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## **Fighting to the Death: Does Hockey Fighting in the NHL Affect Players' Longevity?**

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## ORIGINAL ARTICLE

# Fighting to the death: Does hockey fighting in the NHL affect players' longevity?

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**Abstract**

Hockey is a sport known for its violent nature. Specifically, hockey fights have consistently been an integral part of the National Hockey League. Past research has demonstrated that players are likely to be involved in fighting as a mechanism to gain fan support, generate game momentum or enhance team camaraderie. However, fighting naturally has negative health ramifications. In the current study, we sought to investigate if players' involvement in hockey fights throughout their career was associated with shorter life spans. Previous mortality studies have not distinguished hockey fighting from other aggressive aspects of this sport (e.g., in game physical contact with other players). We conducted an archival study examining the frequency of hockey fighting during the 1957–1971 NHL seasons and player longevity. A Kaplan–Meier survival analysis log-rank method and a subsequent Cox regression accounting for correlates showed no relationship between an elevated number of fights and a reduced lifespan. The lack of effect may indeed demonstrate a negligible influence on long-term health consequences in the context of a generally very physical game. However, with the relatively moderate levels of fighting in the period studied we recommend that the association be explored also in a subsequent era when NHL fighting peaked.

**KEYWORDS**

aggression, mortality, survival analysis

## 1 | INTRODUCTION

Fighting in the National Hockey League (NHL) is unique in American professional sports as those involved are not ejected from play but usually spend a relatively brief period in the penalty box and then rejoin the game shortly after. Fighting seems to persist since it is perceived as integral to the North American game and serves as a main attraction for fans.<sup>1,2</sup> Others contend that the practice enhances

camaraderie between teammates,<sup>3</sup> creates momentum<sup>4</sup> or as an enforcement mechanism.<sup>3</sup> Fighting appears to be calculated and intentional, with more fights occurring in the beginning of games and less during later, more pivotal moments of the game when the score is on the line.<sup>5</sup> This suggests that NHL players are not impulsive or frustrated when engaged in fights, but act in a more deliberated manner possibly for the reasons outlined above. It is also important to note that NHL fighting is not distributed

Nadav Goldschmied and Jaedyn Lambrecht sharing first authorship.

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randomly among the players. Much of the brunt is taken by specialized players, colloquially known as enforcers.<sup>6</sup>

Past research attempted to assess the negative health ramifications of fighting in the NHL<sup>7</sup> found that the incidence rate of concussion in the NHL steadily rose greater than tenfold from 1986–1987 to 2011–2012.<sup>8</sup> Other researcher studied concussions and found that more of these traumatic brain injuries occurred in the first period of the game (47%) compared with the second and third periods<sup>9</sup> in line with fighting frequencies overall.<sup>5</sup> Fighting accounted for approximately 8%–9% of concussions in the NHL.<sup>10</sup> Further, in a very limited sample of 11 NHL players, six were found to have had chronic traumatic encephalopathy (CTE).<sup>11</sup> However, there was no correlation detected between hockey fighting/penalization histories and CTE. Overall, little research has been dedicated to studying the effects of fighting on the mortality of the players, yet anecdotal evidence is striking. For example, several recognized enforcers like Bob Probert, Derek Boogaard, Wade Belak and Rick Rypien experienced premature death in the fairly recent past.<sup>12</sup>

In American football, another contact sport, often compared to hockey in its aggressive nature, it was found that National Football League (NFL) players had four times higher neurodegenerative mortality due to Alzheimer disease (AD) and amyotrophic lateral sclerosis (ALS).<sup>13</sup> This was especially true for players in higher speed positions as they presumably experienced greater impact upon contact with an increased likelihood to sustain injury. It makes sense then that due to their high speed skating on ice, NHL players are especially at risk.

Most broadly, several recent sport longevity reviews and meta-analyses have touted the benefits of intense and consistent physical exertion borne by professionals specifically endurance and mixed athletes (i.e., sports that mainly entail high-intensity anaerobic exercise) having a lower rate of all-cause mortality and extended lifespan compared to the general population.<sup>14–16</sup> One of these studies lamenting that “Several sports were noticeably absent from the elite athlete mortality literature (e.g., ice hockey.)” [p. 12]<sup>15</sup> and the unique and robust fighting element of the North American game may counteract this broad positive effect.

The two longevity studies to include a sample of NHL players failed to address this issue directly. One found that American football players lived the longest while baseball players lived the least, with hockey (NHL sample,  $n=737$ ) and basketball players in-between.<sup>17</sup> However, another study found NHL players having consistently lower proportions of death between the debut years of 1946 and 2005 relative to the other three sports.<sup>15</sup> Since these hockey studies conducted only between-sports analyses, they provided no longevity comparison within NHL play pertaining to fighting.

Fighting in the NHL bares some similarities to boxing as the engaged exchange blows to the upper body,

however, the involved usually must retain one hand on their opponent's uniform since the ice makes it very hard to stay balanced. Thus, in the majority of NHL fights players hold on with one hand and punch hard with the other which allows for little defense from blows to the head.<sup>3</sup>

In one study, the mortality among international boxers from 1950 to 2007 focusing on deaths that occurred during the activity (without exploring longevity effects).<sup>18</sup> The researchers assessed factors such as age at time of death, association with knockout or other outcome of match, rounds fought, and weight class among others. It was found that 64% of death cases were associated with knockouts and 15% with technical knockout, and a higher percentage occurred in the lower weight classes. However, there was a significant decline in mortality after 1983 which may be due to a reduction in exposure to repetitive head trauma (shorter careers and fewer fights), along with heightened medical oversight and stricter safety regulations. Boxers usually fight one to three times a year based on their opponents' availability and the extent of their injuries following a bout. In comparison, the hockey season accords almost unlimited opportunities to engage in fighting.

While diminishing in recent years, NHL fighting, continues to be persistent and at levels much higher compared to any other professional American sports or non-NHL ice-hockey.<sup>7</sup> Though anecdotal evidence in the body of existing research suggests that hockey players who engage in more frequent fighting may have increased mortality rates when compared to those who do not,<sup>12</sup> this topic has yet to be thoroughly investigated. The current study sought to analyze the relationship between longevity and the number of fights that a player engaged in throughout their career based on data from the 1957–1971 NHL seasons as this sample had a sufficient diversity of living and deceased players to be analyzed. We predicted that indeed players involved in more fights would die earlier based on past anecdotal reporting and commensurate clinical findings.<sup>10</sup>

## 2 | METHODS

### 2.1 | Sample

The sample of this study was composed of living and deceased NHL players who participated in at least one documented fight within the 1957–1971 NHL seasons. A total of 388 NHL players were included in the analysis, with 69% living ( $n=240$ ) and 31% ( $n=147$ ) deceased (one dropped due to missing data). The mean age of the players still alive was 76.26 years old (SD = 5.19, Min = 68, Max = 90). Individuals who committed suicide or faced an accidental death were not excluded from the study, and the cut-off date for death data collection was May

15, 2020. The sample was almost exclusively Canadian born players ( $n=372$ , 96%) with seven American born skaters (2%), two from England and Poland (0.5% each) and the rest individuals from other European countries. The majority of the players skated for the league's original six teams between 1942 and 1967. The six teams were the **Toronto Maple Leafs** ( $n=48$ ), **Detroit Red Wings** ( $n=48$ ), **Boston Bruins** ( $n=44$ ), **Montreal Canadiens** ( $n=44$ ), **New York Rangers** ( $n=38$ ) and the **Chicago Black Hawks** ( $n=38$ ). The original six contributed overall 66.5% of the sampled players, and we assigned players to teams based on the majority of their time throughout their career spent with the team (57 players played for only one team). Overall players tended to have longer careers at the time (mean retirement age = 35.22,  $SD=4.1$ ).

## 2.2 | Data collection

An archival data collection from publicly available sources was conducted to measure the effect of hockey fighting on the mortality of players in the NHL. The main source utilized for the collection of data was [www.hockeyfights.com](http://www.hockeyfights.com) which is a website that contains archival logs of all fights between players in the NHL starting from the 1957–1958 season. Any player documented to have participated in at least one fight during their NHL career between 1957 and 1971 was included in the study. Height, weight, birthplace, birth date, and number of fights were extracted from this website. Additionally, [www.hockey-reference.com](http://www.hockey-reference.com) was utilized to determine whether each player documented was dead or alive at the time of data collection. If they were alive, the age of the player was tabulated (and subsequently his days alive as of May 15, 2020 was computed), and if the player was dead, the total days the player was alive was calculated. The NHL official website, [www.nhl.com](http://www.nhl.com), was referenced to collect information regarding the teams they played for, the number of assists they delivered as well as goals they had scored during their careers.

The data was organized and coded into variables with the software program SPSS version 28 Statistics in order to manage and perform statistical analyses.

## 2.3 | Variables

### 2.3.1 | Number of fights

For each NHL player included in the study, year-by-year fight totals for both the regular seasons and the postseasons were added together to determine the total number of fights a player engaged in during his career. Overall,

the mean number of fights was 13.02 ( $SD=17.23$ ) with a median of 6 fights and a mode of 1 (skewness = 2.9, kurtosis = 10.54).

### 2.3.2 | Height and weight

These physical measures were tabulated independently in inches and pounds respectively. The average height was 71.28 ( $SD=1.87$ ) while the average weight was 182.14 ( $SD=12.31$ ). These were included in the model because earlier findings established that smaller bodies had lower death rates and fewer diet-related chronic diseases and that shorter people also appear to have had longer average lifespans.<sup>19</sup> More specifically, Body Mass Index (BMI), a function of both height and weight, had an association with longevity in NFL players debuting before 1940.<sup>20</sup>

### 2.3.3 | Assists and goals

Measures of offensive ice performance were included in the model separately to account for athletic success. The average number of goals scored was 109.78 ( $SD=130.51$ ) while the average of assists delivered was 179.57 ( $SD=179.83$ ). Sport excellence was associated with longevity<sup>21</sup> in a study, which demonstrated counterintuitively that players inducted into the Baseball Hall of Fame while still alive had shorter lifespans compared with age-matched players who were not inducted. Yet a replication challenged this finding.<sup>22</sup> In support of a positive association, it was found that most successful cricketers in England lived longer than their less successful peers.<sup>23</sup>

## 2.4 | Statistical analysis

We conducted a Kaplan–Meier survival analysis. This test is the standard in mortality research<sup>24</sup> and is thought to produce one of the best estimates to assess the fraction of participants living for a certain amount of time after treatment.<sup>25</sup> The effect of an intervention is assessed by measuring the number of participants who survived after the behavior involved (i.e., number of fights) over a period of time. The test involves computing probabilities of occurrence of an event (i.e., death) at a certain point in time and multiplying these successive probabilities by any earlier calculated probabilities to get the final estimate. One basic assumption of the test is that the survival probabilities are the same for all players studied early and late in the study period.

We subsequently employed the Cox regression model, which can provide an effect estimate by quantifying

the difference in survival between patient groups, but in contrast to the Kaplan–Meier method, can adjust for confounding effects of other variables. This is a robust and popular method to analyze survival data, and the main advantage of Cox is the possibility of presenting unadjusted and adjusted HRs with their accompanying Confidence Intervals.<sup>26</sup> We made sure to secure an acceptable EPV of 29.4 to maintain the validity of the model.<sup>27</sup>

### 3 | RESULTS

We separated the sample into four groups of about equal number based on their fight involvement: low frequency ( $n=92$ , 1–2 fights: 44 deceased, 48 alive); medium low ( $n=103$ , 3–6 fights: 38 deceased, 65 alive); medium high ( $n=96$ , 7–16 fights: 38 deceased, 58 alive); high ( $n=97$ , 17–115 fights: 28 deceased, 69 alive). While our focus was on fighting we wanted to ensure that on the main outcome variable studied, longevity, non-fighting NHL players of the same period did not differ significantly. A random sample of 45 players (16 deceased, 29 alive) had a similar longevity distribution as the population of fighters,  $\chi^2(1)=0.115$ ,  $p=0.735$ .

In our main analysis, we initially ran a model to test the effect of fighting on mortality without covariates and then ran a subsequent model to test its effect when controlling for the covariates.

A log rank test undertaken to determine if there were differences in the survival distribution did not reach statistical significance,  $\chi^2(3)=5.23$ ,  $p=0.16$ , thus failing to show a relationship between earlier fighting frequency and mortality. The results of this analysis are summarized in Table 1.

Following common practice in the field of sports and mortality research,<sup>28</sup> we then used a Cox proportional-hazards regression model to test the effects of several predictor variables (including fighting behavior, the factor of interest) on an outcome variable (mortality). The results of this analysis are summarized in Table 2. We found no effect of the number of fights on longevity once again.

The overall model was not a significant improvement in fit relative to the null. The fighting groups variable in the

model (and table) were dummy coded. The high fighting group represents the reference category and has no coefficient associated with it. Its comparison to the medium-high group yields no significance ( $p=0.07$ , Exp (B)=0.63), also a comparison to the medium-low group yields no significance ( $p=0.65$ , Exp (B)=0.9) and lastly, where one would predict an effect if there was one to be detected, the comparison between the high and low fighting groups was also not significant ( $p=0.28$ , Exp (B)=0.78). Since we wanted to produce the most sensitive test to examine our hypothesis, we repeated this test but included fighting as continuous variable in the model. We, again, failed to detect a relationship,  $B=-0.007$ ,  $SE=0.006$ ,  $Wald=1.43$ ,  $p=0.232$  (nor did the other covariates yield any significant association).

### 4 | DISCUSSION

The results demonstrated that in the current sample, fighting, in isolation from other elements of the game and when they were accounted for did not seem to predict longevity outcomes. In contrast to our hypothesis, NHL players' greater involvement in fights throughout their careers was not associated with a shorter lifespan. At the extreme, players who were consistently involved in this violent act, and accumulated an imposing average of more than 35 fights throughout their careers, were no different in their longevity than players who fought only 1 or 2 times during their entire NHL tenure (as well as a restricted sample of non-fighters). What can account for the null result? First, it could be that hockey fighting indeed does not bring about long-term negative health ramifications as those in contact are usually hitting each other for a relatively short period of time (in contrast to boxing which may last a long duration). The players are also involved in the brutal act while struggling to maintain balance on the ice, which should substantially reduce their ability to produce blunt force (but at the same time also defend themselves). In addition, we explored fighting acts for a relatively short period of time in one's lifespan. It is conceivable that NHL fighters also fought before they entered the league while in the junior ranks (a factor not accounted for in this study). However, they were not likely to have continued the practice beyond retirement,

**TABLE 1** Results of kaplan–meier (model i) predicting mortality (in days) by the number of national hockey league fights.

Fighting group	Estimate	S.E.	95% Wald CI
Low	33217.51	2834	27662.86–38772.15
Moderate-low	35061.97	2728.94	29713.26–40410.69
Moderate-high	37452.79	2840.05	31886.05–43019.53
High	45931.69	2831.04	40382.85–51480.53

Note: Estimation is limited to the largest survival time if it is censored.

**TABLE 2** Results of cox regression analysis predicting mortality (in days) by the number of national hockey league fights and covariates.

Parameter	B	S.E.	Wald	Sig.
Height	-0.025	0.06	0.20	0.66
Weight	0.01	0.01	0.45	0.50
Fighting			3.74	0.29
Low	-0.25	0.23	1.19	0.28
Moderate-low	-0.11	0.24	0.21	0.65
Moderate-high	-0.47	0.26	3.26	0.07
Assists	0.00	0.00	0.01	0.93
Goals	0.00	0.00	0.69	0.41

Note: The degrees of freedom (df) for all the variables is 1 except for fighting which is 3.

thus limiting this violent behavior to their late adolescence/early adulthood only, a time of greater capacity for bodily recovery to counteract the impact.<sup>29</sup>

Alternatively, it is possible that while there is a significant deleterious enduring health impact, it does not arise to the level affecting longevity in this sample. In this regard, it is worthwhile to note historical trends in NHL fighting. The period we explored was mostly before fighting peaked in the league. The last season in our sample produced one fight in about two games on average but in the 1987/8 season, the zenith of NHL fighting, more than one fight occurred per game on average.<sup>7</sup> Tie Domi, who played in the NHL during 1990–2006 and was the most prolific fighter in the history of the league, had twice as many major fights as the most involved player in our sample. As such, future research should in time explore the effect on longevity in this later period of NHL play while taking into account changes in equipment rules and other league regulations.

Generally, our findings are in line with past research,<sup>11</sup> which failed to correlate CTE and fighting behavior. It is possible that in the aggregate, while NHL fighting is visible and strongly tied to the league's image,<sup>6</sup> the overall health impact it holds on the body is rather minimal in comparison to the other physical elements of this very demanding game (e.g., body checks, boarding, checking to the head).

Moreover, in comparison to boxing, which is much more demanding during a short period of time (a possible 12-round fight), the NHL season is much more strenuous as players typically spend around 20 min on the ice, game after game, during a long season over long careers.

In addition, we failed to link the other correlates aside from fighting to longevity. Both physical factors, as well as performance distinction, failed to yield associations with

lifespan among NHL players. In regards to the former, it stands to reason that since we employed a rather homogeneous sample (i.e., the physical dimensions of the players are quite similar and dictated by the specific demands of the sports) a correlation would be somewhat hard to detect. Past research found the relationship among mostly heterogeneous samples including both sexes<sup>19</sup> and future research should increase the sample size under the current investigative conditions with a particular emphasis on expanding the study of non-fighters in the league (we obtained only a random sample as opposed to a population of fighters). In addition, longevity as an outcome variable is a blunt, and to some degree, an insensitive measure. Future research should explore further, possibly qualitatively, the quality of life of fighting players in their later years.

While our results are null, we would like to promote this intra-sport analysis conducted here in addition to the ubiquitous inter-sport comparison often used in longevity research.<sup>17,30</sup> A microanalysis of factors associated to longevity within the sport can shed light on foundational issues pertaining to style of play as well as health aspects to inform practitioners. In this vein, our study is attempting to address the dearth of research in hockey and longevity.

## 5 | PERSPECTIVE

Hockey fights are rampant in the NHL even since the establishment of the league. This archival study examining the frequency of hockey fighting during the 1957–1971 NHL seasons, failed to find an association with player longevity. We propose that fighting may be negligible in the context of a generally aggressive type of game with much bodily contact and thus other elements of play such as the frequency of cross-checking, hooking and boarding should be explored in relationship to players' life duration. In this regard, since fighting is rare in the competitive European hockey game,<sup>31</sup> it may be a suitable venue for such an exploration.

## AUTHOR CONTRIBUTIONS

Nadav Goldschmied developed the research question. Nadav Goldschmied and Jaedyn Lambrecht contributed to the conception and design. Haylee Langton supervised data extraction. Nadav Goldschmied, Jaedyn Lambrecht, Alyssa Castro and Haylee Langton performed data analyses. The first draft of the manuscript was written by Jaedyn Lambrecht and Alyssa Castro. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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## CONFLICT OF INTEREST STATEMENT

Nadav Goldschmied, Jaedyn Lambrecht, Alyssa Castro and Haylee Langton declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The dataset generated during the current study is available from the corresponding author on reasonable request.

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