Commenting on chiropractic: A YouTube analysis

Alessandro R. Marcon¹ and Timothy Caulfield²*

Abstract: Numerous studies have examined health-related YouTube videos, but very few studies have also investigated the health-related discussions taking place in YouTube comment sections. Taking up the topic of chiropractic, a popular form of “alternative medicine”, this study first sought to determine if debates or controversies surrounding chiropractic were present in the comments on popular YouTube chiropractic videos. If debates were present, the goal was then to use iterative coding methods to map out how debates were unfolding by describing the general characteristics of the discussions as well as the arguments used by opposing groups. Lastly, the objective was to determine levels of hostility in the debates. Our results demonstrate that there are debates taking place over the efficacy and legitimacy of chiropractic. Furthermore, while our study maps out a wide variety of arguments and debate characteristics, key findings show that those arguing “for chiropractic” rely primarily on personal anecdotes and simultaneously raise issues with “pills” and the pharmaceutical industry. Those opposing chiropractic primarily argue that chiropractic is not sufficiently supported by evidence or “science” and often provide links to additional literature. Overall, hostility levels are quite low in the debates. With an abundance of perspectives being shared in a wide variety of manners, this study suggests that YouTube constitutes a space where individuals can discuss and debate health-related topics like chiropractic. In addition, it sheds light on the rationale underpinning diverse chiropractic-related perspectives and arguments.
1. Introduction

Increased attention is being paid to the role that social media can have in shaping how individuals understand health issues as well as informing the kinds of healthcare treatment decisions they make (Centola, 2013; Korda & Itanim, 2011; Leask, Willoby, & Kaufman, 2014; Thompson & Watson, 2012; Vaterlaus, Patten, Roche, & Young, 2015). A range of issues exist, however, including the quality of online health information (Eysenbach, Powell, Kuss, & Sa, 2002; Hendrick et al., 2012; Silberg, Lunderb, & Musacchio, 1997), and also the degree which online interactive media enables or hinders the exchange of valuable and reliable information (Grande et al., 2014; Moorhead et al., 2013; Syed-Abdul et al., 2013). In this regard, the idea of online social environments such as “echo chambers” or “filter bubbles” have been discussed in which information confirming one’s beliefs is more typically encountered than that containing novel or diverse perspectives (Bakshy, Messing, & Adamic, 2015; Nikolov, Oliveira, Flamm, & Menczer, 2015; Williams, McMurray, Kurz, & Hugo Lambert, 2015). Studies have also demonstrated how online comment-boards, a common attribute of social media, can impact audience perceptions and opinions (von Sikorski & Hänel, 2016; Walther, DeAndrea, Kim, & Anthony, 2010; Witteman, Fagerlin, Exe, Trottier, & Zikmund-Fisher, 2016). Some science and news publications such as Popular Science, Motherboard, and Reuters, in fact, have eliminated online comment boards under articles, viewing them as counter-productive to constructive information exchange (Ellis, 2015). With social media use on the rise among all age groups (PEW, 2015), investigating the online interaction characteristics of the general populace is of growing importance, especially when pertinent health issues are being discussed. As such, the immensely popular site YouTube (YouTube, n.d.), where users interact with one another by sharing videos, leaving comments, and having discussions, is a fitting zone in which to conduct investigations on health-related subjects.

Numerous studies have analyzed YouTube videos on a wide-range of health topics (Basch, Mongiovi, Hillyer, MacDonald, & Basch, 2016; Freeman & Chapman, 2007; Pandey, Patni, Singh, Sood, & Singh, 2010; VanderKnyff, Friedman, & Tanner, 2015; West, Lister, Perry, Church, & Vance, 2014). Some studies have also begun examining the influence of comments with respect to health issues (Tian, 2010; Walther et al., 2010; Williams et al., 2015). However, to our knowledge no studies have examined YouTube comments as they pertain to the popular health treatment chiropractic. The objective of this study is to determine not only the kinds of YouTube comments left under popular chiropractic videos but also how audiences have interacted with these comments by liking and replying.

2. Background

Chiropractic is a popular form of alternative medical treatment but one which also faces criticism. There are studies which have questioned its efficacy to treat ailments - including lower back pain, the ailment for which it is most popular (Crothers, French, Hebert, & Walker, 2016; Dougherty, Karuza, Dunn, Savino, & Katz, 2014; Rubinstein, Terwee, Assendelft, de Boer, & van Tulder, 2013; Wong, Parent, Dhillon, Prasad, & Kawchuk, 2015). Contrasting these studies are others demonstrating its efficacy (Goertz et al., 2013; Santilli, Beghi, & Finucci, 2006). Other studies have highlighted risks of the practice, demonstrating correlations between spinal manipulation and strokes (Cassidy et al., 2009; Reuter, Hämling, Kavuk, Ehrhardt, & Schielke, 2006; Stevinson & Ernst, 2002). The significance of these correlations, however, remains a topic of debate (Cassidy, Bronfort, & Hartvigsen, 2012; Wand, Heine, & O’Connell, 2012). Adding to the debates surrounding the efficacy of chiropractic and other forms of spinal manipulation therapy is the lack of an evidence-base substantiating a wide-range of health benefits claimed by practitioners (Hanna & Honeychurch, 2016; Shelley, Clarke, & Caulfield, 2015). With such debates taking place in academia, questions persist as to whether these issues are also present in popular discourse such as newspaper articles, blogs or social media.
It has been demonstrated that issues of chiropractic efficacy and risk do appear in Canadian, UK and US newspaper print articles but not with great frequency (Rachul, Boon, & Caulfield, 2013). This same research indicates these issues typically arise in public discourse when the treatment is implicated in legal matters (Rachul et al., 2013). In other contexts, such as Australia, there has been a rise in critical attention given to chiropractic, as academics have pressured the Chiropractic Board of Australia to take regulatory action against chiropractors making misleading claims (Harvey & Vickers, 2016). A similar stance has also been taken by some medical doctors in New Zealand (Hanna & Honeychurch, 2016). While chiropractic remains a popular approach that many patients are satisfied with, there seems no doubt that, in some circles, including more popular media, chiropractic remains a controversial treatment (Goldacre, 2009; Homola, 2015; Ingraham, 2016; Jha, 2012), and one that can produce strong opinions (Barrett, 1999; Ernst, 2013).

Given this tension in both the academic literature as well as in some aspects of more popular media, the opportunity is present to analyze chiropractic discourse in popular social media, such as YouTube comments on popular YouTube videos. As such, our study analyzes the most influential (or interacted-with) YouTube comments by examining the two fundamental ways in which commenters can engage with one another: liking a comment or replying to a comment. First we investigated which kinds of comments have created likes and replies, and whether there was a difference between liked comments vs. those being replied to. Next, by investigating the largest reply chains (“discussions”), we sought to identify the kinds of discussions taking place and whether or not debates were present. If debates were taking place, we wanted to identify the key elements of those debates as well as the kinds of arguments and argumentative tactics used by debating camps to substantiate claims. Lastly, as studies have raised issues concerning the negative impacts of hostility/incivility in online comments (Edgerly, Vraga, Dalrymple, Macafee, & Fung, 2013; Ksiazek, Peer, & Zivic, 2015), we also examined the degrees with which this tension was evident in YouTube chiropractic discussions. Analyzing popular YouTube comments in this manner will help to shed light on the degree to which an academic debate on popular alternative health treatment such as chiropractic is playing out in YouTube discussions.

3. Methods

3.1. Data collection

Our objective was to capture a snapshot of popular YouTube video discussions. We therefore captured videos which had received significant attention (views) and interaction (comments). The dataset of videos and accompanying comments was collected by first searching YouTube’s search engine (www.youtube.com) for popular videos with the keyword “chiropractic” and with the search filter set to “view count”. As there were a numerous videos with hundreds of thousands as well as millions of views, we set a minimum view-count to 1,000,000 to highlight the most-viewed videos. In addition to “chiropractic”, additional relevant keywords were then used in searches including a more technical/specialized term: “spinal manipulation”, and a more general/popular term: “back cracking”. As there were numerous relevant videos with over 1,000,000 views, videos were then selected based on number of comments, with a minimum set at 1,000. The four videos with the combined most number of views and comments were selected for analysis on March 4th, 2016, and are displayed in Table 1. Because of the changing nature YouTube video availability (videos are in a continual process of being uploaded and removed), as well as the fact that other parsing criteria could have been taken into consideration for video selection (such as channel subscription data, number of likes for each video, additional search terms, etc.), this data-set should not be seen as a totalization of YouTube chiropractic comments but rather a snapshot of the kinds of discussions taking place on popular YouTube videos.

With over 24,000,000 views and 14,000 comments, this data-set is a snapshot of chiropractic in popularized videos on YouTube. The videos reflect diversity as they were categorized by uploaders with three different video types: Howto & Style, Comedy, and Education (2 videos). The total database of comments from these videos was compiled using a YouTube scraper program, which allows
the following information of each video to be scraped, stored in a spreadsheet (CSV file) and opened in LibreOffice for analysis:

UserID; Username; Date; Timestamp; Comment Text; # of Likes; Has Replies (Yes/No); # of Replies; Reply UserID; Reply Username; Reply Date; Reply Timestamp; Reply text; # of Reply Likes.

Because all analysis of YouTube comments needs to be contextualized as a response to the posted video, as well as to other comments and commenter interactions (Benson, 2015), a brief description of each video has been provided in Table 2 in order to contextualize discussions. For a more detailed description of each video, refer to Appendix 1a.

### 3.2. Data analysis

To assess comments having the most influence in the comment boards, we selected the comments interacted with the most: the top-10 liked comments and top-10 most replied-to comments in each video, the statistics from which are displayed in Table 3. The top-10 most-liked comments had 9,426 likes, accounting for 60% of the total likes in the videos. Selecting the top-10 reply chains in each video resulted in analysis of 1,244 replies, or 54% of the total replies (2,300).

For analysis, our approach employed an “emergent” design in which new investigative directions are permitted to emerge during the analysis (Hesse-Biber & Leavy, 2008). This constitutes a type of “bottom up” (Bowling, 2002) or “inductive” (Bradley, Curry, & Devers, 2007) analysis in which the data plays the predominant role in shaping analytic procedures, including the construction of coding categories. As such, there were numerous stages in the analytic process.
First, we coded all comments in each top-10 list (likes and replies) for each of the 4 videos, assigning categories for the diverse comment characteristics (Bradley et al., 2007; Saldaña, 2013). Detailed explanations and examples of each comment characteristic are provided in Appendix 1b. When conducting the coding, it was possible for comments to be coded as containing multiple characteristics. We then compared the types of comments in each top-10 list to determine whether different kinds of comments created likes vs. replies.

Next, we conducted coding analysis on the top-10 discussions in each of the four videos to determine the kinds of discussions taking place and to evaluate if debates were taking place. This process was informed by a classification scheme for YouTube comment content analysis (Madden, Ruthven, & McMenemy, 2013) as well as a YouTube interaction guide (Benson, 2015). We observed that 3 categories emerged: debate, non-debate and some-debate. “Debate” refers to a discussion containing predominantly, if not exclusively, argumentative discourse on one principle topic. In order to be coded as a “debate” discussion, more than 50% of the comments in the thread had to be argumentative discourse pertaining to the central debate. “Non-debate” discussions included jokes, antagonisms, reflections, opinions, etc. but did not contain a centralized debate. “Some-debate” refers to discussions in which commenters argued over specific topics, but where this argumentative discourse did not constitute the majority of the discussion. In addition to these categories, each discussion was labelled with a principal topic. Because some discussions had multiple topics, they were coded as such.

When “debate” emerged as the most predominant discussion type (Table 4), and because these discussions focused almost exclusively on one topic: “efficacy and legitimacy of chiropractic/chiropractors” (Table 5), these 14 discussions were analyzed with multiple iterations, in order to inductively build the coding framework. The objective was to determine the key elements (shared

| Video                        | Total likes | Top 10 like range ± (Total) | Total replies | Top 10 reply range for analysis ± (Total) | % of total comments that were replies |
|------------------------------|-------------|-----------------------------|---------------|------------------------------------------|--------------------------------------|
| Cracked commercial           | 5,926       | 727–154 (2,999)             | 505           | 48–11 (201)                              | 6                                    |
| Helps teenager               | 6,368       | 1,028–194 (4,591)           | 1,045         | 151–22 (624)                             | 34                                   |
| 4 min of joy!                | 2,959       | 312–61 (1,531)              | 479           | 40–11 (205)                              | 30                                   |
| First time adjustment        | 456         | 60–12 (305)                 | 271           | 123–5 (214)                              | 21                                   |
| Totals                       | 15,709      | 9,426                       | 2,300         | 1,244                                    | 16                                   |

| Video                        | Number of discussion types and replies |
|------------------------------|----------------------------------------|
|                              | Debate      | Replies   | Non-debate | Replies   | Some-debate | Replies |
| Cracked commercial           | 3           | 96        | 5          | 79        | 2           | 26     |
| Helps teenager               | 7           | 464       | 2          | 78        | 2           | 82     |
| 4 min of joy!                | 3           | 90        | 6          | 104       | 1           | 11     |
| First time adjustment        | 3           | 149       | 4          | 28        | 4           | 37     |
| Totals                       | 16          | 799       | 17         | 289       | 9           | 156    |
| % of total                   | 64%         | 23%       | 13%        |           |             |        |
characteristics) of the debate discussions as well as the most-used arguments by commenters. Because we observed that particular arguments were often repeated in the same discussions, often in the same comment or by the same commenter, we decided not to count each individual use of a particular argument. Counting comments in this manner would skew overall tabulations towards very vocal participants and the discussions with a total higher number of comments. In response, we simply calculated whether the discussion, as a whole contained the presence of a particular argument or not. The same process was also undertaken for coding the key elements. By doing so, our analysis maps out the key elements, as well as the arguments most-drawn upon when chiropractic is debated in YouTube discussions but does not provide the numbers for each individual use. As a result, our analysis shows the collective argumentative trends of the two arguing groups as they appeared across all of the debate discussions which appeared under diverse videos and at diverse times. Determining the influence of each argumentative type is beyond the scope of this study.

To determine the metrics for hostility, we did quantify uncivil comments based on the following definition of a hostile message: one inciting “anger or exasperation through the use of name-calling, character assassination, offensive language, profanity, and/or insulting language” (Ksiazek et al., 2015). Comments containing the term “troll” were also quantified (in a separate category) as the term emerged with significant presence in the discourse. A “troll” is a term used primarily online to describe someone who intentionally stirs up debate and hostility in online discussions for the purpose of angering others and causing chaos. On these grounds we were able to establish a means of determining the general hostility levels in the discussions, and to determine whether one argumentative group was more hostile than another.

Because content analysis is a subjective process, we tested for intercoder reliability for three different stages of the coding process. In coding for the differences between the top-10 liked and replied-to comment lists, we achieved a Kappa score of 0.84. In coding for whether a discussion was “debate”, “non-debate” or “some-debate”, we achieved a perfect kappa score of 1.0 after consensus discussions. When coding all 3 “debate” discussions pertaining to the video “First Time”, for key elements and argument types, we achieved a kappa score of 0.90. Combined, these scores demonstrate nearly perfect inter-coder agreement (Landis & Koch, 1977).

4. Results

4.1. Top-10 lists: Liked and replied-to comments

Ten comment characteristics emerged in the top-10 most liked and replied-to comments (see Figure 1) (For a description and text example of each characteristic refer to Appendix 1b). Liked comments and replied-to comments shared many similar characteristics, the most common of which was a direct reference to an element in the posted video. In assessing the difference between liked and replied-to comments, “reflecting with humor” was present in 18 liked comments (45%) and only seven (16%) replied-to comments. Another notable discrepancy was that 20 (48%) of the replied-to comments contained asking critical questions/raising critiques vs. only 10 (25%) of liked comments. Thus, the principle distinction between creating likes and replies is that serious/more humorous sentiment tends to create more likes whereas critical or antagonistic sentiment tends to create more replies.

| Table 5. Topics in debate discussions |
|--------------------------------------|
| Topic                                               | # of discussions |
| Efficacy and legitimacy of chiropractic/chiropractors | 14               |
| Cracking sound as a result of gas releasing in the joint | 1               |
| Efficacy and value of pharmaceutical pills and vegan diets | 1               |
4.2. Discussions from replied-to comments

Analysis from the top-10 discussions from the four videos revealed 16 “debate”, 17 “non-debate”, and nine “some-debate” discussions. Although “debate” and “non-debate” had an almost equal number of discussions, the 16 discussions in “debate” had 799 total replies (64% of the total replies) vs. “non-debate”, where the 289 replies represented 23% of the total. In “some-Debate”, there were 156 replies, representing 13% of the total replies (see Table 4). As such, the majority of discussion taking place was that pertaining to “debate”.

While all discussions were analyzed and coded based on a topic, it was revealed that 14 of the debate discussions were centered on the efficacy/legitimacy of chiropractic (see Table 5), accumulating in a total of 763 comments (61%). After seeing the predominant presence of a debate about the efficacy and legitimacy of chiropractic/chiropractors (this debate was also seen present in six some-debate discussions), we analyzed these 14 discussions for “key elements” and arguments used by the two debating groups, which we labelled: “against chiro” and “for chiro”.

4.3. 14 Discussions debating the efficacy and legitimacy of chiropractic

4.3.1. Key elements of the discussions

The “key elements” of the debates were conversation themes shared by both “for” and “against” groups as well as neutrals. There were a total of 11 “key elements”, six of which compare chiropractic and chiropractors to other treatments and other health care professionals. These six are self-explanatory. The other five elements include “real questions”: the solicitation of information from other commenters; “technical terms”: the use of specific terms related to anatomy or manipulation techniques assumed to be unknown to the general public; “subluxation debates”: debates over the meaning, interpretation, history and practices of “subluxation” as it pertains to manipulations; “legitimacy of the video”: opinions expressed concerning the veracity of the video (whether it was staged, legitimate, etc.); and “credentials/expertise”: commenters questioning one another’s knowledge and authority on the topic. Text examples of five “key elements” can be found in Appendix 1c.

As seen in Figure 2, “real questions” appeared in all discussions, and “technical terms” appeared in 10 (71%). The third most common element was that of comparing medical doctors to chiropractors which occurred in nine (64%) discussions. Debates surrounding “subluxation” appeared in six (40%) discussions, and the legitimacy of the video was also questioned in six (43%) discussions. While the questioning of the video’s legitimacy also took place in six (43%) discussions, all such instances occurred on only one video: “Helps Teenager”. The data does show a presence of chiropractic and chiropractors also being compared with other health treatments and professionals but with lesser salience. It also shows users raising issues regarding other commenter’s expertise and credentials.
4.3.2. Arguments made in the discussions

Those attacking or critiquing chiropractic and chiropractors (“against chiro”), and those defending or praising the practice and practitioners (“for chiro”) made use of distinct argumentative strategies. Text examples of the most-commonly used arguments by both groups can be found in Appendix 1d.

The “against chiro” group labelled chiropractic and chiropractors with five different negative terms: bullshit/bs; snake oil salesman; witchcraft (voodoo, etc.); a con/scam (taking advantage of gullible people); quacks (quack, quackery, quackropractic); and hacks. This group also used four more elaborate arguments that included: (1) equating chiropractic with the placebo effect; (2) deligitimizing the practice by stating that it is not supported by science, evidence, or evidence-based science; (3) stating explicitly that chiropractic does not cure anybody, thus requiring continual treatment, and (4) suggesting that chiropractic can be risky or dangerous. In addition, commenters in this group (1) provided links to studies/articles to support arguments and (2) expressed nuance, stating there are “good chiropractors” or that chiropractic can be effective in some situations, but that numerous medical benefits should not be attributed to the treatment. Figure 3 displays the most common argumentative strategies used by those in the “against chiro” group.

Bs (bullshit) is the most common term negative term used against chiropractic, appearing in nine discussions (64%). This is followed by con/scam, evident in seven (50%), then “witchcraft”, occurring in six (43%). With regards to the more elaborate arguments, the most-commonly used is that which highlights the lack of evidence or science supporting chiropractic. This argument occurs in 12 of the 14 discussions (86%). When explicitly questioning the efficacy of chiropractic, the argument that chiropractic doesn’t cure and thus creates an endless cycle of treatment appears in eight discussions (57%). Equating the treatment with the placebo effect appears in six discussions (43%). Highlighting risks/dangers occurs in five (36%) as does explicitly stating that chiropractic clinics are
making false claims. Linking to additional information is commonly used by commenters in this group, occurring in 10 discussions (71%). Lastly, while chiropractic was argued to be lacking efficacy throughout discussions in various ways, there were eight discussions (57%) in which commenters stated that there are some benefits of the practice, specifically for back pain.

In the “for chiro” group, argumentative characteristics fall broadly into two overarching categories: (1) expounding the benefits of chiropractic and (2) raising critical issues in medical care which chiropractic avoids. Regarding benefits, commenters talk about chiropractic being natural and using natural processes; getting to roots of a problem (not treating merely symptoms but underlying issues); helping with migraines; being safe; having a long history (“over 4,000 years”), and being science-based. In addition, personal anecdotes are used to make claims of chiropractic efficacy.

When raising critical issues in the health care system, commenters talk about: the risks and unnecessity of surgery; the high costs of seeing doctors and getting MRIs; the “AMA conspiracy” in which claims are made that chiropractic was unfairly smeared; and the negative influence and over-reliance on pharmaceutical drugs in healthcare systems. Additional elements of arguments used in “for chiro” group include: providing links to studies/articles to support claims, asking those critical of chiropractic to be “open-minded”, stating that like all professions some chiropractors are “good” (effective) while others are not; and by stating that while some chiropractic clinics offer spurious treatments, the “Gonstead” technique is effective and legitimate. Figure 4 displays the most common argumentative strategies used by those in the “for chiro” group.

When expounding the benefits of chiropractic, personal anecdotes are the most common, appearing in 11 discussions (79%) The next most common: making the case that chiropractic is science-based, appears in six discussions (43%). The other arguments appear in lower frequencies. When raising issues in healthcare practices which chiropractic avoids, the issue of over-prescribing (potentially dangerous) pills appears the most often, occurring in 10 discussions (71%). The problematizing of surgery is the second most common, present in five (36%). The other issues in healthcare appear in discussions at much lower frequencies.

Like the “against chiro” group, those in the “for chiro” group raise a somewhat nuanced perspective on chiropractic, stating that not all techniques in the treatment are valuable or efficacious. This sentiment is present in five of the discussions (36%). Also like the “against chiro” group, links are used to support claims yet this is done so less frequently. Here, four of the 14 discussions (29%) contain links to studies/articles.

4.3.3. Hostility and incivility in the debate discussions
The presence of explicit hostile/uncivil comments in the debate discussions was low. There were a total of 45 comments in the debate discussions which contained hostility/incivility, accounting for
Secondly, there was a higher presence of hostility/incivility in the “for chiro” group than the “against chiro”. Out of 45 comments, 31 (69%) of the hostile/uncivil comments came from the “for chiro” group, with the remaining 14 (31%) coming from the “against chiro” group. The word “troll” was used in an accusatory manner in 24 comments, representing 3% of the total comments. 23 out of 24 cases (96%) came from the “for chiro” group, with the remaining single case appearing in the “against chiro” group (Text examples of hostile comments can be found in Appendix 1e).

5. Discussion
From the 1990s to the present day, complimentary and alternative medicine (CAM), of which chiropractic constitutes a significant part, has grown immensely popular and profitable in North America (Eisenberg et al., 1998; Esmail, 2007). In addition to gaining popularity, chiropractic has also faced a significant amount of criticism. The debate over chiropractic’s clinical efficacy, as well as its role in health care, is well-documented (Homola, 2015; Kaptchuk & Eisenberg, 1998; Shelley et al., 2015).

Furthermore, as the existence of a Wikipedia page notes (https://en.wikipedia.org/wiki/Chiropractic_controversy_and_criticism), the controversy and criticism surrounding chiropractic is evident in popular health discourse. Our study sought to discover if there was a presence of chiropractic debate on one of the most popular social media sites (YouTube), and if so, to map out how that debate was unfolding. A secondary objective was to explore the levels of hostility taking place in the debates.

Our study shows that there is significant debate taking place on popular YouTube videos, and that the overwhelming majority of the debate is focused on the efficacy of chiropractic and the legitimacy of the treatment. In the Top-10 replied-to discussions of the four videos, 61% of all replies fall into debates on this topic. Contrary to popular notions that YouTube discussions are of notably poor quality, full of hostile/uncivil comments and void of constructive knowledge transference, this study suggests otherwise. While there are numerous aggressive or silly comments throughout the various discussions—specifically debates concerning the efficacy and legitimacy of chiropractic—the presence of hostile/incivility is, overall, relatively low. That said, there were numerous and often used negative terms used to attack chiropractic and chiropractors, as displayed in Figure 3. This might explain the reason that those in the “for chiro” group use more hostile/uncivil language than do those in the “against chiro” group (69% vs 31% of total uncivil comments); it illustrates perhaps an emotional response to the negative labelling. It should be restated, however, that the overall presence of overtly hostile language remains low, with only 6% of all replies containing this sort of language.

On a positive note regarding the constructive nature of many of the debates, “real questions” (information being requested by commenters) were found in 100% of the discussions, and technical
talk was evident in 70%. While we did not quantify each instance of technical talk or “real questions”, the fact that there are instances of such rhetoric demonstrates that individuals with some degree of specific knowledge are engaging in the debates, and that despite an abundance of conflicting perspectives, numerous commenters are seeking to exchange relevant information in constructive or civil manners. Indeed, there were an abundance of links to academic articles and external sources in discussions. A further step of analysis would require one to assess the accuracy or quality of this information exchanged, an area of analysis not undertaken in this study.

Regarding the mapping out of arguments and argumentative strategies used in the debates, those defending or praising chiropractic use personal anecdotes more than any other argument to make their case, as seen in Figure 4. This is relevant as numerous studies have examined the role that narrative or the sharing personal experiences can have in influencing others when it comes to health topics (Dohan, Garrett, Rendle, Halley, & Abramson, 2016; Hinyard & Kreuter, 2006; Perrier & Ginis, 2015). Furthermore, the extensive criticism expressed towards the use of pharmaceutical drugs in healthcare, as displayed in Figure 4, sheds light on the reasons why these commenters value and defend chiropractic. It is not merely the case that those defending chiropractic primarily believe in its efficacy and underlying science (although this does appear in 43% of discussions) but rather that their advocacy also stems from mistrust or critiques of health care and the influence of pharmaceutical companies. Based on this information, it can be suggested that those advocating chiropractic treatment do so, at least partially, from a reactionary standpoint, stemming from negative perspectives of more conventional health care. Those seeking to critique chiropractic and influence those in the public who support the practice should consider these critical perspectives and how they are substantiated.

Those in the “against chiro” group, in attempting to convince other commenters—and seemingly a wider audience—about issues surrounding chiropractic, rely predominantly on the argument that chiropractic is lacking evidence and is not science-based. This argument is a common one that can be found in academic discourse critiquing the treatment, (Ernst, 2008; Mirtz, Morgan, Wyatt, & Greene, 2009; Shelley et al., 2015) and is part of a long history of discourse addressing what constitutes and what goes against science-based practices in medicine or health care (Derkatch, 2016; Sackett, 1997; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). Furthermore, the “against chiro” commenters on YouTube raise issues of health risks associated with the treatment and suggest that chiropractors make false claims regarding their practices (five or 36% of the discussions). In raising these issues, commenters here often provide links to additional literature (academic studies, news articles, etc.) as evident in 10 (71%) of the discussions. While making arguments, those critiquing also uses various critical terms to negatively label the practice or call it into question, as seen in Figure 3. Using terms such as “quacks” or “snake oil salespeople” for alternative practitioners such as chiropractors, and describing chiropractic as “witchcraft”, a “scam”, or “bullshit” again speaks to concerns over the lack of evidence in the treatment and the manner in which it is unjustly being sold to the public. Discourse of this kind can easily be found elsewhere online (Ernst, 2016). In contrast to these sentiments, however, there are also numerous instances (eight or 57% of the discussions) where those critiquing the practice also state that chiropractic can provide some medical benefits for specific ailments or that some chiropractors are more legitimate than others. As such, this group, generally speaking, does appear to display a relatively high level of “open-mindedness” concerning the practice.

This study contributes to the research examining how social media sites, in this case YouTube, become spaces where individuals present views, reflect on, and debate health topics (Du, Rachul, Guo, & Caulfield, 2016; Marcon, Klostermann, & Caulfield, 2016; Radzikowski et al., 2016; Vance, Howe, & Dellavalle, 2009). Specifically, this study sheds light on the kinds of rhetoric employed by the groups both defending and critiquing chiropractic. Gaining additional insights into how individuals understand popular health issues and practices can only serve to benefit policy makers and other stakeholders as it helps to elucidate not only the beliefs of various individuals, but also how they strive to validate those beliefs to others.
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The authors declare no competing interest.

Author details
Alessandro R. Marcon1
E-mail: marcon@ualberta.ca
ORCID ID: http://orcid.org/0000-0001-5471-6184
1 Department of Law, Health Law Institute, University of Alberta, Edmonton, Alberta, Canada.

E-mail: caulfield@ualberta.ca
ORCID ID: http://orcid.org/0000-0001-5018-423X

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Appendix 1a

Video descriptions and additional metadata

Video 1: Cracked Chiropractor Commercial

Posted by: Rhett and Link, a comedy duo self-described as “Internetainers”, who host an online show titled, “Good Mythical Morning.” It appears as though this program is no longer being produced.

Length of Video: 59 s

Video Description: Video shows a man giving a monologue while performing various chiropractic maneuvers. He states that many people have questions about chiropractic care, which he lists while performing the moves. He then, while continuing to perform maneuvers, introduces himself, and promotes his business. He describes various health problems people might have, and tells people to call and make an appointment today. His logo then appears and a jingle sounds which states “Ryan Lee Chiropractic Centre; Gentle, Comfortable, Professional.” Contact information including address for his clinic appears on the screen. Under the link is a video showing behind the scene footage of the making of the commercial. The chiropractor seems serious about his profession and is willing to go along with the comedic/promotional stunt.

Video 2: Chiropractic helps teenager stuck in acute pain for 4 months with extreme kyphosis & dead leg

Posted by: Chiropractic Excellence. They are chiropractors treating all ages for over 30 years, and state they their channel exists to educate people “about the amazing potential of chiropractic to enable natural healthy living, without resorting to drugs or surgery”. They describe their practice as able to help “everyday” and include a link to their website. Additional links are provided for “Dr Ian” including Facebook, Instagram, YouTube, Google+ . The clinic is based in Australia.

Length of Video: 10:56

Video Description: A video telling the story of a chiropractor, Dr Ian, giving treatment to a 17-year-old who had thrown out his back pulling out a tree root. Over a period of time involving multiple treatment sessions, Dr Ian gives the boy helps the boy stands up straight and heals his pain. The boy is seen with his father at the end of the video. Both seem to be very happy to have the unfortunate situation remedied.

Video 3: The Great Neck/Back Cracking Compilation Fixed and Extended!!!! 4 min of neck cracking joy!!

Posted by: hokey dokey (no additional information provided)

Length of Video: 3:53

Video Description: A montage of people having various parts of their body adjusted. The “cracking” sound is heard for each adjustment throughout the video. Often times the practitioners voice can be heard alongside the adjustments explaining the type of procedure they are performing. The phrase “There we go” is used often by those doing the adjustments. Coincidently, clips from Videos 1 and 4 appear in the footage.
Video 4: First Time Chiropractor Hip Adjustment Demonstration by Austin Chiropractic Care

Posted by: PsycheTruth. Information provided in the “About” section states: “Videos educational videos about, massage, yoga, asmr, nutrition, chiropractic, psychology, weight loss, how to, massage therapy, fitness, workout, wellness, alternative medicine, health care, fitness, training, exercise, interesting facts, mind control, psychetruth Featuring; Corrina Rachel - Certified Holistic Health Coach Licensed Massage Therapists; Athena Jezik, Jen Hilman, Greg Gorey, Meera Hoffman, Cristen Renee, Melissa La Munyon Yoga Instructors: Joy Scola, Meera Hoffman, Katrina Repman, Mollie Galbraith. I like knowing stuff. I think you should like knowing stuff too.”

Length of Video: 9:17

Video Description: An instructional video by Dr Jeff Echols (chiropractor), who explains and demonstrates an adjustment called the “Lumbar Roll” or “Side posture”. He says the adjustment can be a real “life saver”. He claims people walk better and feel better after the adjustment. He begins by explaining a misalignment and why it causes pain in the lower back. He uses a synthetic skeleton to assist the explanation. He also states that adjustments can be very beneficial for pregnant women as they assist delivery. Then, with a woman on the table, he shows how to spot or diagnose misalignment and then performs the adjustment. He says he hopes the video is “helpful” and suggests visiting his website, or calling him if you have any questions.

Appendix 1b

Top-10 comment characteristic descriptions

(1) Reflecting with humour: Explicitly, a comment containing laughing/smiling text and/or emoticons such as:, XD, “haha”, “lol”, or implicitly, text satirizing the content of the video; making an absurd/fictional claim about its content in a seemingly non-argumentative fashion

Text example: “I bet all the people who is watching this is trying to sit straight. lol”

(2) Referencing pop culture: linking something in the video to another character or aspect of popular culture (movies, videogames, television, etc.)

Text example: “Liu Kang WINS ... CHIROPRACTALITY”

(3) Providing a link: copying and pasting a URL in the comment which another user can click

Text example: “I think there should be laws governing viral marketing like this, at the very least insane shit like this should have a warning label on it that its all made up bullshit. Oh and chiro is pure bullshit too; http://www.patheos.com/blogs/unreasonablefaith/2009/04/7-things-you-need-to-know-about-chiropractic-therapy/”

(4) Making a personal reflection: reflecting on how the video makes the commenter feel or connecting the video with a personal experience that the commenter has had

Text example: “this gives me satisfaction, I have no idea why.”

(5) Giving instructions: using the imperative tense to instruct others; giving advice

Text example: “Pay attention kids, this is what happens when you sit around all day playing WoW/COD/Whatever.”
(6) Referring to a specific element of the video: referring to a specific object, person or technique in the video (in contrast to commenting generally); including a time reference to highlight a specific shot or section of the video

**Text example:** “3:25 that woman is trying to figure out if he came in that way, or if she should run for her life”

(7) Commenting on comments: referring to/reflecting upon a comment made by another user

**Text example:** “Goddamn all the comments on this are sexual. wtf ppl you looked up chiropractor techniques not porn haha”

(8) Praising: speaking favorably about something in/related to the video

**Text example:** “Amazing story and further proof positive that chiropractic care is not only legit, it can change someone’s life!”

(9) Asking questions (not critical): asking a question which does not appear to criticize anything in or related to the video

**Text example:** “Why do other medical doctors bash Chiropractic?”

(10) Critiquing (with questions): raising issues about something in/related to the video in a critical manner (problematizing), using questions or statement

**Text example:** “Too bad chiropractic is quackery and not a legitimate medical profession.”

**Appendix 1c**

Text examples of five “key elements” in “debate” discussions
(All individual usernames have been replaced by “username”)

(1) Real questions: questions being asked with the purpose of soliciting information as opposed to rhetorical questions, used in various situations to make light of a situation/person, to make an argument, or to persuade others

**Text examples:**

“+ username I read the report in that link three time and I still don’t know what the frig they are talking about. Sorry to trouble you but can you please post a few more links.”

“sorry. i don’t buy that for a minute. any proof to back up your claim?”

“+ username I actually watched that episode before I even saw your comment. Before watching this I thought a chiropractor was for like popping bones back into place and stuff, but seriously? Chiropractors actually claim that they can fix shit like heart disease and stress?”

(2) Technical terms: highly specialized medical, physiological or chiropractic terms, seemingly unknown to lay people

**Text example:**

“... sciatica is pain from impingement on the sciatic nerve that generally presents as a radiating pain down the posterior thigh, and can be caused by many conditions but generally from what I’ve
seen has to do with hypertonic internal rotators of the femur, generally piriformis. Peripheral neuropathy is a numbness, tingling or pain in the extremities, neither of which this patient is experiencing so I don’t really see how that’s relevant .”

(3) **Subluxation debates**: comments which explicitly use the term “subluxation” and take up notions including the practices, theory and history aligned with the term

**Text examples**:

“+ username Thats and the fact that subluxation was just made up by a con artist, it has no basis in science at all”

“+ username not all chiropractors adhere to the theory of subluxation. The whacky ones assert that spinal causes are root to most visceral ailments - but this doesn’t mean that all chiropractic treatment is voodoo. That’s patently immature and dramatic. Many modern methods (Gonstead for example) are able to provide significant relief for mechanical problems. Maybe you didn’t read the article properly, but even it affirms that spinal manipulation to correct many disorders (such as sciatica, sacroiliac joint malfunctions and nerve entrapment) is an effective evidence based therapy. Chiropractors specialise in this treatment. This isn’t homeopathy.”

(4) **Credentials/expertise**: comments addressing whether other commenters have the expertise, experience or credentials needed to validate claims being made

**Text example**:

“+ username As far as the person posting as username, she claims to have expertise in this area, but obviously does not, as she has no experience with spinal manipulation, nor has she been able to posit a plausible alternative condition that this boy has, which proves her ignorance. Her only claim is that although she doesn’t really know what is going on, she is somehow certain that this chiropractor did not fix this boy ...”

(5) **Medical doctors vs chiropractors**: comments which draw comparisons between MD’s and chiropractors with regards to a variety of topics such as practices, schooling, expertise, medical authority, and contributions to academic literature.

**Text examples**:

“+ username + Noel Haddock I think a huge problem in society is that people don’t realize how little legitimate training chiropractors actually receive. Chiropractors are doctors in the same sense that I am an ‘ordained priest’ because I took an online course. I never went to seminary school and most chiropractors never went to medical school.”

“+ username For me, for joint or muscle issues, I consider chiropractic care BEFORE a regular MD. It was not always like that. But the MD’s just prescribed muscle relaxers and pain medication with no real root cause relief. They only medicated the symptoms. The Chiropractor I use is a real professional and will test each joint for strength to determine where the root cause of the problem lies.”
Appendix 1d

Text examples of the most common arguments used from arguing groups
Against Chiro Group

(1) Evidence-based/Science

Text examples:

“+ username chiropractors are nonsense, no proven scientific evidence any of this works. No conclusive medical research has ever been done. Waste of money and time”

“one is better than the other because it is based on science, the other quackery and mystical thinking”

(2) Placebo

Text examples:

“+ username best placebo effect, read this http://www.sciencebasedmedicine.org/the-end-of-chiropractic/”

“No sir, anecdotes are whatever you say. Scientific research states the placebo is more effective than chiropractic ‘care.’ It was started by an untrained man that got the techniques from a ghost.”

(3) Doesn’t cure/Endless treatment

Text examples:

“+ username Helper my point is spinal manipulation cures nothing ad everyone knows it.”

“My friend swears by his Chiropractor - BUT he’s been going there for 15 years! I wouldn’t call that ‘fixed’ or ‘cured’, I would call that a ‘band aid’. Fix them just enough so the pain goes away but make sure they are not cured because you won’t get any more money if you cure them. The most profitable patients are the ones who keep coming back.”

(4) False medical claims

Text examples:

“+ username I can’t believe people think by snapping some joints they can cure a heart disease or stress? Yes that’s what chiropractics claim! That’s just bullshit! Watch Penn & Teller: Bullshit - Season 1 - Ep 2: Alternative Medicine It’s in the same league as laying magnets on you or dancing around with a drumstick made of a black chickens shinbone.”

“+ username Because some people and some chiropractors believe that it will cure a wide array of illnesses and maladies when there is absolutely no science backing up the claim whatsoever. Chiropractic adjustments are really only good for when your spine or the surrounding muscles are messed up and are the direct cause of pain (like in the video). People looking to cure migraines, the common cold, cancer, whatever, should go see a medical professional.”
(5) Some good chiro

Text examples:

“+ username it isn’t entirely without its uses though...saying it is completely useless is false. It just doesn’t fix or help with the ailments many people think it will or use it for.”

“Chiropractors are not medical doctors - they are spine therapists. Some are rational and evidence-based, and competent. Others believe in mythical concepts and are not evidence-based. The rational therapists work much like physiotherapists. If they are competent and evidence-based, they are unlikely to be ‘bashed’. This video, unfortunately, is neither rational nor evidence-based.”

(6) Risks

Text examples:

“+ username Arthritis? No, not a chance. They might have a deadly stroke, but arthritis is definitely not caused by ‘popping’ joints.”

“It’s as good as placebo effect. same reason acupuncture is covered by many insurance plans. it’s cheaper for the insurance company than real medicine, especially for problems that go away on their own or are psychosomatic. there’s no evidence to support any of the claims made by chiropractic. ‘subluxations’ don’t exist and they aren’t the cause of the numerous illnesses which chiropractic claims. it’s also dangerous, people have died from it.”

For Chiro Group

(1) Personal anecdote:

Text examples:

“Well since my mother has had horrible back pain for years and going to a Chiropractor has helped considerably i call you bullshit.”

“So when I bashed my head on the ground and could hardly move and wanted to just go to sleep, then my dad raced home from work and had to bring his adjustment table upstairs to my room because I could hardly even walk, he adjusted me neck and it was the loudest pop I’ve heard, and I felt the pain literally whither away and my head ache faded away instantly. That’s not placebo. And it is not BS.”

(2) Science-based

Text examples:

“Medicine has been around a lot longer than the age of peer-reviewed studies. Medicine is strong because it subscribes to the scientific method and constantly evolves. Chiropractic is sincerely interested in adapting its approaches as new science emerges. Both professions are interested in the same thing - homeostasis. The difference is in the approach to care which is based on philosophy. Medicine falls within an allopathic approach. Pharmacotherapy is extensively used because it is very easy to research. The problem is, it doesn’t have the answer to every pathology in the human body. Outside of infections, I do not know of any conditions that can be cured by pharmacotherapy. Treated, sure, but not cured. I therefore welcome ‘alternative’ approaches to health care because we don’t have all the answers yet. When we have clear answers, medicine will take them and call them their own. Several medical doctors and physical therapists have been using spinal manipulation for
years because there is research supporting its efficacy for back pain and neck pain. Chiropractors use spinal manipulation for a different purpose but are very interested in its efficacy for those conditions."

"+ username Unfortunately, your opinion is incorrect. The medical literature favors Chiropractic for an effective treatment of migraines, boosting immunity, and even heart disease. Go to PubMed and do you research before you comment expressing your opinion as set in stone."

(3) Pills/pharmaceutical industry:

Text examples:

"Why such hostility, and insults aimed at Chiropractic work? It has it’s place in the field of treatment. Especially given the fact that the pharmaceutical pills that are being prescribed for people now has worse side effects than the symptom they are supposed to treat …"

"To have a less painful life, to have a relief from pain without drugs, to have this adjustment which results in a greater range of motion and a superior quality of life is, to my way of thinking, a real practice of medicine and health care."

(4) Surgery

Text examples:

"yeah i know right, like when doctors wide open someone to have surgery, super dangerous … fucking idiot, thats what they do and what they studied for years, they know that they are doing moron."

"+ username Doctors would rather slice someone open and pump them full of drugs because they are pain by pharmaceutical companies to do so. Often medicine is not needed to relieve symptoms of an illness but they give them to you anyway because it’s easier and it keeps the big companies happy. Not to take away from good doctors, some doctors are amazing ad save lives. But there are doctors out there that KNOW someone may just need an adjustment or some physio but they will opt for expensive surgery and medicine instead. My mother had very high blood pressure for years and was being pumped more and more full of BP medication with no real results. She eventually went to a private doctor (who gets paid privately) and he suggested chiropractic work after he noticed spelling around her atlas and lower back. 2 weeks of adjustments and she’s never had a problem since. No medication. The proof is in the pudding pal."

(5) Some chiros good, some bad:

Text examples:

"You would find very few modern day Chiropractors who still practice straight Chiropractic, which is the ‘Spine effects everything model’ Although, technically the spinal cord does, the meric chart and a adjustment can fix the flu concept of Chiropractic is dying out, and in my professional opinion, I am grateful of that. If you were to visit a school like the one I went to, which is very science based, and relies on modern understandings of biology, biomechanics and physiology, you would change your mind a bit. But the origins of Chiropractic are quiet shady at best … The reason it stuck around through the beginning is because you can get actual benefits with proper adjustments."

"+ username Thank you, that seems like a much more reasonable assessment. I agree that there are some chiropractors that claim to cure things that don’t make sense to me (e.g. colds, impotency, etc.) But, when it does come to back problems and other spine and joint related issues, I do think
chiropractors can be helpful. Unfortunately, you have extremists like + username who believe that chiropractors are not doing anything at all, which just seems completely wrong from my personal experience and observation …”

Appendix 1e

Text examples of hostile/uncivil comments

(1) “+ username I wish I could slap you silly with a piece of salami and watch you cry.”

(2) “Guess what, genius? It was a joke. What a shock you neither got it nor can see through this other bit of quackery. Great post though. You showed me all right. Showed me that you’re a dolt.”