**Methodology**

> **Search Strategy:** A structured literature review was conducted to assess the possible relationship between boxing-related cranial injuries and dementia pugilistica. The literature search was conducted using the Medline Ovid SP database.

- **Inclusion Criteria:** Articles with human research containing the keywords “concussion”, “dementia”, “pugilistica”, “boxing”, and “professional”.

- **Exclusion Criteria:** Articles published before 2009 were not included in the search and only articles with English text were chosen.

- **Analysis:** The abstracts of the resulting 54 articles were reviewed by three raters for relevance to the research question, with 100% concurrence. The resulting 15 articles were then reviewed by the raters for relevance, again with 100% concurrence. In total, 8 articles were included in the present study. All study articles included were relevant to the research question.

**Background**

Approximately 1.4 million emergency department visits per year are for traumatic brain injuries, which has been thought to underlie a host of problems related to neuronal dysfunction or death. Different types and severities of traumatic brain injuries (TBI) are differentially associated with several neurologic outcomes including seizures, Alzheimer’s dementia (AD), Parkinsonism, Dementia Pugilistica (DP), multiple sclerosis (MS), amyotrophic lateral sclerosis (ALS), posttraumatic symptoms, ocular and visual disorders, and endocrine disorders. Data indicates that moderate and severe TBIs increase the risk of dementia between 2.5- and 4-fold. The terms “punch-drunk” and “slugging” data were first ascribed by Martinell and Nil: in 1928 to describe a neurologic disorder that primarily affected boxers who were exposed to the cumulative effects of repetitive, subconcussive blows to the head. This was successively labeled dementia pugilistica and currently chronic traumatic encephalopathy (CTE), which is a type of dementia associated with high risk factors acquired from multiple mild TBIs, as experienced by professional boxers. CTE is a collection of neurologic and neuropsychological symptoms believed to be a result of repetitive subconcussive or subconcussive blows to the head and although most commonly reported in boxers, there have been reports in other sports. DP symptoms emerge anywhere from 7 to 35 years after the beginning of a boxer’s career, and manifestations of neurologic decline usually do not present until after 20 years of a career. Even then, worsening may occur decades later. Boxers who have been hit in the head should be scanned for the gene of APOE-ε4 to assess if there is a genetic risk for developing dementia pugilistica. The presence of this gene creates a confounding effect as most of the studies that analyzed cases and controls and disregarded genetic history. Ethical considerations for boxers include pre-test scanning for the gene of APOE-ε4 to assess if there is a heightened risk of contracting DP.

**Results**

A retrospective study revealed that 9% of dementia patients reported a history of TBI, when compared to only 3% in the control group. Anderson et al. found that 16.67% of concussions were classified as mild, 54.76% were moderate, and 28.57% were classified as severe. Another study reported that 10-18% of mild concussion cases, 25% of moderate cases and 33% of severe cases developed dementia-like symptoms. A recent study on developing CTE with APOE-ε4 found that these individuals were at increased risk of CTE.

**Conclusions And Future Direction**

The evidence strongly suggests that there is indeed an association between cranial injuries and dementia, but the limitations within all the studies makes it impossible to reach a definitive conclusion. Therefore, the insufficient data is unable to answer the research question. This indicates that to establish conclusive and future work should be conducted to include more recent high quality experimental studies as well as the review of grey literature. Moreover, since all the studies reviewed were biased and limited, guidelines should be developed to standardize diagnostic criteria and measurements within studies. For future studies to achieve statistically significant results, the use of larger sample sizes in longitudinal prospective studies are required as well as more comprehensive procedures for analyzing patients. The appearance of a strong correlation gives rise to implications for reassessing regulations and improving the safety of boxers and other contact sports.

**References**