in the Italian Triveneto area showed that the average rate of suicide was 1.12 suicides per 1000 inmates, while the rate of suicide attempts in the same period was 15 times higher. These findings are consistent with previous data from Italy relating to 1990–2002 (Preti & Cascio, 2006) and 1997–2008 (Rabe, 2012). However, Fazel et al. recently reported rates in Italian prisons of 0.81 suicides per 1000 inmates for the 2011–2014 period (Fazel et al., 2017), which is lower than those registered in Triveneto during the same period. This suggests that suicides rates in all Italian prisons decreased in recent years, while rates in Triveneto prisons have not. Better identification of inmates' suicidal risk seems, thus, crucial in order to enhance suicide prevention in this area. In this

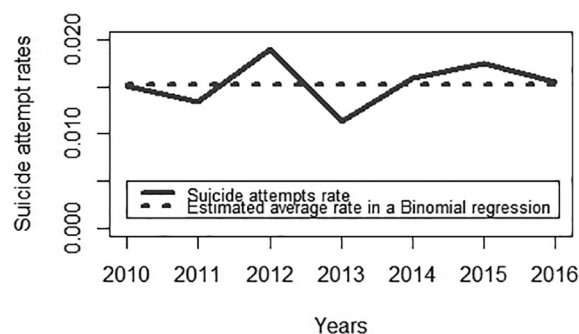


Fig. 1. Yearly observed and estimated rates for suicide attempts on 1000 inmates. Period 2010–2016.

context, increased knowledge of suicide attempters' characteristics may be of particular importance, since a history of suicide attempts is a major risk factor for subsequent suicide in prisons (Hawton et al., 2014; Humber et al., 2013). Our data suggest a rate of 15 attempted suicides per 1000 inmates during the study period, which is 50% higher than previous Italian findings (Preti & Cascio, 2006). The observed increase in suicide attempts in recent years should lead to additional efforts to prevent suicide attempts in custody. Our findings support earlier literature in showing that suicide attempts in prisoners are ten to twenty times more prevalent than completed suicides (Jenkins et al., 2005; Preti & Cascio, 2006). Our binomial regression analysis highlighted that the most important predictors of suicide attempts were male gender, average age around 30 years old and ordinary security level. This means that most suicide attempts happen under these conditions, which, however, describe the majority of prison inmates in Italy. Wider environmental factors and population-based prevention strategies should therefore also be taken into account (Barker et al., 2014; Marzano et al., 2016).

Our findings also suggest that inmates who attempted suicide differed from inmates who died by suicide in several respects. *Firstly*, they were more likely to be younger than suicide cases, with inmates aged 18 to 20 years old carrying the highest rate of attempts. Similarly, a British study reported that 23% of male inmates younger than 20 years old had self-harmed at some point during their current prison sentence (Hawton et al., 2014). *Secondly*, foreign inmates represented > 70% of suicide attempters, with the highest rate in those from African countries. In contrast, although suicide cases were mostly native-born Italians, suicide rates in African and Italian inmates were quite similar (1.4 vs. 1.2). This is a new finding in the Italian context, since previous data indicated a slight over-representation of attempts in foreign inmates and a significantly lower risk of suicide in foreign prisoners (Preti & Cascio, 2006). International data on prisoners who attempted or died by suicide suggest a higher risk in inmates of white ethnicity (Fazel et al., 2008; Hawton et al., 2014), and a recent study from Germany (Radeloff et al., 2017) showed that immigrants had a lower suicide risk in prison compared to German citizens. Disparities in mental health provision for immigrants with severe psychiatric disorders have been highlighted in Italy, with the latter receiving fewer interventions, as well as fewer days of hospital and residential care compared to Italians (Rucci et al., 2015). This disparity may be present also in prisons and may have influenced suicidal behaviour risk. *Thirdly*, we observed that the highest proportion of suicidal inmates committed crimes related to theft and robbery and drug offenses, consistent with previous studies (Hawton et al., 2014; Verdolini et al., 2017). Nonetheless, one in four suicides committed homicide compared to only 8% of suicide attempts. Violent crimes have also been observed to carry a higher risk of completing suicide in other studies (Fazel et al., 2008; Fruehwald et al., 2004; Rabe, 2012).

With twelve out of fifteen male prisons being overcrowded, the highest proportion of suicides and suicide attempts was found in these prisons. An earlier Italian study (Preti & Cascio, 2006) reported that the rate of suicide in prisons exceeding their statutory capacity by over 20% was about 10 times higher than in other prisons. On the other hand, overcrowding did not appear to be a significant predictor of suicide attempts in our binomial regression model. Similarly, international data on the effect of overcrowding on suicidal inmates show mixed results, potentially also due to the use of different measures and definitions of overcrowding (Dye, 2010). For example, in England and Wales overcrowding was not associated with higher suicide risk, when adjusting for prison category (Leese et al., 2006), or for larger population size, higher turnover and higher security level (van Ginneken et al., 2017). The percentage of overcrowding in English and Welsh prisons, however, was only 12% on average (van Ginneken et al., 2017), compared to our mean percentage of 25%. In contrast, Rabe et al. (Rabe, 2012) demonstrated that European prison mortality was influenced by prison density. Although low overcrowding may be

related to protective factors for suicide, such as reduced single cell occupancy and increased peer support (Dye, 2010; Fazel et al., 2008; Fruehwald et al., 2004; Leese et al., 2006), high overcrowding may be related to delays in legal procedures (Rabe, 2012), lack of goods and services (Dye, 2010), and/or increased conflicts between inmates, which may precede suicide attempts (Opitz-Welke, Bennefeld-Kersten, Konrad, & Welke, 2013).

On the other hand, we could not differentiate between security conditions and extent of overcrowding, since prison-level data were only available at aggregated level, and many of the prisons included in our study comprised separate sections with different levels of security. Although high security prisons have been associated with an increased risk of inmate suicide (Pompili et al., 2009; Wichmann et al., 2000), Dye et al. (Dye, 2010) argued that suicidal behaviours are as common in maximum security facilities as they are in ordinary security conditions with high overcrowding. This seems consistent with our findings, since the highest percentage of suicidal inmates were in overcrowded ordinary sections and almost all suicidal acts involved inmates in ordinary conditions. Further, rates of suicide attempts were not so dissimilar in high security compared to ordinary sections. In contrast with a previous study (Rabe, 2012), we also found that sex offenders in protected sections had the lowest rates of suicide attempts. However, in a previous review (Fazel et al., 2008) a higher suicidal risk in sexual offenders was not demonstrated.

One of our main novel findings was the high rate of suicide attempts in cooperative witnesses housed in special sections. The latter are usually ex-affiliates of criminal organizations and therefore might experience additional stressors owing to the greater isolation and loss of personal autonomy in their prison section. They might also fear for the safety of their families (as potential targets of criminal vendettas), or feel guilty for collaborating with the police and betraying ex-affiliates. However, this finding should be interpreted with caution, since the number of cooperative witnesses who attempted suicide was low.

In our data, one in seven suicides and one in five suicide attempters had a prior history of both attempted suicide and self-injury. Further, > 30% of suicides and nearly 40% of suicide attempters had previously self-injured. Due to this high prevalence, it seems crucial to take into account both suicide attempts and self-injury in suicide prevention programmes (Carli et al., 2011). It might be also argued that self-injury acts prior to complete suicide may actually have been suicide attempts. Indeed, self-harm acts with or without a clear intent to die have been found to be one of the main risk factors for subsequent suicide and suicide attempts in prison (Fazel et al., 2008; Hawton et al., 2014; Wichmann et al., 2000).

4.1. Strengths and limitations

The strength of this individual-based register study is that it included data on all suicides and suicide attempts occurring in Triveneto prisons during a seven-year period. This avoided biases such as information and selection bias. To our knowledge, this was also the first study to investigate suicidal acts with regard to different levels of prison overcrowding, as well as in cooperative witnesses.

However, several limitations should be taken into account. Firstly, this is a naturalistic study where the causality of different factors on suicidal risk cannot be inferred. Secondly, the low number of subjects in specific sub-groups did not allow for detailed analysis, due to the low cell sizes and the consequent loss of statistical power. This applied to women prisoners, who represented only 4% of all suicide attempts, and, more generally to prisoners who died by suicide ($n = 29$ during the study period). This also hindered binomial regression analysis for suicide rates. Also, no individual-level data on prisoner self-injury were available, so detailed analyses in relation to this were not possible. Although self-injuries and suicide attempts may differ in important ways, it is arguably difficult to clearly distinguish the suicidal intent and hopelessness which underline an individual act of self-harm

(Lohner & Konrad, 2006). During the study period, the total number of recoded self-injury episodes in Triveneto was 3349, with rates increasing from 105.2 per 1000 inmates in 2010 to 170.3 per 1000 inmates in 2016. It seems likely that a number of these self-harm acts were carried out with suicidal intent. Third, data were obtained from prisons of a specific region, and may therefore not be generalizable to prisons across other countries or Italy itself. Fourth, data on suicide attempts in the general population were not available and could therefore not be compared to those drawn from prisons. This is perhaps a relatively minor limitation, since there is limited evidence of an association between prison suicide rates and rates of suicide in the general population (Fazel, Grann, Kling, & Hawton, 2011). It seems plausible that this might also apply to suicide attempts. Fifth, data on the number of Triveneto inmates for each offence type were not available, hindering further analyses. Finally, we could not analyse many factors of possible or probable importance for suicidal behavior in prisons, such as cell occupancy, incarceration rate, length of sentence, prison turnover, prisoner status (i.e. pre-trial, convicted, appellants and plaintiffs) or levels of inmate purposeful activity (Baggio, Getaz, & Tran, 2018; Fazel et al., 2008; Fazel et al., 2017; Hawton et al., 2014; Rabe, 2012; van Ginneken et al., 2017). Other individual risk factors, such as the presence of mental disorders, substance abuse, childhood trauma or socio-economic conditions (Fazel et al., 2008; Jenkins et al., 2005; Marzano, Hawton, Rivlin, & Fazel, 2011; Rivlin, Hawton, Marzano, & Fazel, 2010, 2013; Sarchiapone, Carli, et al., 2009; Sarchiapone, Jovanovic, et al., 2009), could also not be investigated.

4.2. Conclusions

Suicide prevention in Italian prisons is an important health care priority, since suicidal behaviours are unfortunately common in this setting. The aforementioned national action plan to prevent suicidal behaviours in prisons is arguably a key first step in this direction (Conferenza Unificata Stato-Regioni, 2017). More specifically, local plans such as those of Veneto and FVG regions (Giunta regionale Regione Friuli Venezia Giulia, 2017; Giunta Regionale regione Veneto, 2012) should implement prevention policies with a direct impact on prisons placed in their respective areas. National and local plans arguably address the need to incentivise suicide prevention strategies, as recommended by the World Health Organization (World Health Organization, 2007) and the international literature (Barker et al., 2014; Marzano et al., 2016). In this respect, the importance of integrating health care, criminal justice and prison administration processes has been repeatedly highlighted, consistent with the need for multifactorial prevention programs, addressing both clinical and environmental factors (Barker et al., 2014; Marzano et al., 2016).

Since we demonstrated higher rates of suicide and suicide attempts in Triveneto compared to previous Italian findings (Fazel et al., 2017; Preti & Cascio, 2006), the implementation of these policy plans seem particularly urgent in this area. Moreover, individual characteristics of suicidal inmates should be taken into account when designing prevention strategies, in Italy as abroad (Fazel et al., 2017). Most suicidal prisoners were born in a foreign country, had committed violent crimes and were in overcrowded prisons. Further, inmates under witness protection programs seemed to carry the highest suicide attempt rate. More research is needed, however, to support our findings, for instance by investigating in larger samples, with a greater level of detail, whether and to what extent cooperative witnesses may be at increased risk of suicide. Policy evaluations should also be carried out, to enhance the currently limited knowledge of effective prevention strategies (Barker et al., 2014; Marzano et al., 2016).

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