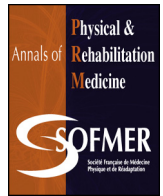




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Review

History of traumatic brain injury in prison populations: A systematic review

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ABSTRACT

Traumatic brain injury (TBI) can lead to cognitive, behavioural and social impairments. The relationship between criminality and a history of TBI has been addressed on several occasions.

Objective: The objective of this review was to present an update on current knowledge concerning the existence of a history of TBI in prison populations.

Methods: PubMed and PsycINFO databases were searched for relevant papers, using the PRISMA guidelines. We selected papers describing TBI prevalence among incarcerated individuals and some that also discussed the validity of such studies.

Results: Thirty-three papers were selected. The majority of the papers were on prison populations in Australia (3/33), Europe (5/33) and the USA (22/33). The selected studies found prevalence rates of the history of TBI ranging from 9.7% and 100%, with an average of 46% (calculated on a total population of 9342). However, the level of evidence provided by the literature was poor according to the French national health authority scale. The majority of the prisoners were males with an average age of 37. In most of the papers (25/33), prevalence was evaluated using a questionnaire. The influence of TBI severity on criminality could not be analysed because of a lack of data in the majority of papers. Twelve papers mentioned that several comorbidities (mental health problems, use of alcohol...) were frequently found among prisoners with a history of TBI. Two papers established the validity of the use of questionnaires to screen for a history of TBI.

Conclusion: These results confirmed the high prevalence of a history of TBI in prison populations. However, they do not allow conclusions to be drawn about a possible link between criminality and TBI. Specific surveys need to be performed to study this issue. The authors suggest ways of improving the screening and healthcare made available to these patients.

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1. Introduction

According to the World Health Organization, traumatic brain injuries (TBIs) will become the main cause of death and handicap in the world by the year 2020 [1]. They lead to greater levels of deficiency, longer hospitalizations and higher hospitalization costs

than any other injuries [2]. In France, the incidence of TBI, irrespective of seriousness, has been estimated at 150,000 a year [2]. The usual breakdown of all recorded TBIs shows about 80% for mild TBI, 10% for moderate and 10% for severe TBI, with a probable under-representation of mild TBI subjects, who are rarely hospitalized [3]. They typically concern young males. The first two causes of TBIs are road traffic accidents and falls [4].

The prevalence of sequelae and the lifetime prevalence of TBI are not well known. In the United States, the global prevalence of people living with significant TBI sequelae is thought to be 3.2 million, i.e. 1.1% of the population [5]. In Europe, a Danish study

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estimated the proportion of people in the general population with TBI sequelae preventing all professional activities to be 0.32% [6]. There are no figures on reported history of TBIs in the general population in France.

Long-term TBI sequelae, especially cognitive and behavioural, are not well known and often underestimated so that a term often used is that of an *invisible handicap*. The disorders observed can lead to slowness in information processing, attention disorders, memory and executive impairments [7]. Anxious-depressive disorders are also frequently reported, as well as social cognition disorders, such as lack of emotional perception, or a lack of social tact or empathy [8–10]. These are thought to occur alongside behavioural disorders, such as aggressiveness, loss of inhibition, intolerance towards frustration, and sometimes violent acts that can be limiting for social integration [8–10]. Good practice guidelines for the treatment of these disorders have been published by the French national health authority (Haute Autorité de santé, HAS) and have been the subject of several articles published in the *Annals of Physical and Rehabilitation Medicine* [11–13]. In addition, a study carried out in Finland on a controlled cohort evidenced that a history of TBI during childhood or adolescence increased the risk of psychiatric disorder in adulthood, and that among men, a history of TBI was significantly linked to criminality [14].

In 2010, in order to counter this *invisible pandemic*, a French inter-ministerial mission for the development of an action plan to help TBI and spinal cord injury patients submitted a report to the health authorities. One of the consequences of this report was the drawing up of an action plan. Recommendation No. 10 advocated a specific follow-up for the most vulnerable populations, prison populations in particular. In the present article, the term *prisoner* can refer to three situations: prisoners having received a custodial sentence, incarcerated following a legal decision (whatever the sentencing authority), individuals having received a conditional sentence, incarcerated, but with some freedom of movement (curfew system, electronic monitoring for example), and prisoners who are remanded pending trial.

There are in France 191 prisons. On January 1st 2016, according to the French prison administration, 76,601 people were incarcerated (custodial sentence: 66,678 and conditional sentence: 9923). Out of the 66,678 incarcerated individuals, 18,158 were awaiting judgment (remanded) and 46,602 were unconditionally sentenced. Women numbered 2650 (3.9%), and 715 individuals were under 18 (1% of the prison population). Since legislation dated January 18th 1994, responsibility for prisoners' health follow-up has been entrusted to the French Ministry of health and all prisons now have healthcare units (known previously as Consultation and ambulatory care units), and these hospital units are directly linked to a healthcare facility. There are also in France 52 follow-up care and rehabilitation beds shared between Marseille and Fresnes. These needs have been objectified on the one hand by the high prevalence of a number of infectious pathologies (human immunodeficiency virus, hepatitis C and tuberculosis), and on the other hand, by the high frequency of disabilities, 3 times higher than in the general population. Indeed, 10% of prisoners require assistance because of a health problem, and around 200 have a physical disability. In France, since the 1994 reform, two questionnaire surveys assessing prisoners' health before their arrival in prison, have been implemented [15,16]. There are no questions specifically concerning the existence of a history of TBI. However, the reported prevalence of epilepsy was 2% in 2003 (1.5% in 1997). It was therefore, at the time of that survey, about 4 times higher than the prevalence found in the general population. In 2013, a survey carried out in French prisons evidenced a prevalence of 30.6% for the existence of a history of TBI for a population of 1148 new arrivals in prison. The prevalence of

epilepsy was 6% for the whole prisoner population under study, i.e. 12 times higher than in the general population [17].

The objective of this literature review was to focus on the prevalence of a history of TBI in prison setting. The search methodology and article analyses were developed following the PRISMA criteria. The results of this review are presented and discussed. A certain number of suggestions concerning organization and care are detailed at the end of this article.

2. Methods

2.1. Electronic sources used and search strategies

The methodology consisted in a search on PubMed and PsycINFO databases carried out by three of the co-authors (ED, AR and MC) (Fig. 1). This search was carried out in two stages, with a first selection of articles in 2013 and an update on this search on 02/08/2016. Any articles relating to the subject under study and published up to this date could be retained, whether published in English or in French. The keywords used, taken from the Mesh, were the following: *prisoner, prison, traumatic brain injury, head injuries*. All the articles collected from the two databases were compared and duplicates were eliminated. Titles and abstracts of 118 selected articles were then scrutinized to check their relevance to the subject. The selected articles were read in full by each of the three authors independently in order to retain only those that met the inclusion and exclusion criteria of this review. A list of the articles selected by the three authors was then discussed and agreement was reached on which should be retained. The reference lists of the included articles were also examined so as to identify further possible articles. The articles retained concerned adults of both sexes and under 18-year-olds.

2.2. Exclusion and inclusion criteria

The exclusion criteria were: publication in a language other than in French or English, articles that focused on the association between criminality and TBI, but related for instance to TBI follow-up cohorts (e.g. Elbogen et al., 2014 [18]), studies focusing on particular types of prisoners (political prisoners that were victims of torture in Vietnam, Mollica et al., 2014 [19]), or studies with a more sociological than medical stance (Brewer-Smyth et al., 2016 [20]). Initially, for the qualitative analysis of this review, we chose to retain published meta-analyses and literature reviews that could be of some relevance to the study, but they were not taken into account in mean prevalence calculations (Hughes et al., 2015, for instance [21]). Two articles were also excluded for this mean prevalence calculation because they were secondary analyses on a population that had already been studied (Scholfield et al., 2011 [22] and Durand et al., 2016 [23]).

The inclusion criteria were the following: the articles were to give a clear definition of the term *traumatic brain injury* and the term *prevalence*. Perusal of the articles aimed to provide a clear picture of the type of population under study: ordinary prisoners, prisoners in psychiatric units, percentage of men and women, and under 18-year olds as applicable. We did not use inclusion and exclusion criteria concerning the year of publication or the size of the sample (in particular, we did not exclude small-sized samples [< 20]).

2.3. Selection and article assessment criteria

The main objective of this literature analysis was to calculate mean prevalence across the articles selected, taking into account population characteristics (age, sex), the trauma (age of

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