

## Assessment of Information on Concussion Available to Adolescents on Social Media

### Abstract

**Background:** Considering how many people obtain information about their health online, the aim of this study was to describe the content of the currently most widely viewed YouTube videos related to concussions and to test the hypothesis that consumer videos would be anecdotal, while other sources would be more informational. **Methods:** The term “concussion” was used to search for videos with 100,000 or more views on YouTube that were posted in English or Spanish. Descriptive information about each video was recorded, as was information on whether certain content was conveyed during the video. The main outcome measures are sources of upload and content of videos. **Results:** Consumer videos accounted for 48% of the videos, television based accounted for 50% of the videos, and internet based accounted for only 2% of the videos. None of the videos viewed fell into the professional category. Television based videos were viewed significantly more than consumer or internet based videos. Consumer and television based videos were equally anecdotal. Many of the videos focused on adolescents and were related to sports injuries. The majority of the videos (70.4%) addressed concussion causes, with 48% stating sports. Few videos discussed symptoms of concussion and prevention. **Conclusions:** The potential for widespread misinformation necessitates caution when obtaining information on concussion on a freely accessible and editable medium, such as YouTube.

**Keywords:** *Adolescents, concussion, social media, YouTube*

### Introduction

A concussion (Mild Traumatic Brain Injury [MTBI or mTBI]) is the result of a traumatic brain injury, caused by an external impact to the head or by violent shaking of the head. The effects of these insults include headaches, dizziness, confusion, ringing in the ears, nausea, vomiting, problems with vision, balance, motor coordination, mood, memory, alertness, and concentration, and may also include a temporary loss of consciousness, lasting under 30 min. Since loss of consciousness is not always present, cases of concussion may go unreported, even though they may be quite common, especially among persons involved in contact athletic activities. While the majority of concussions are mild and patients recover fully, MTBI is considered very common in the United States (US), and repeated instances of concussion may lead to postconcussive syndrome as well as chronic traumatic encephalopathy (CTE), which has been linked to the dementia symptoms noted in some professional athletes.<sup>[1]</sup>

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The incidence of concussion has been characterized as a significant public health concern, which is currently underreported. The Centers for Disease Control and Prevention (CDC) estimates that only about 11% (or 1 out of 9) cases of concussion are reported and thence, treated accurately. Better reporting results in better diagnosis, better treatment, and with more attention directed at the problem, better prevention is possible. According to the CDC, the 2017 President’s Budget includes a funding request for a “National Concussion Surveillance System,” a nationwide survey which, if approved, would obtain information for more accurate estimates of concussion statistics in the US.<sup>[2]</sup>

The American Speech-Language-Hearing Association reports that about 1.5% of Americans live with TBI-induced long-term disabilities that affect daily functioning and that this probably represents an underestimate of the true prevalence of the problem.<sup>[3]</sup> Considering that more than 200 million persons in the US participate in organized physical activities and that many of these include a high risk of TBI

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and given the numbers reported for emergency room admissions as well as hospitalizations,<sup>[4]</sup> one can surmise that a huge number of persons who have sustained a mild TBI do not seek or receive medical advice.<sup>[5,6]</sup>

Among persons without training in health-related areas, misconceptions regarding TBI abound including parameters such as definitions, short-term and long-term effects, and recovery.<sup>[7,8]</sup> In the past decades, numerous studies have been carried out to examine the public's knowledge of TBI and MTBI and possibly discern those attitudes that might encourage treatment for concussion and TBI. Perhaps learning what the public misunderstands can help us better aim information and public health initiatives.

Omalu *et al.* drew the attention of the scientific community to chronic CTE as a result of years of repeated concussions associated with football in professional athletes.<sup>[9-11]</sup> However, others argued the absence of convincing evidence regarding the connection between sports concussions and CTE.<sup>[12,13]</sup> Finally, in 2015, Peter Landesman's film "Concussion" was released by Sony Pictures, regarding Omalu's story and popularized the connection between repeated concussions and CTE.<sup>[14]</sup>

This scientific controversy may have created lasting doubt about the effects of repeated concussions on cognitive functioning in athletes. Merz, Van Patten, and Lace attribute the persistence of misconceptions about TBI, postconcussive syndrome, and chronic CTE to disagreements and contradictions in scientific publications and further compounded by misinformation from the media.<sup>[15]</sup> Ahmed and Hall reviewed 153 online articles related to concussion, with a specific focus on the terms used to refer to concussions caused by sports and arrived at the conclusion that the variability with which such information is presented to the public may contribute to misinformation.<sup>[16]</sup> They further developed a checklist for enhanced consistency when media professionals are reporting on TBI to the general public.

While agencies such as the Department of Education of the State of New Jersey<sup>[17]</sup> have put in place a comprehensive program for health and physical education for student-athletes (and all students) from preschool to Grade 12 (P-12), this information may not be widely known to the general public. The specific standards include updated policies on Sports-Related Concussion and Head Injury that were passed into law in 2010, as P. L.2010, Chapter 94, supplementing P. L.1984, c. 203 (C.45:9-37.35 et seq.) and chapter 40 of Title 18A of the New Jersey Statutes.<sup>[18]</sup> The law (NJSA 18A: 40-41.4) required of each school to adopt a policy on the prevention and treatment of concussions and head injuries for K-12 student-athletes.<sup>[18]</sup>

It is important to note that concussion in adolescents is probably underreported, with female athletes experiencing a higher incidence of concussion than males in the same

sports.<sup>[19]</sup> Langlois *et al.* in a review of the incidence of TBI estimated that concussions in the US may occur at an annual rate of 3.8 million including those that entailed only loss of consciousness.<sup>[6]</sup> Clearly, underreporting of concussions in youth sports results in problems with monitoring epidemiology,<sup>[20]</sup> and therefore learning to what information the public has access to and enhancing the public's knowledge are critical.

Despite the availability of such reputable sources of information, often, millennials and their families search for their facts on a variety of topics from online sources such as YouTube. YouTube currently has over 1 billion users and reaches more 18-34 year olds than any US-based cable network.<sup>[21]</sup> Several studies have clearly determined that there is a plethora of information related to health on YouTube.<sup>[22-25]</sup> A recent study<sup>[26]</sup> evaluated the content of videos related to concussion that appear on YouTube. They found that more than a third of the videos showed a sports-related injury, and another quarter of videos were of the related news reports. The authors concluded that high quality videos uploaded by educational and health organizations were a need that should be fulfilled.

Ahmed and Hall (2016) in their review of the terms used to refer to concussion in online articles, noted that modifiers such as "mild" or "serious" had the potential to mislead the reader regarding the severity of brain injury in general.<sup>[16]</sup> A proliferation of YouTube videos on "epic fails" that involve falls and injuries (YouTube, 2016: A search produced about 23 million results) indicates a possible light view of head injuries, especially by young persons. Given the release of the film "Concussion," mentioned above in 2015, and the new video uploads occurring hourly on YouTube, the purpose of this paper was 2-fold: first to describe the content of the currently most widely viewed YouTube videos related to concussions, and second to test the hypothesis that consumer videos would be more anecdotal, whereas other sources would be more informational.

## Methods

The term "concussion" was used to search for videos with 100,000 or more views on YouTube. This was determined by sorting for the number of views. A total of 127 videos using this keyword had over 100,000 views. After excluding 27 videos that were in a language other than English or Spanish, a sample of 98 videos were included in this sample.

The following basic descriptive data were recorded: Title, URL, date of upload, length of the video, language of the video number of views, cumulative number of thumbs up and thumbs down, and gender of the people featured in the video. The source of upload was determined to be one of the following: consumer; professional; television based; and internet based. Consumers were defined as a nonprofessional member of the general public, whereas a

professional was defined as a person qualified to discuss the topic based on having credentials and training in a relevant field. Television-based clips were videos that were derived from television, such as a segment from the news or a broadcast television program. Finally, internet based clips were videos that were derived from a website or other internet source.

The videos were then analyzed to establish whether or not they contained pertinent information, which was largely informed by a fact sheet from the CDC and prevention.<sup>[27]</sup> Evidence of the following information was noted: Mentions causes; if this is about an individual experience and if so, is the individual experience about an athlete; mentions mechanisms; mentions need for immediate care; pain mentioned; mentions aftercare; mentions sports as a cause; mentions sequelae; mentions residual and long-term effects; mentions academic limitations; mentions accommodations; mentions symptoms that have to do with thinking/remembering; mentions symptoms that have to do with physical issues; mentions symptoms that have to do with emotions or mood issues; mentions symptoms that have to do with sleep; mentions danger signs in adults; mentions danger signs in children; and mentions use of helmets for prevention. In addition, whether or not the video message was specifically targeted to adolescent audiences, as well as the inclusion of celebrities was noted.

Statistical analysis of the videos was performed using IBM SPSS Statistics for Windows (version 23, Armonk, NY). The mean length of the videos and the mean number of views per each category were calculated. Differences between consumer and television-based videos were assessed for categorical data using Chi-square analysis and for interval level data using unpaired *t*-tests. Student's *t*-test was performed using two-tailed tests.  $P < 0.05$  was used to determine statistical significance of results. Due to the small sample size ( $n = 2$ ) of internet-based videos, these types of videos were excluded when determining *P* values. Interrater reliability for categorical data was calculated using Cohen's Kappa and was found to be  $\kappa = 0.979$ .

This study was exempt from review by the Institutional Review Board (IRB) at William Paterson University, as the IRB does not review studies in which human subjects are not involved.

## Results

In this study, 98 YouTube videos were analyzed. Collectively, the videos were viewed a total of 71,760,719 times. The videos had all been uploaded between 2007 and 2016. A large influx of videos occurred in 2015 (26.5%; 26/98). This spike in uploads that was noted may have been influenced by the release of a popular movie on the topic [Table 1].

The videos were categorized based on their origin of upload, as consumer, professional, television based, and

internet based. Consumer videos accounted for 48% (47/98) of the videos, television based accounted for 50% (49/98) of the videos, and internet based accounted for only 2% (2/98) of the videos. None of the videos viewed fell into the professional category.

An equal number of consumer and television based videos contained anecdotal accounts (51.1% and 57.4%, respectively). The television based videos were viewed significantly more than the consumer or internet based videos. The mean number of views for television based videos was 1,144,714 compared with 328,392 for consumer based videos and 117,644 for internet-based videos. On the other hand, consumer based videos and internet -based videos were, on average, longer than the television based videos. Consumer videos had a mean length of 4.63 min, internet based videos had a mean length of 4.64 min, and television based videos had a mean length of 2.82 min.

The content of the videos was also analyzed and revealed numerous differences and similarities among the videos [Table 2]. The majority of the videos (70.4%; 69/98) addressed causes of concussions, with 48% of them (47/98) stating sports as the cause. Most of the videos (53.1%; 52/98) discussed an individual experience. Very few of the videos discussed symptoms related to concussions and methods of prevention.

Nonetheless, the consumer videos were, in general, more informative in providing information on residual and long-term effects ( $P = 0.001$ ), symptoms related to thinking or remembering ( $P = 0.001$ ), emotions or mood ( $P = 0.019$ ), and dizziness and headache ( $P < 0.001$ ). The consumer videos were also more likely to discuss danger signs in both adults ( $P = 0.069$ ) and children ( $P = 0.305$ ), need for immediate care ( $P = 0.116$ ) and after care ( $P = 0.043$ ), and use of helmets for prevention ( $P = 0.072$ ).

## Discussion

The results of this study generated several interesting findings. First, among the top 98 most widely viewed videos, none were uploaded by a professional source. The fact that all of the videos were created by consumers, were television based, or internet based should lead one to question the reliability and completeness of the information that is conveyed about a serious health issue. Research suggests that there is a significant amount of misinformation related to health matters available to the public on the Internet,<sup>[28]</sup> and more specifically on social media and YouTube.<sup>[29]</sup> Health professionals should be mindful of the type of information that is most commonly viewed by those who are searching YouTube for valid health information on concussion.

Second, many of the videos focused on adolescents and were related to sports injuries. However, only about 14% of the videos referred to physical after-effects of concussion and 20% referred to cognitive or emotional symptoms.

**Table 1: Number of views and length of 98 widely viewed concussion videos**

	Total (n=100), n (%)	Consumer (n=47), n (%)	Television based (49), n (%)	Internet based (2), n (%)	P
Year of video upload					
2007	2 (2.0)	2 (4.3)	0	0	0.009
2008	3 (3.1)	3 (6.4)	0	0	
2009	4 (4.1)	2 (4.3)	2 (4.1)	0	
2010	3 (3.1)	1 (2.1)	2 (4.1)	0	
2011	10 (10.2)	7 (14.9)	1 (2.0)	0	
2012	6 (6.1)	3 (6.4)	2 (4.1)	1 (50.0)	
2013	18 (18.4)	7 (14.9)	11 (22.4)	0	
2014	15 (15.3)	7 (14.9)	8 (16.3)	0	
2015	26 (26.5)	6 (12.8)	19 (38.8)	1 (50.0)	
2016	13 (13.3)	8 (17.0)	5 (10.2)	0	
Length of video (min)					
Mean (SD)	3.46 (3.28)	4.63 (3.95)	2.82 (2.63)	4.64 (0.3)	0.008
Range	0.16-16.39	0.27-16.65	0.28-16.07	4.43-4.85	
Number of video views					
Mean (SD)	732,252 (1,866,588)	328,392 (293,061)	1,144,714 (2,570,889)	117,644 (1436)	0.032
Range	102,323-16,782,693	103,029-1,412,053	102,323-16,782,693	116,628-118,659	

SD=Standard deviation

**Table 2: Source and contents of 98 widely viewed concussion videos**

Content category	Total (n=98), n (%)	Consumer (n=47), n (%)	Television based (49), n (%)	Internet based (2), n (%)	P
Targeted towards adolescents	37 (37.8)	9 (19.1)	28 (59.6)	0	0.001
Mentions causes	69 (70.4)	38 (80.9)	29 (61.7)	2 (100)	0.021
Features a celebrity	48 (49)	7 (14.9)	40 (85.1)	1 (50)	0
About an individual experience	52 (53.1)	24 (51.1)	27 (57.4)	1 (50)	0.545
The individual experience about an athlete	14 (14.3)	7 (14.9)	7 (14.9)	0	0.667
Mentions mechanisms	13 (13.3)	12 (25.5)	1 (2.0)	0	0.001
Mentions need for immediate care	13 (13.3)	9 (19.1)	4 (8.2)	0	0.116
Pain mentioned	7 (7.1)	7 (14.9)	0	0	0.005
Mentions aftercare (posthospital)	7 (7.1)	6 (12.8)	1 (2.0)	0	0.043
Mentions sports as a cause	47 (48)	22 (46.8)	23 (47.0)	2 (100)	0.99
Mentions sequelae	9 (9.2)	7 (14.9)	0	2 (100)	0.005
Mentions residual and long term effects	10 (10.2)	10 (21.3)	0	0	0.001
Mentions accommodations	2 (20.4)	1 (2.1)	0	1 (50)	0.305
Mentions symptoms that have to do with thinking/ remembering	15 (15.3)	13 (27.7)	2 (4.1)	0	0.001
Mentions symptoms that have to do with physical issues	13 (13.3)	13 (27.7)	0	0	0
Mentions symptoms that have to do with emotions or mood	5 (5.1)	5 (10.6)	0	0	0.019
Mentions symptoms that have to do with sleep	1 (1.0)	1 (2.1)	0	0	0.305
Mentions danger signs in adults	9 (9.2)	7 (14.9)	2 (4.1)	0	0.069
Mentions danger signs in children	1 (1.0)	1 (2.1)	0	0	0.305
Mentions use of helmets for prevention	3 (3.1)	3 (6.4)	0	0	0.072

Furthermore, only two of the videos mention academic, athletic, or work accommodations following concussion, and only three mention the use of helmets for prevention of concussion. Finally, only ten videos mention that residual long-term deficits may occur as a result of concussion. Therefore, while some useful information may be available on YouTube, it is sparse and insufficient.

YouTube is not the only source of lackluster information. A recent study centered on images related to concussion that were available on common photograph-sharing platforms.<sup>[30]</sup> These authors suggest that the use of these platforms could be a valuable tool for those who focus on sports concussions. However, a content analysis of the descriptions of online news articles related to concussions

determined that the reliability of online content was variable.<sup>[16]</sup> Thus, the authors cautioned that the public could be receiving misinformation when searching within this medium. Again, health-care professionals should be cautious and aware of the information and messages conveyed through popular culture on this topic. Certainly, information, education, and vigilance are paramount in improving recognition, and hence, care of persons who have sustained a concussion. This should be accessible to all involved, from parents, young athletes, and coaches, to health care personnel, as studies have shown little awareness of the parameters involved in concussion.<sup>[31]</sup>

The final finding in this study worth noting was that the cumulative number of views of the videos on this sample was over 70 million. Therefore, the potential for widespread misinformation further necessitates caution when seeking information on concussion on a freely accessible and editable medium such as YouTube. This and other such media have the potential of reaching a very large audience, and professional organizations would be well suited to guide the conversation and the flow of information on important topics such as this one.

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### Conflicts of interest

There are no conflicts of interest.

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