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# **UAB**

## **Universitat Autònoma de Barcelona**

Bachelor's degree in Criminology and Bachelor's degree in Law

### **Recidivism: evaluating the influence of pre- incarceration, in-prison, and post-release factors**

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## **ABSTRACT**

Prison recidivism is an ongoing global challenge. This study examines the predictors associated with recidivism and aims, firstly, to identify the significance of three temporal stages in recidivism (pre-imprisonment, imprisonment, and release), and secondly, to analyse the predictive capacity of various factors proposed from different theoretical perspectives. Using a Proportional Hazard Cox Model, several factors influencing recidivism across these stages were analysed. The results highlight the release stage as pivotal, emphasising the impact of staggered release in reducing recidivism. Within the imprisonment stage, variables related to parole grants significantly affect recidivism rates, underscoring the importance of social connections during incarceration. The study further emphasises the role of criminal associations and occupational stability upon release from prison in mitigating the risk of recidivism. Pre-imprisonment factors, such as age of onset of criminal activity or prior prison records, align with the Theory of Accumulated Disadvantages. Finally, it is concluded that the theory of social support, closely related to the general strain theory, provides the best explanation for the relationship between variables across different stages and recidivism.

**Key words:** Recidivism, release, imprisonment, social support theory, incarceration

## **RESUMEN**

La reincidencia penitenciaria es un desafío global constante. Este estudio examina los predictores asociados con la reincidencia y tiene como objetivo, primero, identificar el peso de tres etapas temporales en la reincidencia (el pre-encarcelamiento, encarcelamiento y la salida de prisión) y, segundo, analizar la capacidad predictiva de distintos factores propuestos desde distintos enfoques teóricos. Utilizando un Modelo de Cox de Hazard Proporcional, se analizan varios factores que influyen en la reincidencia a lo largo de las etapas. Los resultados muestran la etapa de la salida de prisión como fundamental, resaltando el impacto que tiene la salida escalonada en la reducción de la reincidencia. Dentro de la etapa de encarcelamiento, las variables relacionadas con las concesiones de permisos penitenciarios afectan significativamente las tasas de reincidencia, subrayando la importancia de las conexiones sociales durante la reclusión. El estudio enfatiza además el papel de las asociaciones criminales y la estabilidad ocupacional a la salida de prisión en la mitigación del riesgo de reincidencia. Los factores pre-encarcelamiento, como la edad de inicio de la actividad criminal o las encarcelaciones previas, se alinean con la Teoría de Desventajas Acumuladas. Finalmente, se concluye que la teoría del apoyo social, que está estrechamente relacionada con la teoría general de la tensión, proporciona la mejor explicación para la relación entre las variables de distintas etapas y la reincidencia.

**Palabras clave:** Reincidencia, salida de prisión, encarcelamiento, teoría del apoyo social, encarcelamiento

## Contents

|  |    |
|--|----|
| 1. Introduction.....   | 4  |
| 2. Theoretical framework .....   | 5  |
| 2.1. Pre-imprisonment time and recidivism .....  | 5  |
| 2.2. Imprisonment and recidivism.....  | 7  |
| 2.3. Release and recidivism.....   | 9  |
| 2.4. Aim of the research and hypothesis .....  | 10 |
| 3. Methodology .....   | 11 |
| 3.1. Population and sample .....   | 11 |
| 3.2. Data.....   | 13 |
| 3.3. Analysis .....  | 17 |
| 4. Results.....  | 17 |
| 5. Discussion .....  | 22 |
| 6. Conclusions.....  | 24 |
| References.....  | 27 |
| Appendices.....  | 32 |
| Appendix 1: Exclusion and inclusion criteria .....   | 32 |
| Appendix 2: Deviations between population and sample .....   | 34 |
| Appendix 3: Collinearity diagnosis .....   | 35 |
| Appendix 4: Diagnostic of linearity of Age at release, Length of sentence, and Number of prison records..... | 36 |
| Appendix 5: Diagnostic of proportionality of hazard ratios .....   | 37 |

## **1. Introduction**

Recidivism, the recurrence of criminal behaviour among individuals previously convicted and released from prison, remains a persistent challenge in criminal justice systems worldwide. This research focuses on elucidating the factors contributing to recidivism and seeks to understand why offenders continue to engage in criminal activities after their release from incarceration.

The research aims to identify the most crucial stage among pre-incarceration, imprisonment, and release time for understanding recidivism. It also explores the relevance of factors proposed by theoretical approaches at each stage, with the overarching goal of guiding the development of effective criminal justice policies. To achieve these objectives, a Cox Proportional Hazard Model has been employed to analyse various factors influencing recidivism across different stages.

The research findings offer insights into both knowing which stage is the most important and the significance of pre-imprisonment, imprisonment, and release variables in predicting recidivism rates. Firstly, the release stage emerged as the most effective in explaining recidivism. This indicates that variables within this stage provided more accurate explanations for the recidivism variable compared to variables from other stages. Secondly, in examining pre-imprisonment factors, the age at which criminal activity began emerged as a significant predictor, aligning with the Theory of Cumulative Disadvantages. Within the imprisonment stage, only specific hypotheses related to violating prison furlough rules and being granted prison furloughs were confirmed. The significance of these variables suggests the considerable influence of social connections on recidivism rates, and therefore the importance of the strain an inmate may experience. It is noteworthy that prison furlough, in its own right, plays a significant role, regardless of whether parole is granted, or release occurs from an open regime. Finally, findings from the release stage confirm hypotheses regarding the impact of release conditions, such as open regime or parole, and the presence of criminal associates on recidivism rates. Additionally, the study emphasises the role of occupational stability in reducing recidivism risk.

Overall, this research contributes to a deeper understanding of recidivism and offers valuable insights for informing evidence-based interventions and policy initiatives aimed at reducing re-offence rates and promoting successful reintegration into society.

## **2. Theoretical framework**

Numerous research has been conducted into identifying how different factors affecting inmates' impact their likelihood of recidivism. According to Cid & Martí (2021), four main theoretical approaches can be identified in the field. First, general strain theory (Agnew, 1992) posits that exposure to strain, such as negative stimuli, may lead to negative emotions and re-offending. Second, social support theory (1994) suggests that greater social support reduces criminal behaviour by assisting during times of strain, closely aligning with general strain theory. The third and fourth theories are differential association theory (Sutherland, 1947) and social learning theory (Akers, 1985), both argue that criminal attitudes are learnt and thus the context in which a person socialises matters for both the onset and maintenance of criminal behaviour.

Each of the aforementioned theories can provide explanations on how different stages of the life-course can influence recidivism: the time before entering prison, the imprisonment period, and the process of release.

### ***2.1. Pre-imprisonment time and recidivism***

Before entering prison, an inmate can be in some situations that may affect recidivism. Various research has been conducted to study these variables (e.g. family problems, personality traits, among others) and those will be the issue of this section. Although some of them cannot be changed, they are important to control the effects of other variables in conjunction with the usual control variables used in criminological research (sociodemographic and the offence's characteristics (Bales & Piquero, 2012; Nagin et al., 2009)), to which we will refer later in this work.

Considering general strain theory, an individual may have experienced some stimuli during their life that may cause strain and therefore responded with criminal behaviour. However, we must note that personality (along with other factors, especially those from social learning) is a key element regarding the effect of strain on the individual. Furthermore, a person acting in a criminal way given a strain depends on some factors and one of these that has been studied is personality traits. Individuals high in negative emotionality are more likely to experience intense emotional reactions to events that cause strain (specially anger) and to be disposed to respond to such events in an antisocial manner (Agnew et al., 2002; Andrews & Bonta, 2010). When an individual responds in an antisocial manner, there is a generalised rule violation and trouble, impulsivity, lack of problem-solving skills, low self-control, lack of planning, hostility, among others. Hence, it has been shown that personality is important in understanding criminal behaviour (Boduszek et al., 2011; Bonta

& Andrews, 2007; Bonta & Stephen Wormith, 2013; Gottfredson & Hirschi, 1990; Repo & Virkkunen, 1997). Moreover, regarding sources of strain, having had family problems such as abuse and/or neglect is linked with criminal behaviour (Grunwald et al., 2010; Van Duin et al., 2021). All these factors related to the strain an individual may experience have been shown to be associated with recidivism, but they are also important because they affect other areas of the individual's life that are also significant for criminal behaviour, such as employment, finances, among others.

Going to social support theory, an individual may have had a lack of support from family and the community that would have been positive to cope with the negative stimuli and strain felt during life (Van Duin et al., 2021). It is relevant to point that having suffered from family problems that consist of abuse or/and neglect not only causes strain but also means that one of the most important institutions of social support that provides protection against criminal behaviour was lacking (Andrews & Bonta, 2010).

Finally, regarding differential association and social learning theories, as we stated earlier, people who have been socialised in criminal contexts are more likely to commit a crime in the future (Akers, 1985, as cited in Boduszek et al., 2011; Hochstetler & DeLisi, 2005). Taking into consideration the family, we know that it is the primary agent of socialisation, meaning that the first patterns of behaviour a child will learn is from their parents (Grusec & Lytton, 1988). Thus, when parental criminality has been seen, an increase in the likelihood of criminal behaviour was also seen (Grunwald et al., 2010). In the same line, when we think of peers or friends, associations with delinquent friends were found to be predictive of recidivism through the learning and reinforcement of criminal attitudes. Through differential association (and differential reinforcement) criminal attitudes, behavioural and motivational techniques essential to committing crimes are acquired and consolidated (Boduszek et al., 2011). Hence, a very close factor to differential association is criminal thinking. When individuals are orientated towards criminal behaviour and have internalised criminal concept (learnt from their associates), they are more likely to engage in delinquent behaviour (Boduszek et al., 2011). This factor has been defined as the thought content that conducts an individual to both the initiation and maintenance of habitual non-normative behaviour (Andrews & Bonta, 2010; Folk et al., 2018; Walters, 2006, as cited in Boduszek et al., 2011). However, we may also point out that the direct effect of criminal thinking in recidivism is modest on average and in some studies non-existent, which could mean that it is dependent on other factors (Folk et al., 2018). To sum up, research has demonstrated the importance of the social environment in which a person is placed for



understanding the acquiring of criminal attitudes and, therefore, the increase in the likelihood of committing crimes (Boduszek et al., 2011).

Lastly, early criminal onset is a critical factor, indicating a higher likelihood of persistent delinquency and serious long-term offending. This early engagement can lead to a cycle of criminal behaviour, influenced by factors like peer associations. Also, an early onset of criminality may be an early link in a chain of causal mechanisms that increase in themselves the likelihood of becoming a long-term offender (i.e., losing a job, dropping out from school) (Gann et al., 2015). This idea was already explained by the Theory of Cumulative Disadvantages elaborated by Sampson and Laub (1997). This theory emphasises how early disadvantages, such as poor education, unemployment, and family instability, can accumulate over time, leading to a higher likelihood of persistent delinquency and long-term offending. The theory suggests that these accumulated disadvantages can create a self-perpetuating cycle of criminal behaviour, making it difficult for individuals to escape from crime once they have become involved in it.

## *2.2. Imprisonment and recidivism*

Various studies highlight the significance of an inmate's prison experience for re-entry, as new events and behaviours during imprisonment can impact the release period and hinder ex-prisoner reintegration (Atkin-Plunk & Armstrong, 2018; Butler et al., 2020; Cochran et al., 2014; Hochstetler & DeLisi, 2005).

From a general strain theory standpoint, inmates may experience strain due to various situations. It's crucial to consider the conditions of confinement as they can diminish the positive impact of protective factors, weakening their connection to recidivism (Turanovic & Tasca, 2022). We could especially mention having conflicts with inmates. Arguably, quality of life within prisons can be seen in proxy with in-prison conflict and violent behaviour (Di Tella et al., 2010). Finally, another factor that has been studied and that may cause strain on prisoners is the length of imprisonment. Many researchers have found that lengthier sentences do not have an effect on recidivism (Nagin et al., 2009; Snodgrass et al., 2011; Wermink et al., 2018), but there are others that have seen some impact on recidivism, for example, examining separately the inmates by the length of their sentences and realising the existence of an effect in recidivism -an inverted U-shaped relationship- that shows in the first terms of the sentence, where the time served increases the likelihood of recidivism (Mears et al., 2016).

Concerning social support theory, during imprisonment, there is a detachment from social networks and removal of sources of support and that is distressing and can lead to numerous

challenges while in prison (e.g. misconduct) (Turanovic & Tasca, 2022). In fact, isolation from family and friends is a source of strain (De Claire & Dixon, 2017; Turanovic & Tasca, 2022) and if pro-social connections are maintained throughout incarceration, we would see a decrease in the risk of re-offending (Atkin-Plunk & Armstrong, 2018; De Claire & Dixon, 2017). Therefore, interventions or programming that consider social support have success not only in decreasing recidivism but also easing the strain out experienced by the prisoners, and avoiding misconduct (Cochran, 2014; De Claire & Dixon, 2017; Duwe, 2017). One way to maintain these sources of social support and, therefore, influence prison adjustment and recidivism, is through prison visitation or prison furloughs (Atkin-Plunk & Armstrong, 2018; Bülow & Dagan, 2021; De Claire & Dixon, 2017; Turanovic & Tasca, 2022). It is elemental to mention that different experience with visitation may have different effects on recidivism. A more constant visitation is most effective at reducing re-offending, a more near-entry visitation also serves at reducing likelihood of recidivism, which shows how important visitation is for the early period of incarceration, most probably because of what was mentioned before, it helps inmates to adjust the new climate and relieve strain (Cochran, 2014).

Regarding differential association/social learning theory, there are two main factors that affect during incarceration. The first to which we will refer is treatment. Treatment or programming is the opportunity inmates have to engage in positive social learning through different programmes that provide them with education, job skills, among others (Astray-Caneda et al., 2011). Programmes are important because when inmates have components established prior to release, their likelihood of long-term success increases (Atkin-Plunk & Armstrong, 2018; Davis et al., 2013; Ellison et al., 2017). However, it is important to point out that these programmes need to be executed properly and adhering to the principles of effective intervention so that there is a reduction of recidivism (Bonta & Stephen Wormith, 2013). Also, in order to adequately prepare the inmate for re-entry, programmes need to offer more than just skill based training (Astray-Caneda et al., 2011). Improvements in cognitive processing, communication abilities and enhancement of long term prospects are needed (Farley & Pike, 2016). Moreover, programming also helps with other factors that are associated with recidivism, such as finding a job (Duwe & Clark, 2014). Finally, is important to take into account that treatment also reduces the likelihood of misconduct during imprisonment (Farley & Pike, 2016). The second factor involved in social learning is the contact with other criminals that may elevate the criminal human capital of inmates (Gaes & Camp, 2009, regarding contact with other inmates in high security units). This variable has not been largely studied and when it has been, it has not yielded positive results

or only for certain types of crimes (for effects in certain types of crimes see Damm & Gorinas, 2020; for null effect see Harris et al., 2018).

### *2.3. Release and recidivism*

The last stage through which an inmate goes through that is elemental for recidivism is re-entry. Not every inmate is released in the same circumstances and some of these conditions may hinder the process of reintegration and increase the odds of recidivism.

Considering general strain theory, the inmates that are not granted parole, do not have a progressive release (from less freedom to absolute freedom), or do not have support programmes at release will suffer more strain than those who do. These inmates will face with serious challenges after being incarcerated, such as finding a job, and can have other criminogenic needs, such as substance abuse that will need support and assistance or the strain and frustration may lead back to criminal behaviour (Duwe, 2017; Orrick et al., 2011).

In regards to social support theory, many studies point out that the provision of conventional support that motivates the person to put effort in the process of desistance and help easing the strain re-entry may cause matters to reduce the probabilities of recidivism through the informal social control process (Berg & Huebner, 2011; Cid & Martí, 2016; Duwe, 2017; Orrick et al., 2011). Two essential ways to get social support have been highlighted in previous research: family and professional support. Having family as a social support source has been pointed out as effective in reducing the odds for recidivism (Berg & Huebner, 2011; Boman & Mowen, 2017). These ties with the family could have been broken by entering prison and individuals may face severe difficulty in re-establishing them, which can affect the likelihood of the ex-prisoner returning to the context that facilitated their criminal behaviour (as we will explain later, they can return to the same peers that contributed to the onset of the criminal attitudes) (Boman & Mowen, 2017). The other source, professional support, has also been studied. The evidence shows that continuity of care is a critical component in the re-entry process to have success in the process of desistance (Berghuis, 2018; Duwe, 2017; Orrick et al., 2011). It has been seen that when inmates are released with supervision, they are less likely to re-offend (Duwe & McNeeley, 2021; Ellis & Marshall, 2000; Ostermann, 2013; Wikoff et al., 2012). However, it was also noted by the authors that the supervision must go beyond what is surveillance (Ostermann, 2013) and need to have a therapeutic philosophy, that is to say, follows the Risk-need-responsivity (RNR) model of supervision (Drake, 2018; Duwe & McNeeley, 2021).

In terms of social learning, there are two main issues that we are going to focus on: criminal peers and treatment. Regarding the first, there are studies that demonstrate criminal associates are a risk factor for recidivism (Boman & Mowen, 2017). But not only that, criminal peers significantly weaken the link between family support and desistance (Boman & Mowen, 2017). Considering treatment, as already introduced in the previous paragraph, when care is continued through release, the ex-prisoners still have the opportunity to decrease the odds of recidivism through programmes that follow the RNR model (Drake, 2018; Ndrecka, 2014; Wikoff et al., 2012) and assure that the transition from prison to the community does not cause strain or if it does, providing the inmates with resources to cope with it will be crucial (Berghuis, 2018). Also, it is important that some programmes also target (but not solely) factors that are closely related to criminal behaviour, such as finding a job, since it has been seen that employed ex-prisoners are less likely to recidivate (Berg & Huebner, 2011; Ndrecka, 2014).

To conclude, from the review of the current knowledge on what causes recidivism, we can extract that it is crucial to consider the three main stages of imprisonment since each one leads to different needs because there is a difference in the context in which the ex-prisoner was inserted.

#### *2.4. Aim of the research and hypothesis*

This research aims to identify which of the stages— pre-incarceration, imprisonment, and post-release time- is most important to understand recidivism, while exploring the relevance of the factors considered by the aforementioned theoretical approaches in each stage for recidivism.

The hypotheses are:

**H1.** During pre-imprisonment time:

**H1.1** Having had child maladjustment will increase the probability of recidivism.

**H1.2** Having had an early onset of criminal behaviour will increase the odds for recidivism.

**H1.3** Having had familial records will increase the probability of recidivism.

**H1.4** Having had a problematic socialisation will increase the probability of recidivism.

**H1.5** Having had personality issues such as hostility or impulsivity will increase the probability of recidivism.

**H2.** During imprisonment:

**H2.1** Having had conflicts with inmates will increase the probability of recidivism.

**H2.2** Having had measure violations will increase the probability of recidivism.

**H2.3** Having had limited response to treatment, will increase the probability of recidivism.

**H2.4** Obtaining prison furloughs is associated with a reduced probability of recidivism.

**H3.** At release time:

**H3.1** Having been released from an open regime or parole will decrease the probability of recidivism.

**H3.2** Having had lack of family support will increase the odds of recidivism.

**H3.3** Having criminal associates will increase the probability of recidivism.

**H3.4** Having a lack of economic resources will increase the odds of recidivism.

**H3.5** Having occupational problems will rise the likelihood of recidivism.

**H3.6** Having a pro-criminal attitude will increase the probability of recidivism.

### **3. Methodology**

#### ***3.1. Population and sample***

The data that is going to be used was constructed by CEJFE (*Centre d'Estudis Jurídics i Formació Especialitzada*) and published in April 2023 alongside with their research exploring recidivism. The data was extracted from SIPC and JOVO, databases corresponding to the Catalan prison system and the system of alternative criminal measures, respectively. The data that is analysed in this study contains information of the population that was released on permanent release, conditional release, or suspension of the sentence during 2015 and was followed up until December 31, 2019. The follow-up time is maximum of five years and minimum of four years (*Àrea d'Investigació i Formació en Execució Penal, 2023*).

In 2015, a total of 4025 inmates were released. After excluding cases where inmates were not released or died and considering factors like expulsion from the state or not meeting the minimum follow-up period, the population for the study amounted to 3651 ex-prisoners. Further exclusions were made based on criteria such as lack of important

criminological information, being under an alternative penal measure, prisoners who were never classified and those who were serving time for non-payment of a penal fine. Furthermore, inmates that returned to prison but for a crime committed before being released and were pending trial or execution of a sentence were also excluded.

After these exclusions, the dataset comprised 2474 entries, but due to missing values, 238 cases were further excluded. The final sample consisted of 2226 former prisoners. For more details regarding the exclusion and inclusion criteria, refer to Appendix 2, where recidivism rates for the excluded individuals are also provided.

Table 1 displays a comparison of demographic characteristics and recidivism rates between the sample and the general population. These are selected lines from a more detailed table (Appendix 2) and are crucial for discussing potential biases within the sample.

The sample drawn for analysis shows a gender imbalance, with women more represented among those never classified and those imprisoned for non-payment of fines, other women were lost when omitting the missing values. Additionally, there is a lower proportion of individuals aged 19 to 34 upon release, mainly due to their higher representation in those same other groups. The same is to be said about foreigners being underrepresented in our sample. Furthermore, individuals aged 26 to 34 are also more prevalent in the sample of people that return to prison for a previous offense rather than for recidivating.

Regarding the type of crime for which they were convicted for prior to follow-up, there is a significant lack of individuals who committed non-violent property crimes. This disparity is primarily since these offences are predominantly found among those who were never classified or incarcerated for non-payment of fines. This is logical, as individuals in these circumstances typically receive short sentences (as their crimes are not considered serious) and prison staff have limited time to assess their placement and start all the activities and programmes needed for their desistance. Most of them serve sentences of fewer than 2 years and that would explain why we also have a lack of individuals that served fewer than 2 years of prison.

**Table 1***Demographic and recidivism comparison between population and sample (main deviations)*

|                                | Population  |       | Sample      |       | Difference   |
|--------------------------------|-------------|-------|-------------|-------|--------------|
|                                | n           | %     | n           | %     | P. P         |
| <b>Sex</b>                     |             |       |             |       |              |
| Women                          | 325         | 8.90  | 142         | 6.38  | <b>-2.52</b> |
| <b>Age at release</b>          |             |       |             |       |              |
| 19 to 25                       | 255         | 7.01  | 100         | 4.49  | <b>-2.52</b> |
| 26 to 34                       | 1185        | 32.59 | 669         | 30.05 | <b>-2.54</b> |
| <b>Nationality</b>             |             |       |             |       |              |
| Spanish                        | 2158        | 59.11 | 1392        | 62.53 | <b>3.43</b>  |
| <b>Prior prison records</b>    |             |       |             |       |              |
| 1 prior                        | 788         | 21.58 | 494         | 22.19 | <b>0.61</b>  |
| From 2 to 5                    | 730         | 19.99 | 438         | 19.68 | <b>-0.32</b> |
| More than 5                    | 167         | 4.57  | 83          | 3.73  | <b>-0.85</b> |
| None                           | 1966        | 53.85 | 1211        | 54.40 | <b>0.55</b>  |
| <b>Type of crime</b>           |             |       |             |       |              |
| Against property - non-violent | 1006        | 27.72 | 414         | 18.60 | <b>-9.12</b> |
| <b>Violent crime</b>           |             |       |             |       |              |
| Non- violent                   | 2396        | 66.02 | 1333        | 59.88 | <b>-6.14</b> |
| <b>Type of release</b>         |             |       |             |       |              |
| 1st degree                     | 37          | 1.10  | 31          | 1.39  | <b>0.29</b>  |
| 2nd degree                     | 1233        | 36.75 | 1036        | 46.54 | <b>9.79</b>  |
| 3rd degree or others           | 522         | 15.56 | 449         | 20.17 | <b>4.61</b>  |
| Parole                         | 779         | 23.22 | 710         | 31.90 | <b>8.68</b>  |
| <b>Length of sentence</b>      |             |       |             |       |              |
| Up to 2 years                  | 2328        | 65.26 | 1251        | 56.20 | <b>-9.07</b> |
| <b>Recidivism</b>              |             |       |             |       |              |
| Recidivated                    | 771         | 22.56 | 439         | 19.72 | <b>-2.84</b> |
| <b>Total</b>                   | <b>3651</b> |       | <b>2226</b> |       |              |

### 3.2. Data

#### *Dependent variable*

The dependent variable of the research is prison recidivism, that is, a reincarceration for a new offence committed during the follow-up period. The date of reincarceration is that of the detention. As mentioned before, the minimum follow-up time was 4 years. The average time between the releasing date and the final date of follow-up is 4.50 years. The average time before reincarceration of our sample is 3.37 years. The 66.70% of the recidivists were reincarcerated before 4 years. By 4.50 years, 89.30% of the recidivists already reoffended.

### *Independent variables*

Since the type of analysis is a Cox regression (see section 3.3), it is important to limit the number of predictors to avoid overfitting and ensure generalisability. The rule of thumb is to have no more than  $n_e/15$  predictors, where  $n_e$  is the number of events (people that recidivated during the follow-up time), that is, 439 people. Hence, the maximum number of predictors, including controls (see *Control Variables* subsection), cannot be more than 29.20, which can be rounded down to 29 variables. In this study we have included 24 variables, including controls. Sticking with this rule of thumb will ensure the stability of the parameter estimates and possibility of generalising the results to the population.

Within the variables selected, there are some that come from the application of the RisCanvi<sup>1</sup> protocol. Within control variables, only drug and alcohol abuse as well as the duration of the sentence are sourced from RisCanvi. Considering the variables of pre-imprisonment phase, all originate from it. Contemplating the imprisonment phase, all variables stem from RisCanvi except for being or not granted prison furloughs. Likewise, regarding the release phase, all variables come from RisCanvi except for the type of release.

These variables are collected by professionals from diverse fields like jurists, social workers, psychologists, and social educators. Data is usually obtained through interviews or document reviews. Specific assessments, such as those related to personality traits, may involve self-reports, psychological tests, behavioural observation, or expert-led interviews.

As for other variables, they are administrative in nature and are simply extracted from databases.

No collinearity concerns were detected among the independent and control variables. GVIF values are available in Appendix 3.

In the following lines, an explanation of each predictor will be given divided by the stages.

For the pre-imprisonment stage, six variables were chosen:

1. Child maladjustment: This variable is categorised in Yes or No category and it corresponds to observing or not childhood behavioural problems (such as conflicts with peers), considerable academic struggles, or school absenteeism.

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<sup>1</sup> The RisCanvi protocol is a risk assessment tool designed for violence prevention within the Catalan prison system. It is specifically aimed at evaluating the risk of violent recidivism among individuals who have been incarcerated. The protocol has been introduced as part of efforts to manage and mitigate the risk of reoffending, particularly with violent crimes, among prisoners (Andrés-Pueyo et al., 2018).



2. Criminal activity onset: Dichotomised as up to 30 years or 30 years or older, collects the subject's age at the time of the first known offence or violent incident.
3. Family records: First or second-degree relatives with a history of antisocial or criminal behaviour.
4. Problematic socialisation: Family relationships characterised by indifference, hostility, or frequent use of punishments.
5. Hostility: Negative dispositions, aggressive attitudes towards others. Easily feels attacked, becomes angry or aggressive over trivial matters. This variable is categorised by *Always or worsened* - consistently displayed hostility during imprisonment or displayed it only after the second assessment– and *Never or better* – never exhibited hostility or improved during imprisonment, implying a shift from hostility to non-hostility.
6. Impulsivity: Tendency for dramatic mood or behavioural fluctuations. Reacts excessively, suddenly, and explosively, both behaviourally and emotionally. Leads to an unstable lifestyle in interpersonal relationships, work, or residences. The categorisation of this variable is the same for Hostility factor.

For the imprisonment stage, four variables were selected:

1. Conflicts with inmates: Engages in arguments or fights, provokes, or receives provocations or pressures from other peers. The categorisation is *Yes* the person has had conflicts with inmates at some point during imprisonment or *No* they did not at any time.
2. Measure violations: Violation of rules during a prison furlough. Categories are *Yes* if ever happened or *No* if the rules of prison furloughs were never breached when granted one.
3. Limited response to treatment: Subject received treatment with poor adherence or results, considering the past year. This variable is categorised as *Always or Worsened* - consistently displayed limited response to treatment during imprisonment or exhibited it only after the following assessments – and *Never or better* – never exhibited limited response to treatment or improved during imprisonment, indicating a shift from limited response to treatment to showing some adherence or results.
4. Prison furloughs: This variable is categorised as *Yes* or *No*, indicating whether the inmate was granted or not granted prison furloughs.

For the release stage, 6 variables were picked:

1. Lack of family support: Consider the past year, including assessment time, lack of social network, satisfying relationships, or support, with irregular contact with family and friends. This variable is categorised as *Always or Worsened* - consistently having a lack of family support (*Always*) or after the following assessments losing the family support (*Worsened*) - and *Never or Better* - never had a lack of family support (*Never*) or had it but after the following assessments they do have family support (*Better*).
2. Type of release: The specific way an individual is released from custody. The categories are *Ordinary or closed regime* - 1<sup>st</sup> or 2<sup>nd</sup> degree classifications- *Open regime* - 3<sup>rd</sup> degree or mixed - and *Parole*.
3. Criminal associates: Belongs to social groups at risk of criminal acts. This predictor is categorised as *Yes/No*.
4. Lack of economic resources: Estimated economic status in the past year or before entry if incarcerated for over 12 months. It is categorised as: *Always or worsened* - consistently lacking economic resources during imprisonment or transitioning from sufficient to insufficient resources - or *Never or improved* - absence of economic deprivation or improvement during imprisonment.
5. Occupational problems: Across the inmate's lifespan, there is evidence of chronic unemployment, job instability, or frequent short-term positions, alongside labour market integration challenges. This also includes reluctance to seek work, frequent job dismissals, or easy job abandonment. This variable is categorised the same as *Lack of economic resources*.
6. Pro-criminal attitudes: Overt antisocial attitudes, typical of criminal subcultures, endorsing or justifying violence and criminal behaviour. It includes sadistic, homicidal, paranoid, xenophobic, misogynistic, or sexist attitudes not stemming from a mental disorder. The predictor is categorised as *Yes or No*.

### ***Control variables***

Pursuant to Nagin et al. (2009) and Bales & Piquero (2012), eight control variables have been considered: demographic variables (sex, nationality, age at release and level of studies); characteristics of the base offence (type of offence and length of the sentence); prior records and drug or alcohol use during imprisonment.

Regarding demographic variables, sex is categorised as Male or Female, nationality as Spanish or Foreign, age at release is a continuous variable ranging from 19 to 84 years old,

and education level includes categories for inmates with basic or secondary education and those with higher education.

Considering the characteristics of the base offence, we consider; a) the classification of offences at base sentencing given the following categories: offences against persons, non-violent offenses against property, violent offenses against property, domestic violence, drug-related offenses, sexual crimes, traffic violations, and others; b) length of sentence, which is represented as a continuous variable ranging from 0.04 to 20.60 years of imprisonment.

Concerning prior records, the predictor is used as a continuous variable varying from 0 to 37 prior records of incarcerations.

Finally, the variable drug or alcohol use provides information on whether at some point the inmate has been abusing of drugs or alcohol, impacting their familial, occupational, or social aspects of life, within the past year of incarceration. The codification is *Yes* or *No*.

### **3.3. Analysis**

The analytic strategy that has been used is a Cox Proportional Hazard Model. It is a technique that allows for multivariate survival analysis and works by modelling the hazard function (Flynn, 2012), which is the subject's risk of reoffending at any given time during the follow-up. It is a technique widely used and consolidated in recidivism research. The output of the Cox model is a Hazard Ratio (HR) for each variable taken into consideration.

Cox regression assumes proportionality of hazards, meaning hazard ratios remain constant over time. It also requires independence among individuals' event occurrences. When including numeric variables, Cox regression assumes the relationship between each predictor variable and the log-hazard rate is linear. No assumption was violated in this analysis (Appendixes 4 and 5).

## **4. Results**

This section will present the results for both the purposes of this research: knowing which of the stages of imprisonment are most important and within these stages, what are the significant variables to recidivism.

Firstly, in Table 2 there are three statistics that have been chosen to show which stage is more associated with recidivism. Three models were run combining control variables with the respective stage (e.g. control variables plus imprisonment variables).

**Table 2**

**Comparison of model statistics by pre-imprisonment, imprisonment, and release stages**

| <b>Stage</b>     | <b>Concordance</b> | <b>Likelihood ratio test</b> | <b>pseudo R<sup>2</sup></b> |
|------------------|--------------------|------------------------------|-----------------------------|
| Pre-imprisonment | 76.80%             | 440.30 (p=0)                 | 17.95%                      |
| Imprisonment     | 77.60%             | 469.60 (p=0)                 | 19.02%                      |
| Release          | 79.00%             | 518.50 (p=0)                 | 20.78%                      |

The concordance index is a measure used to assess the predictive accuracy of a binary model. A higher index signifies that the model accurately ranks individuals based on their predicted recidivism times. As shown in the table, the release stage model exhibits the highest value, indicating that it accurately predicts recidivism correctly about 79% of the time when comparing pairs of observations.

Another statistic providing insight into the importance of each stage is the Likelihood Ratio Test. A higher value indicates that the model captures patterns and relationships in the data more accurately. Consistently, the release stage model yields the highest result in this regard.

Finally, considering the pseudo-R-squared<sup>2</sup>, the model with the highest value is the release stage model, suggesting that it explains a greater proportion of the variance in the dependent variable compared to the other models.

Overall, we can state that the release conditions are the most important to recidivism. Conversely, the model including pre-imprisonment variables performs the worst, albeit still providing good values.

Table 3 provides a summary of the constructed models, distinguishing between four distinct models, each incorporating an additional stage of imprisonment. The models are categorised as follows: one model includes only control variables, another incorporates control variables along with pre-imprisonment variables, the third adds imprisonment variables to the previous two, and finally, the fourth model comprises all stages, including control variables, pre-imprisonment variables, imprisonment variables, and release variables.

The Likelihood Ratio test shows improving fit from models 1 to 4, with the fourth model capturing data accurately. Concordance index and pseudo-R-squared rise, indicating better predictive accuracy and explanatory power with all variables. The final model achieves

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<sup>2</sup> This version of the R<sup>2</sup> statistic it is differently computed than the R<sup>2</sup> for linear regression and, for survival models, it is very affected by the amount of censoring data in the dataset.

21.62% pseudo-R-squared, suggesting substantial explanatory power. Considering each stage was appropriate, providing valuable details to explain recidivism.

When looking at the control variables, all the predictors are at first significant (model 1), however, educational level loses significance as the pre-imprisonment variables are added (model 2), the same happening with length of sentence.

Key predictors of recidivism include sex, with women having a 42% lower risk, and nationality, with foreigners facing a 31% lower risk. Age at release decreases risk by 4% per year, while each prison record increases risk by 13%. Property crimes, especially non-violent ones, double the risk compared to crimes against persons.

Considering pre-imprisonment variables, the only variable that is significant is criminal activity onset, when that is before being 30 years old, the risk of recidivism is 47% greater than those that start committing crimes after 30 years old. Regarding other variables, hostility and impulsivity lose significance. For the first variable, it loses significance once release variables are considered. For the second, it loses significance once imprisonment variables are considered. It is worth mentioning that all the variables except for family records are significant in the model including only pre-imprisonment variables.

For the variables of imprisonment, only having violated measures when being granted a prison furlough and being or not granted a prison furlough are significant in the last model. Prisoners that violate the rules of prison furlough have a 40% greater risk of recidivism and the prisoners that are not granted prison furloughs have a 29% greater risk of recidivism. Regarding conflicts with inmates, it is significant in the model that only includes imprisonment variables and the model that includes control and imprisonment variables. That means that once pre-imprisonment variables are included, conflicts with inmates loses its importance for the model. Limited response to treatment has never been significant, in any of the models.

Finally, in the release stage, lack of familial support is not significant. It is in the model including only the release variables, but as soon as the control variables were included, it lost significance. For lack of economic resources, it never had any significance. Regarding pro-criminal attitudes, in the final model it is not significant, but it was in the model including only release variables and the one including controlling variables. Once pre-imprisonment variables are included, it lost importance.

**Table 3***Cox regression models for recidivism time (n = 2226)*

| Predictors                | Model 1: Control variables |         | Model 2: Control + Pre-imprisonment predictors |         | Model 3: Controls + Pre-imprisonment + Imprisonment predictors |         | Model 4: Controls + Pre-imprisonment + Imprisonment + Release predictors |         |
|---------------------------|----------------------------|---------|--|---------|--|---------|--|---------|
|                           | $\beta$                    | HR      | $\beta$  | HR      | $\beta$  | HR      | $\beta$  | HR      |
| Sex - Woman               | -0.889                     | 0.41*** | -0.699   | 0.50**  | -0.620   | 0.54*   | -0.543   | 0.58*   |
| Nationality - Foreign     | -0.236                     | 0.79*   | -0.154   | 0.86    | -0.303   | 0.74*   | -0.367   | 0.69**  |
| Age at release            | -0.048                     | 0.95*** | -0.035   | 0.97*** | -0.039   | 0.96*** | -0.039   | 0.96*** |
| Level of studies          |                            |         |  |         |  |         |  |         |
| Basic or secondary        | 0.463                      | 1.59*   | 0.365  | 1.44 .  | 0.298  | 1.35    | 0.252  | 1.29    |
| Drug or alcohol abuse     |                            |         |  |         |  |         |  |         |
| Yes                       | 0.403                      | 1.50*** | 0.304  | 1.36**  | 0.251  | 1.29*   | 0.186  | 1.20    |
| Number of prison records  | 0.156                      | 1.17*** | 0.136  | 1.15*** | 0.134  | 1.14*** | 0.127  | 1.13*** |
| Type of crime             |                            |         |  |         |  |         |  |         |
| Non-violent property      | 0.768                      | 2.16*** | 0.786  | 2.19*** | 0.777  | 2.17*** | 0.713  | 2.04*** |
| Violent property          | 0.464                      | 1.59*   | 0.479  | 1.61*   | 0.460  | 1.58*   | 0.380  | 1.46*   |
| Domestic violence         | 0.564                      | 1.76**  | 0.541  | 1.72*   | 0.487  | 1.63*   | 0.440  | 1.55*   |
| Drugs                     | -0.761                     | 0.47**  | -0.717   | 0.49**  | -0.637   | 0.53*   | -0.438   | 0.65    |
| Sexual crimes             | -0.651                     | 0.85    | -0.160   | 0.85    | -0.128   | 0.88    | -0.162   | 0.85    |
| Traffic                   | 0.301                      | 0.52    | -0.701   | 0.50    | -0.745   | 0.47    | -0.793   | 0.45    |
| Others                    | -0.165                     | 1.35    | 0.393  | 1.48    | 0.472  | 1.60*   | 0.475  | 1.61*   |
| Length of sentence        | 0.030                      | 1.03 *  | 0.024  | 1.02    | 0.015  | 1.01    | 0.021  | 1.02    |
| Child maladjustment       |                            |         |  |         |  |         |  |         |
| Yes                       |                            |         | 0.158  | 1.17    | 0.039  | 1.04    | -0.119   | 0.89    |
| Criminal activity onset   |                            |         |  |         |  |         |  |         |
| Up to 30 years old        |                            |         | 0.497  | 1.64**  | 0.407  | 1.50*   | 0.383  | 1.47*   |
| Family records            |                            |         |  |         |  |         |  |         |
| Yes                       |                            |         | -0.039   | 0.96    | -0.043   | 0.96    | -0.165   | 0.85    |
| Problematic socialisation |                            |         |  |         |  |         |  |         |
| Yes                       |                            |         | 0.079  | 1.08    | 0.042  | 1.04    | 0.003  | 1.00    |

**Table 4***Cox regression models for recidivism time.*

| Predictors                      | Model 1: Control variables |    | Model 2: Control + Pre-imprisonment predictors |         | Model 3: Controls + Pre-imprisonment + Imprisonment predictors |         | Model 4: Controls + Pre-imprisonment + Imprisonment + Release predictors |         |
|---------------------------------|----------------------------|----|--|---------|--|---------|--|---------|
|                                 | $\beta$                    | HR | $\beta$  | HR      | $\beta$  | HR      | $\beta$  | HR      |
| Hostility                       |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    | 0.549  | 1.73*** | 0.357  | 1.43*   | 0.274  | 1.32 .  |
| Impulsivity                     |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    | 0.313  | 1.37*   | 0.190  | 1.21    | 0.055  | 1.06    |
| Conflicts with inmates          |                            |    |  |         |  |         |  |         |
| Yes                             |                            |    |  |         | 0.309  | 1.36*   | 0.207  | 1.23    |
| Measure violations              |                            |    |  |         |  |         |  |         |
| Yes                             |                            |    |  |         | 0.559  | 1.75**  | 0.336  | 1.40*   |
| Limited response to treatment   |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    |  |         | -0.063   | 0.94    | -0.159   | 0.85    |
| Prison furloughs                |                            |    |  |         |  |         |  |         |
| No                              |                            |    |  |         | 0.627  | 1.87*** | 0.256  | 1.29*   |
| Lack of familial support        |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    |  |         |  |         | -0.231   | 0.79    |
| Type of release                 |                            |    |  |         |  |         |  |         |
| Open regime                     |                            |    |  |         |  |         | -0.593   | 0.55**  |
| Type of release                 |                            |    |  |         |  |         |  |         |
| Parole                          |                            |    |  |         |  |         | -0.983   | 0.37*** |
| Criminal associates             |                            |    |  |         |  |         |  |         |
| Yes                             |                            |    |  |         |  |         | 0.289  | 1.34*   |
| Lack of economic resources      |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    |  |         |  |         | -0.027   | 0.97    |
| Occupational problems           |                            |    |  |         |  |         |  |         |
| Always or worsened              |                            |    |  |         |  |         | 0.330  | 1.39**  |
| Pro-criminal attitudes          |                            |    |  |         |  |         |  |         |
| Yes                             |                            |    |  |         |  |         | 0.164  | 1.18    |
| Likelihood ratio test (p-value) | 394.20 (p=0)               |    | 440.30 (p=0)                                   |         | 485.70 (p=0)   |         | 542.20 (p=0)   |         |
| Concordance index (se(c))       | 75.77% (se = 0.01)         |    | 76.81% (se = 0.01)                             |         | 77.99% (se =0.01)  |         | 79.43% (se =0.01)  |         |
| pseudo R <sup>2</sup>           | 16.23%                     |    | 17.95%   |         | 19.60%   |         | 21.62%   |         |

Significance codes: \*\*\* = p &lt; 0.001; \*\* = p &lt; 0.01; \* = p &lt; 0.05; "." = p &lt; 0.08

The predictors that are finally significant are: type of release, criminal associates, and occupational problems. Regarding type of release, getting out of prison from an open regime represents a decrease of 45% in risk of recidivism compared to being released from an ordinary or closed regime. Furthermore, having had access to parole decreases the risk of recidivism by 63% compared to the ordinary or closed regime. Concerning having criminal associates, it increases the risk of recidivism by 34%. Lastly, having always had occupational problems or them starting in prison increases the odds of recidivism by 39%.

## **5. Discussion**

Returning to our hypotheses and considering the pre-imprisonment period, we are unable to confirm the hypotheses that we posited as increasing the risk of recidivism: H1.1 (having had child maladjustment), H1.3 (having records in the family), H1.4 (having had a problematic socialisation), H1.5 (being hostile or having impulsivity issues). Regarding hostility, it only loses significance when the release variables are included in the model, which would mean that some of the variables affecting release already explain the variance that was being captured by the hostility variable. Those variables could be pro-criminal attitudes or having criminal associates. Given that criminal associates predictor is the only one that is significant in the last model, we could argue that through differential association is how aggressiveness is acquired and a person can become hostile (Boduszek et al., 2011). As for impulsivity, since it loses significance once imprisonment variables are considered, it may be that those who violated the rules of prison furloughs are also those who do not have self-control. When a person acts against the rules already implies being impulsive (Agnew et al., 2002; Andrews & Bonta, 2010; Bonta & Andrews, 2007). Regarding child maladjustment and problematic socialisation, they are related since having shown childhood behavioural problems or academic struggles is related to how you have been socialised, in a harsh strict way or conversely, with indifference. They both lose significance once control variables are incorporated into the model. Most likely because variables such as drug use are related with variables regarding familial socialisation. That is, since drug use comes after the socialisation variables and the first may be caused by the second, both cannot hold significance in the model. Finally, for the family records predictor, it is never significant, even in the model that solely includes the six variables of pre-imprisonment.

On the other hand, considering the pre-imprisonment time, the age at which criminal activity was started (criminal activity onset) has hold its significance until the final model, so hypothesis H1.2 can be confirmed, the earlier the criminal activity onset, the greater risk



of recidivism. Ex-prisoners that had their first violent incidence or offence before being 30 years old have a considerably higher chance of recidivism than those who had their first offence known after that age. According to the Theory of Cumulative Disadvantages (Sampson & Laub, 1997), early disadvantages, like committing a crime and the factors that are related, such as unemployment or peer associations, accumulate over time leading to a higher likelihood of persistent delinquency. This conclusion would also apply to explain the significance of number of prison records, since entering prison constitutes a disadvantage in itself.

For imprisonment variables, only hypothesis H2.2 (having violated the rules of prison furloughs) and H2.4 (having been granted prison furloughs) can be confirmed. Violating the rules of prison furloughs yields to an increased risk of recidivism, probably because of lack of self-control and commitment to one's desistance process or because of the sanctions that are related to these violations, since they may accumulate to the overall strain of being in prison (Cochran, 2014).

On the other hand, being granted prison furlough yields a lesser risk of recidivism. This would be because they are maintaining their connection with society through meaningful interactions, which also help alleviate the strain an inmate may experience in prison. Additionally, they enable the prisoner to demonstrate responsibility and trustworthiness (Bülow & Dagan, 2021). Here we could also talk about the length of sentence. The theory of general prevention states that when a person knows that for some crimes there is an increased cost – lengthier sentences- they will not commit it. Since the variable failed to be significant, having longer sentences is neither positive nor negative. At most, it would be negative, but we have already included variables about the imprisonment effects that control the relationship between length of sentence and recidivism, which we are discussing.

All other hypotheses failed to be confirmed, those are H2.1 (having conflicts with inmates) and H2.3 (limited response to treatment) in the line that those predictors yield to an increased odd of recidivism. Conflicts with inmates can be normal to the situation of being imprisoned and shows a bad quality of life, which in the end would mean hampering the positive effects of other factors. In fact, the variable is significant until pre-imprisonment variables are included. Most likely hostility and impulsivity already explain conflicts between inmates. In the case of limited response to treatment, it is never significant, which is rare because it is not a variable regarding whether the prisoner received treatment or not but if he or she did not adhere to it correctly or did not show any results. However, it is not

the best measure to compare between those who needed treatment, those who benefited from it, and those who did not need it or did not benefit from it.

As for the last stage, release, we can confirm hypothesis H3.1 stating that being release from open regime or parole has a significant lower risk of recidivism than being released from the ordinary or closed regime. Ex-prisoners who continue their care post-release have the chance to lessen their likelihood of reoffending through programmes aligned with the RNR model. Additionally, the relationship between being granted parole and a reduced likelihood of recidivism appears to be notably stronger. This heightened association likely stems from the requirement for inmates to demonstrate substantial positive development within the open regime (Duwe & McNeeley, 2021).

Hypothesis H3.3, stating that having criminal associates increases the risk of recidivism, is confirmed. This supports our earlier assertion that aggressiveness is acquired and sustained through the theory of differential association. Lastly, the other hypothesis to be confirmed is H3.5, which states that having occupational problems leads to an increased risk of recidivism. It has been seen that employed ex-prisoners or those who do not have a problem finding a job are less likely to recidivate, that is why programmes that target employment also help decrease odds for recidivism (Berg & Huebner, 2011).

As for the hypothesis of the release stage that cannot be confirmed, one is regarding lack of familial support (H3.2). This is probably because we need to measure the quality of relationships, as the RisCanvi already includes in the definition of family support, without including being or not visited as enough to analyse this quality. Also, RisCanvi includes in the definition of family support being visited by friends, which then results in a variable that combines two socialisation institutions that are different. It holds significant in the model that only includes release variables, but as soon as controlling variables are included, the significance drops. Hypothesis H3.6 is the other one that cannot be confirmed. Having pro-criminal attitudes does not significantly increase the odds for recidivism. Since it loses significance when pre-imprisonment variables are included, we think that that is because of the hostility variable, which, although not being collinear, in definition they are very related. Having pro-criminal attitudes will lead to a hostile behaviour.

## **6. Conclusions**

This paper has delved into the different stages of an inmate's life to ascertain which stage holds the greatest relevance to the risk of recidivism, along with identifying the significant variables within those stages that contribute to recidivism. Our analysis highlights the

release stage as the most influential in explaining recidivism. Specifically, variables associated with the circumstances surrounding an inmate's release from prison emerge as the most critical factors in reducing the risk of recidivism. Notably, being granted parole or transitioning from an ordinary or closed regime to an open regime significantly decreases the risk of recidivism by 63% and 45%, respectively. Furthermore, increasing the frequency of granting parole or releasing inmates into open regimes more frequently would lead to lower recidivism rates. In addition to these findings, it is crucial to highlight that experiencing occupational difficulties increases the risk of recidivism by 49%. Similarly, having criminal peers, which increase the risk of recidivism by 34%, presents another significant challenge. These results suggest that when inmates are released from prison, any difficulties in securing or maintaining employment, as well as associating with criminal peers, will hinder desistance regardless of the type of release. Therefore, efforts to address both occupational challenges and criminal associations are of paramount importance in reducing recidivism rates.

When considering the variables within different stages that significantly contribute to recidivism, those consistent with social support theories emerge as the most explanatory factors. For example, during imprisonment, the absence of prison furloughs has been shown to increase the risk of recidivism by 29%. This observation aligns with the notion that being granted prison furloughs helps maintain sources of social support, thereby alleviating the strain of incarceration. Importantly, even when controlling for factors such as being granted parole or being released from an open regime, the significance of being granted prison furloughs remains evident. However, it is crucial for inmates to adhere to the rules of prison furloughs. Violations of these rules lead to detrimental effects on recidivism, with an observed increase in the risk by 40%. This effect is more profound than the positive impact of being granted prison furloughs.

As previously discussed, social support variables were found to be the most closely associated with recidivism during the release stage. However, it's worth noting a limitation of this study: familial support failed to demonstrate significance. This suggests the need for a re-evaluation of how familial support is conceptualised, perhaps through a revised approach. Such a revised approach could differentiate between friend visitation and family visitation, while also providing information about the quality of the relationship.

In the pre-imprisonment phase, the only variable confirmed to be important is early criminal onset, aligning with the Theory of Cumulative Disadvantages, which suggests that involvement in crime initiates a cycle leading to further delinquency. This theory also finds

support in the findings regarding prison records, where a higher number of records correlates with an increased risk of recidivism. However, other variables failed to be confirmed, most likely due to the absence of direct measures of social support, such as the level of institutional, economic, or familial support available to the inmate before entering prison. Only variables that indirectly represented this idea were utilised.

Lastly, it is important to note that the significance of social support theories also underlines the importance of strain theories. Social support serves as a mechanism to alleviate the consequences of negative stimuli. Therefore, the prominence of social support in explaining recidivism implies the relevance of strain theories, which emphasise the impact of negative experiences on individuals' behaviour.

Nevertheless, it's important to recognise the limitations of this study, such as the exclusion of certain sample groups during the study's design phase. This is significant because some of the excluded groups exhibit distinct relationships with recidivism. For example, one of the excluded groups consists of individuals not classified, who demonstrate a substantially higher recidivism rate of 65.30%, in contrast to the 19.72% rate observed in the included sample. Moreover, concerning the variables, it was evident that alternative conceptualisations could have better suited the study's design. Given the reliance on data collected by penitentiary institutions, it would be beneficial for future research to reassess and refine the conceptualisation of the variables in accordance with current theoretical frameworks derived from various studies. Finally, about the study design, while Cox regression is effective for analysing associations, it does not inherently establish the clear temporal relationships necessary for causal inference. Therefore, supplementary methods are needed to strengthen causal claims.

In essence, this study emphasises the significance of the release stage in understanding recidivism, particularly regarding variables associated with parole and transitioning to open regimes, which significantly reduce re-offending risk. Moreover, social support theory emerges as crucial during both the release stage and imprisonment time, underlining the importance of supportive interventions in mitigating recidivism.

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## Appendices

### *Appendix 1: Exclusion and inclusion criteria*

The total amount of released inmates in 2015 was 4025. Of these, some cases were excluded for several reasons: inmates that did not end up getting released or died. Of the remaining 3814, 70 ex-prisoners were omitted due to expulsion from the state, and another 45 ex-prisoners were not considered because they did not meet the minimum follow-up period of four years.

Hence, the population, those that meet all the requirements, amounts to 3651 ex-prisoners, from which a sample that is adequate for this study has been taken.

There are some criteria that has been considered to exclude part of the population for this study. First, people for which we do not have any information of important variables regarding criminological factors had to be excluded. Those are the inmates who were never classified in one of the three existent regimes or inmates that were serving time for non-payment of a penal fine. Furthermore, inmates that returned to prison but for a crime committed before being released and were pending trial or execution of a sentence, which technically cannot count as recidivism. Finally, those who were imposed an alternative penal measure instead of prison were also excluded, since in this study only prison recidivism is analysed.

After these exclusions, the total entries in our dataset are 2474. Because of the type of analysis, it is important that we do not have many missing values in the data. There are 238 cases who had missing information in the variable of type of release, thus, these were excluded from the analysis. Likewise, 5 individuals lacked information of their length of sentence, 2 ex-prisoners did not have their age at release registered and other 3 did not have information regarding number of prison records. The final sample comprises of 2226 former prisoners.

It is important to mention the recidivism rate of those groups excluded to compare it with the recidivism rate of the included, which is 19.72% (Table 1 of Appendix 1). In the case of those who were not classified, 65.30% of them recidivated. For those who were imposed an alternative measure, 13.70% recidivated. Finally, of those who returned to prison for a non-payment of a penal fine, 19.50% recidivated. Naturally, there is not a recidivism rate for those who returned to prison for a previous case. The rate for those who were never classified while in prison is the one that causes more concern, since it differs considerably from the general rate of recidivism, 22.60%, which includes the total population of 3651 ex-prisoners. Generally, those inmates that are never classified are in prison for a short

period of time, generally a maximum of 2 years and in a module that is specifically for the non-classified - approximately 96% of the non-classified were in prison for up to 2 years-. When the inmates are not classified, they are not able to engage in activities and treatment that is going to be fruitful for the desistance process. Moreover, since they are not classified, they cannot be gradually released from prison, that is, from a more closed regime to an open regime, where the inmates have the ability of going to work outside of prison, for example. Instead, they are abruptly released, as are those in ordinary or closed regimes. This situation is what is believed to cause the higher recidivism rate.

*Appendix 2: Deviations between population and sample*

**Table 1**

*Demographic and recidivism deviations between population and sample*

|                                    | Released<br>population in 2015 |       | NA | Sample      |       | Difference    |
|------------------------------------|--------------------------------|-------|----|-------------|-------|---------------|
|                                    | n                              | %     |    | n           | %     | Percentage    |
| <b>Sex</b>                         |                                |       |    |             |       |               |
| Men                                | 3326                           | 91.10 |    | 2084        | 93.62 | <b>2.52</b>   |
| Women                              | 325                            | 8.90  |    | 142         | 6.38  | <b>-2.52</b>  |
| <b>Age at release</b>              |                                |       |    |             |       |               |
| 19 to 25                           | 255                            | 7.01  |    | 100         | 4.49  | <b>-2.52</b>  |
| 26 to 34                           | 1185                           | 32.59 |    | 669         | 30.05 | <b>-2.54</b>  |
| 35 to 45                           | 1248                           | 34.32 |    | 791         | 35.53 | <b>1.21</b>   |
| 45 to 55                           | 653                            | 17.96 |    | 454         | 20.40 | <b>2.44</b>   |
| 55 to 65                           | 228                            | 6.27  |    | 166         | 7.46  | <b>1.19</b>   |
| 65 and more                        | 67                             | 1.84  |    | 46          | 2.07  | <b>0.22</b>   |
| <b>Nationality</b>                 |                                |       |    |             |       |               |
| Spanish                            | 2158                           | 59.11 |    | 1392        | 62.53 | <b>3.43</b>   |
| Foreign                            | 1493                           | 40.89 |    | 834         | 37.47 | <b>-3.43</b>  |
| <b>Prior penitentiary records</b>  |                                |       |    |             |       |               |
| 1 prior                            | 788                            | 21.58 |    | 494         | 22.19 | <b>0.61</b>   |
| From 2 to 5                        | 730                            | 19.99 |    | 438         | 19.68 | <b>-0.32</b>  |
| More than 5                        | 167                            | 4.57  |    | 83          | 3.73  | <b>-0.85</b>  |
| None                               | 1966                           | 53.85 |    | 1211        | 54.40 | <b>0.55</b>   |
| <b>Type of crime</b>               |                                |       |    |             |       |               |
| Against persons                    | 410                            | 11.30 |    | 256         | 11.50 | <b>0.20</b>   |
| Against property - non-violent     | 1006                           | 27.72 |    | 414         | 18.60 | <b>-9.12</b>  |
| Against property violent           | 387                            | 10.66 |    | 306         | 13.75 | <b>3.08</b>   |
| Domestic violence                  | 361                            | 9.95  |    | 268         | 12.04 | <b>2.09</b>   |
| Drugs                              | 615                            | 16.95 |    | 460         | 20.66 | <b>3.72</b>   |
| Sexual crimes                      | 75                             | 2.07  |    | 63          | 2.83  | <b>0.76</b>   |
| Traffick                           | 352                            | 9.70  |    | 212         | 9.52  | <b>-0.18</b>  |
| Other                              | 423                            | 11.66 |    | 247         | 11.10 | <b>-0.56</b>  |
| <b>Violent crime</b>               |                                |       |    |             |       |               |
| Violent                            | 1233                           | 33.98 |    | 893         | 40.12 | <b>6.14</b>   |
| Non- violent                       | 2396                           | 66.02 |    | 1333        | 59.88 | <b>-6.14</b>  |
| <b>Type of release</b>             |                                |       |    |             |       |               |
| 1st degree                         | 37                             | 1.10  |    | 31          | 1.39  | <b>0.29</b>   |
| 2nd degree                         | 1233                           | 36.75 |    | 1036        | 46.54 | <b>9.79</b>   |
| 3rd degree or others               | 522                            | 15.56 |    | 449         | 20.17 | <b>4.61</b>   |
| Parole                             | 779                            | 23.22 |    | 710         | 31.90 | <b>8.68</b>   |
| Without classification             | 784                            | 23.37 |    | 0           | 0.00  | <b>-23.37</b> |
| <b>Length of sentence RisCanvi</b> |                                |       |    |             |       |               |
| From 2 to 6 years                  | 615                            | 17.24 |    | 475         | 21.34 | <b>4.10</b>   |
| More than 6 years                  | 624                            | 17.49 |    | 500         | 22.46 | <b>4.97</b>   |
| Up to 2 years                      | 2328                           | 65.26 |    | 1251        | 56.20 | <b>-9.07</b>  |
| <b>Recidivism</b>                  |                                |       |    |             |       |               |
| Recidivated                        | 771                            | 22.56 |    | 439         | 19.72 | <b>-2.84</b>  |
| Didn't recidivate                  | 2646                           | 77.44 |    | 1787        | 80.28 | <b>2.84</b>   |
| <b>Total</b>                       | <b>3651</b>                    |       |    | <b>2226</b> |       |               |

### Appendix 3: Collinearity diagnosis

In this case, running **GVIF** and  $GVIF_{2 \times dF}^{\frac{1}{}}$  is adequate since the usual VIF depends on which levels is left out as the reference. Also, we are not interested in the VIF for each individual level of a categorical predictor, but rather of the predictor as a single entity. *car::vif()* automatically gives us the GVIF, that is the same for each categorical predictor no matter the reference level, as long as the predictor is coded as a factor.

The rule of thumb for **VIF** is 10; for  $GVIF_{2 \times dF}^{\frac{1}{}}$  (adjusts for the number of levels) is 3.2 (square root of 10). If less than threshold, we conclude that there is no collinearity among the independent variables in the model. If more than threshold, we conclude that there is collinearity among the independent variables in the model.

**Table 2**

*GVIF and  $GVIF_{2 \times dF}^{\frac{1}{}}$  values for each predictor of the model*

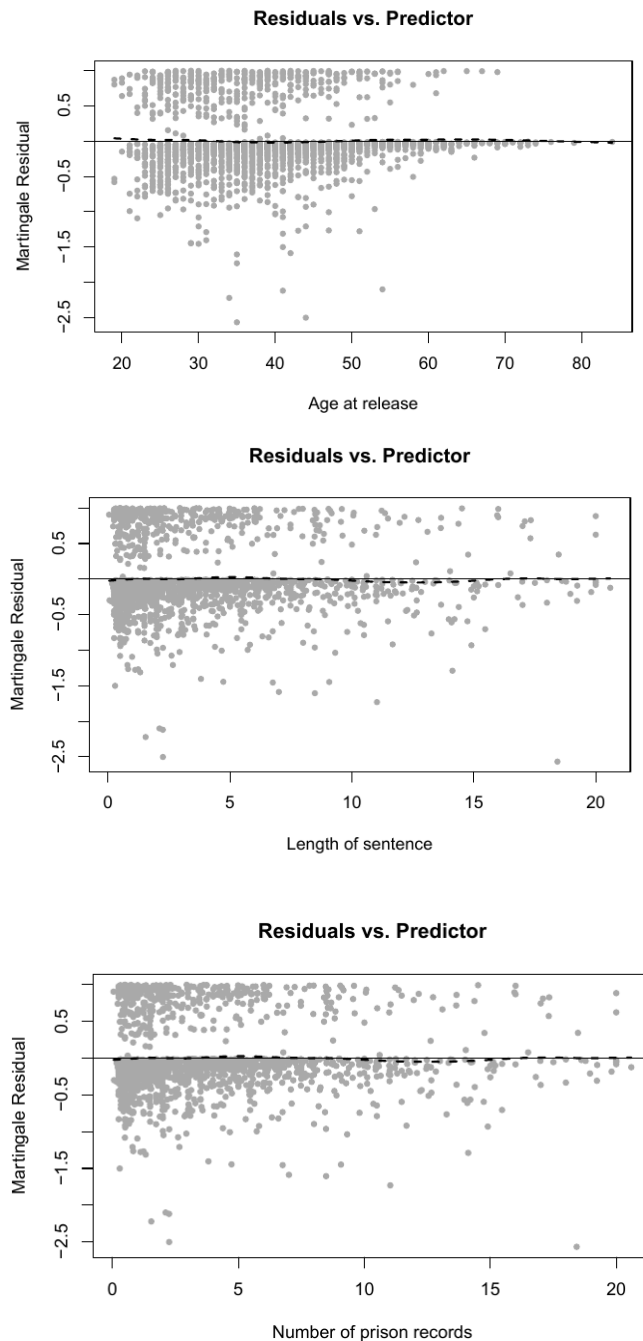
| Variable                      | GVIF | Df | $GVIF_{2 \times dF}^{\frac{1}{}}$ |
|-------------------------------|------|----|-----------------------------------|
| Sex                           | 1.07 | 1  | 1.03                              |
| Nationality                   | 1.45 | 1  | 1.20                              |
| Age at release                | 1.57 | 1  | 1.25                              |
| Level of studies              | 1.05 | 1  | 1.03                              |
| Drug and alcohol abuse        | 1.24 | 1  | 1.11                              |
| Number of prison records      | 1.35 | 1  | 1.16                              |
| Type of crime                 | 1.71 | 7  | 1.04                              |
| Length of sentence            | 1.50 | 1  | 1.23                              |
| Child maladjustment           | 1.52 | 1  | 1.23                              |
| Criminal activity onset       | 1.31 | 1  | 1.14                              |
| Family records                | 1.35 | 1  | 1.16                              |
| Problematic socialization     | 1.50 | 1  | 1.22                              |
| Hostility                     | 1.54 | 1  | 1.24                              |
| Impulsivity                   | 1.50 | 1  | 1.23                              |
| Conflicts with inmates        | 1.58 | 1  | 1.26                              |
| Measure violations            | 1.21 | 1  | 1.10                              |
| Limited response to treatment | 1.45 | 1  | 1.21                              |
| Permits                       | 1.74 | 1  | 1.32                              |
| Lack of familiar support      | 1.30 | 1  | 1.14                              |
| Type of release               | 1.63 | 2  | 1.13                              |
| Criminal associates           | 1.42 | 1  | 1.19                              |
| Lack of economic resources    | 1.22 | 1  | 1.11                              |
| Occupational problems         | 1.39 | 1  | 1.18                              |
| Pro-criminal attitudes        | 1.55 | 1  | 1.24                              |

*Appendix 4: Diagnostic of linearity of Age at release, Length of sentence, and Number of prison records*

The linearity assumption in Cox regression regarding continuous variables is that the relationship between the log hazard and the continuous predictor is linear on the log hazard scale. To check for violations of the linearity assumption, you can use techniques such as plotting the Martingale residuals against the continuous predictor.

**Figure 1**

*Linearity of continuous variables against the Martingale residuals.*



### Appendix 5: Diagnostic of proportionality of hazard ratios

Standard form of the model assumes the hazards for any two individuals always has the same proportion. Thus, the PH assumption implies the HR measuring the effect of any predictor is constant over time. The row for each predictor tests the null hypothesis that the predictor's coefficient does not vary with time. Based on statistical significance of individual terms, we would conclude that the coefficients for *Lack of familial support* and *Prison furloughs* have significantly non-proportional hazards. However, we must also consider the fact that we are carrying out multiple tests. The GLOBAL row tests the null hypothesis that all the predictors meet the PH assumption. Based on the global test, we would conclude that the **PH assumption is sufficiently met for all the variables**.

If the null hypothesis is correct (proportional hazards) then the beta trajectories will be close to horizontal within the upper and lower limits of the confidence interval drawn. As we can see in the following diagrams, the trajectories for all the variables are flat, even for *Prison furloughs* and *Lack of familial support*, confirming the proportionality of hazard ratios over time.

**Figure 2**

*Proportionality of hazard ratios*

