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Growth in Public Interest and Scientific Research on Kinesiology Taping

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Abstract

Kinesiology taping has grown in popularity, though there are a number of unsubstantiated claims made by some kinesiology taping advocates. An investigation was conducted into trends in general and scientific interest in kinesiology taping. Data in the public domain (Google Trends and Google Scholar data) indicated significant growth of interest both in terms of public search queries and scientific publications relevant to kinesiology taping. Cyclical trends in interest relevant to kinesiology taping were identified. Segmented regression indicated some of the growth in interest in kinesiology taping may be attributed to exposure of spectators of the Olympic Games to kinesiology taping in athletes. Despite substantial growth in research on kinesiology taping there remain unsubstantiated claims.

Keywords: Kinesiology Tape, Google Trends, Google Scholar Data, Segmented Regression, Olympic Games

Introduction

Kinesiology tape is a thin, stretchy, elastic cotton strip with an acrylic adhesive. Originally developed by Japanese Chiropractor Dr Kenso Kase in the 1970's as a natural, alternative healing method, its alleged benefits have been met with controversy. Studies have shown benefits of kinesiology tape in assisting recovery of sport injuries and other non-sport injuries (Thelen et al., 2008) as well as increasing sport performance (Hsu et al., 2009; Yoshida et al., 2007). This study investigates the growth in interest in kinesiology taping as well as the growth in research on this topic.

Clinical benefits

Studies on kinesiology tape for joint and muscle injuries demonstrate kinesiology tape can improve pain free active range of movement (ROM) immediately after tape application for patients with shoulder pain (Thelen et al., 2008). There is also evidence that kinesiology tape can lead to pain relief and lumbar muscle function normalization in those suffering from chronic lower back pain (Paoloni et al., 2011) however there does not appear to be any additional benefits to patients suffering from lower back pain that are already undergoing manual therapy (Added et al., 2016). Kinesiology tape has also shown to benefit post-operative swelling (Ristow et al., 2013). On the other hand, there is conflicting evidence on whether kinesiology tape decreases pain intensity and overall disability in patients or only has a non-significant effect (Shakeri, Keshavarz, Arab & Ebrahimi, 2013). Studies have shown short term pain relief for patients with shoulder impingements (Hsu, et al., 2009) whilst some studies show no benefit in terms of a decrease in pain (Thelen et al., 2008). Kinesiology tape may also benefit patients with postural imbalances. This implies a beneficial assistive treatment approach when combined with physiotherapy (Simsek et al., 2011). In a systematic review of randomized controlled studies (Parreira, Costa, Junior, Lopes & Costa, 2014), itself building on five other systematic reviews, it was concluded that kinesiology taping was no better than a placebo. It was thus recommended that kinesiology taping had no place in clinical practice (Parreira et al., 2014). Though there were some studies identifying marginal benefits these were hypothesized as being due to random fluctuations becoming significant due to small sample sizes involved (Parreira et al., 2014).

Sport benefits

In terms of sports performance, kinesiology tape has been shown to increase the range of trunk flexion (Yoshida et al., 2007). Additional studies have shown kinesiology tape to increase muscle activation (Hsu et al., 2009) and knee flexion ROM in athletes with an acute hamstring strains (Gunur & Alsancek 2014). The viability of kinesiology taping for proprioception is a particularly contentious field (Bischoff et al., 2018). Kinesiology tape has been demonstrated to increase proprioceptive post-anterior cruciate ligament rupture knee stability (Bischoff et al., 2018), proprioceptive ankle stability (Simon et al., 2014) and enhance absolute force sense error for both healthy athletes and athletes suffering from medial epicondylitis (Simon et al., 2014). A contrasting result from Halseth et al. (2004), demonstrated that kinesiology taping likely did not enhance proprioception. Other studies have shown kinesiology tape to enhance either relative or absolute force sense in healthy college athletes, improve range of motion in certain injured cohorts and force sense error compared with other tapes (Mostafavifar et al., 2012). However, no benefits were seen in maximal grip strength (Chang et al., 2010), or peak power across a range of interventions (Harmanci et al., 2016). Csapo and Alegre (2015), conducted a meta-analysis on 19 studies and concluded that kinesiology taping effects were not dependent upon the muscle groups taped and that any strength gain from kinesiology taping would be negligible.

Evidence shows kinesiology tape holding potential in increasing sport performance and as a beneficial method of treatment combined with traditional physiotherapy. However, due to many conflicting studies, additional clinical studies need to be undertaken to further validate the efficacy of kinesiology tape.

Growth of general and scientific interest in kinesiology taping

The aim of this study was to investigate the growth of interest in kinesiology tape since its creation. It was interesting to evaluate patterns in interest in kinesiology taping in the context of the many unsubstantiated claims for this methodology. It was first necessary to design a method to measure this growth over time. Internet activity was selected as a suitable proxy for worldwide interest in a particular topic at a given point in time. It was considered to be a very reasonable hypothesis that growth in kinesiology taping would increase yearly (from zero) since its creation and it would be of interest to investigate any substantial changes in its popularity using statistical analysis on this data. Given the wide ranging and yet unproven claims associated with kinesiology taping it was hypothesized that as general interest and number of subsequent claims increased that this trend would also be represented by increase in the number of scientific publications and citations within the scientific literature.

Methods

An algorithm was written utilizing the programming language R (R version 3.3.2 "Sincere Pumpkin Patch") to access publicly available data on Google trends data for specific topics. Data was gathered from January 2004 (the limit of reliable historical data) to March 2018 on the use of three key search phrases selected as relevant to kinesiology taping ("kinesiology tape", "kinesio tape" and "kt tape"). A number of details were gathered including geolocation and time data for the searches. Data was analyzed using Davies's test (Davies, 1987) to test for breakpoints via a non-zero difference-in-slope parameter of a segmented relationship. Segmented regression was also used to identify the position of these breakpoints using the R package segmented version 0.5.3.0 (Muggeo, 2008). An overview of worldwide trends was created using the R package googleVis version 0.6.2 (Gesmann, & de Castillo, 2011).

The programming language python (Python 3.6.4) was utilized to access publicly available Google scholar data in order to measure scholarly activity on the topic of kinesiology taping, using the same phrases as for Google trends searches. This code was complemented with substantial manual searching to comply with Google Scholar's access criteria.

All investigation was conducted on publicly available data in accordance with Google API's terms of service (https://developers.google.com/terms/).

Results

Table 1 shows the top 25 countries ranked in terms of the popularity of the search phrases relative to the total search volumes for each country. The score is scaled from 0-100 where 100 is allocated to Singapore, the country with the highest number of searches relative to the size of the country's search traffic. The other countries are scaled according to their proportion of national volume of search queries relative to this score (such that for example the second highest scoring USA has 79.5% of the volume of Singapore relative to the USA population size). Figure 1 demonstrates the interest by region for the world.

Table 1. Summary of the top 25 countries by relative search prevalence

Country	Relative Search Prevalence	Country	Relative Search Prevalence	Country	Relative Search Prevalence
Singapore	100.0	South Africa	37.3	Portugal	22.4
United States	79.5	Australia	35.4	United Arab Emirates	19.9
Canada	60.2	Hong Kong	34.8	Norway	19.9
Germany	59.6	Switzerland	31.7	Greece	19.9
Hungary	58.4	Malaysia	26.7	Israel	19.3
Ireland	49.1	Denmark	24.8	Croatia	18.6
Austria	46.6	Slovenia	22.3	Brazil	18.01
United Kingdom	43.5	Philippines	22.4		
New Zealand	41.0	Czech Republic	22.4		

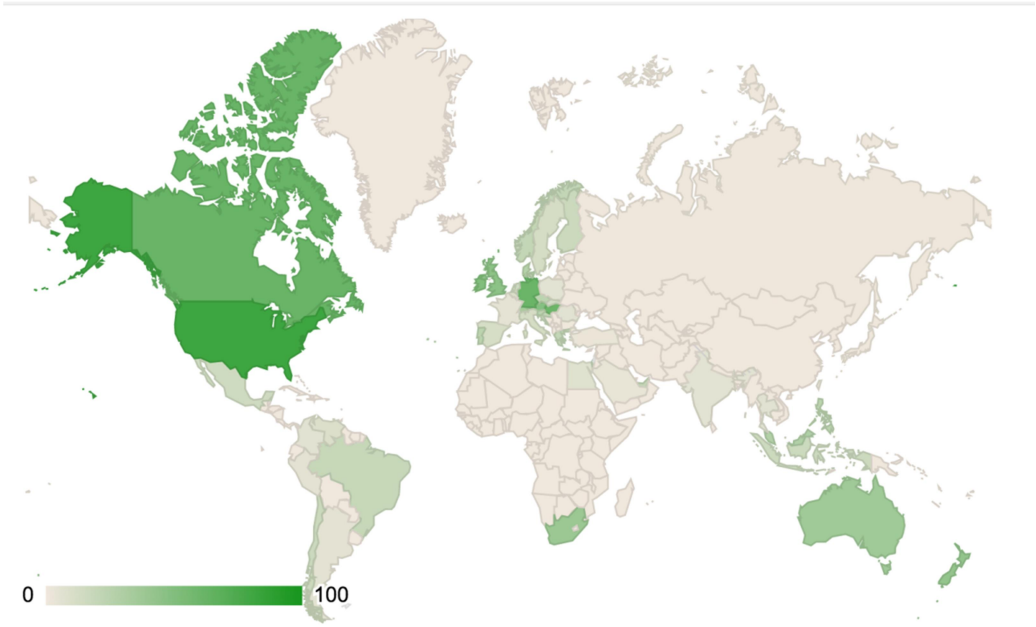

Figure 1. Distribution of relative volume of search traffic by nationality

Due to the search query terms being English language terms, the majority of users were in countries where the primary written language was English such as North America, Australia, New Zealand and the United Kingdom. However other countries also demonstrated a high prevalence of Google searches for kinesiology tape, such as Germany.

The use of the three search phrases between January 2004 and March 2018 (data up to 20th March 2018) is demonstrated in Figure 2.

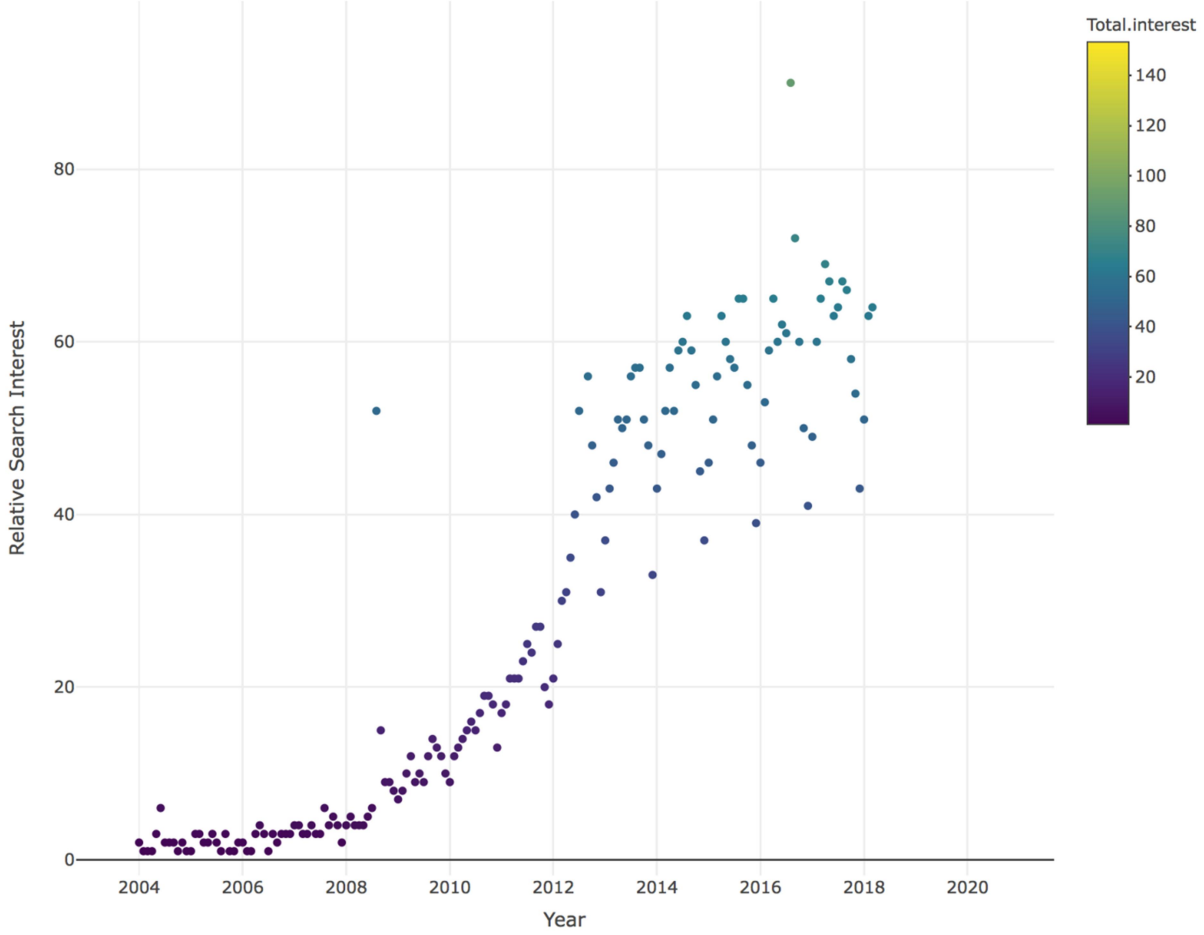

Figure 2. Relative search volume over time for public Google searches since 2004

A distinct peak with a relative search interest value of 52 is seen in August 2008. This peak appears to initiate a dramatic increase in the use of the three search phrases. A similar peak is seen in August 2016 and represents the highest value on the chart (90). The initial peak of 52 is not exceeded until August 2012, after which point the chart appears to enter a cyclical pattern with peaks each year between August and October. This pattern is better demonstrated in Figure 3. In fact examining the Figure 3 it appears in most years since 2004 there are relative peaks between August and October. Davies's test indicated ($p<0.0001$) the presence of breakpoint(s) in the chart. Segmented regression identified breakpoints at 1st December 2006, 1st February 2012 and 1st August 2012.

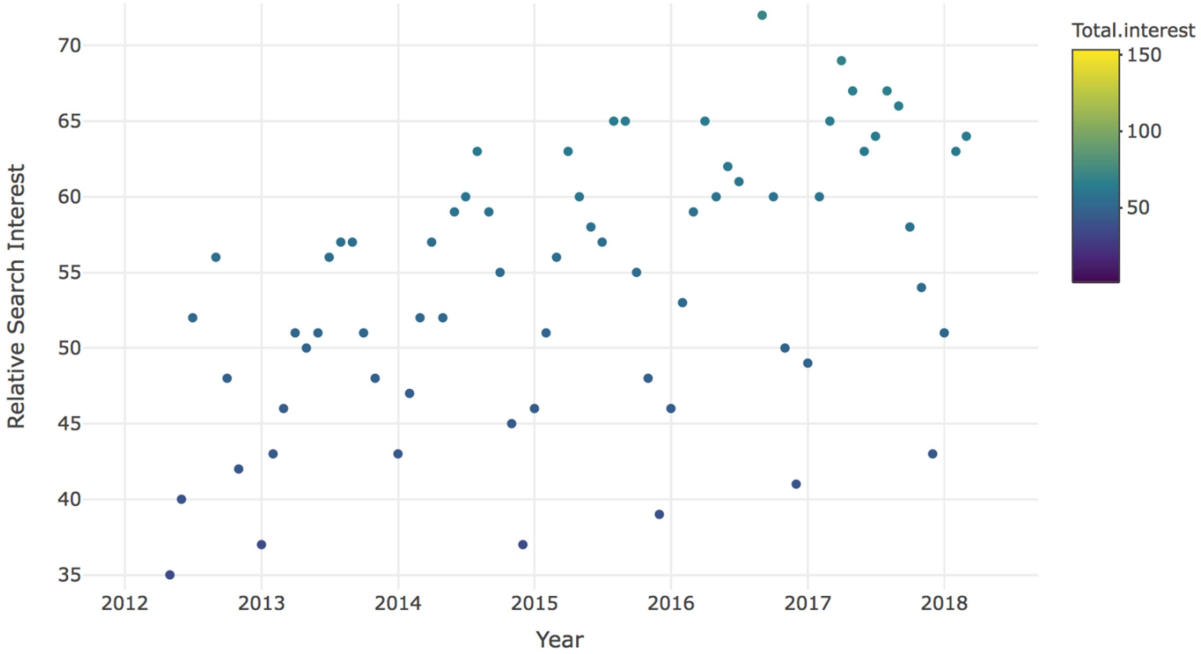

Figure 3. Relative search volume over time for public google searches since 2004 with range reduction. A cyclical oscillation with relative lows in search traffic towards the end of the year and a larger relative volume in the middle of the year

The number of citations and papers identified by Google Scholar using the phrases relating to kinesiology taping are shown in Figure 4. It can be seen that the number of articles referring to kinesiology tape has grown substantially in the past 10 years. It is notable that there has not been similar growth in the number of citations.

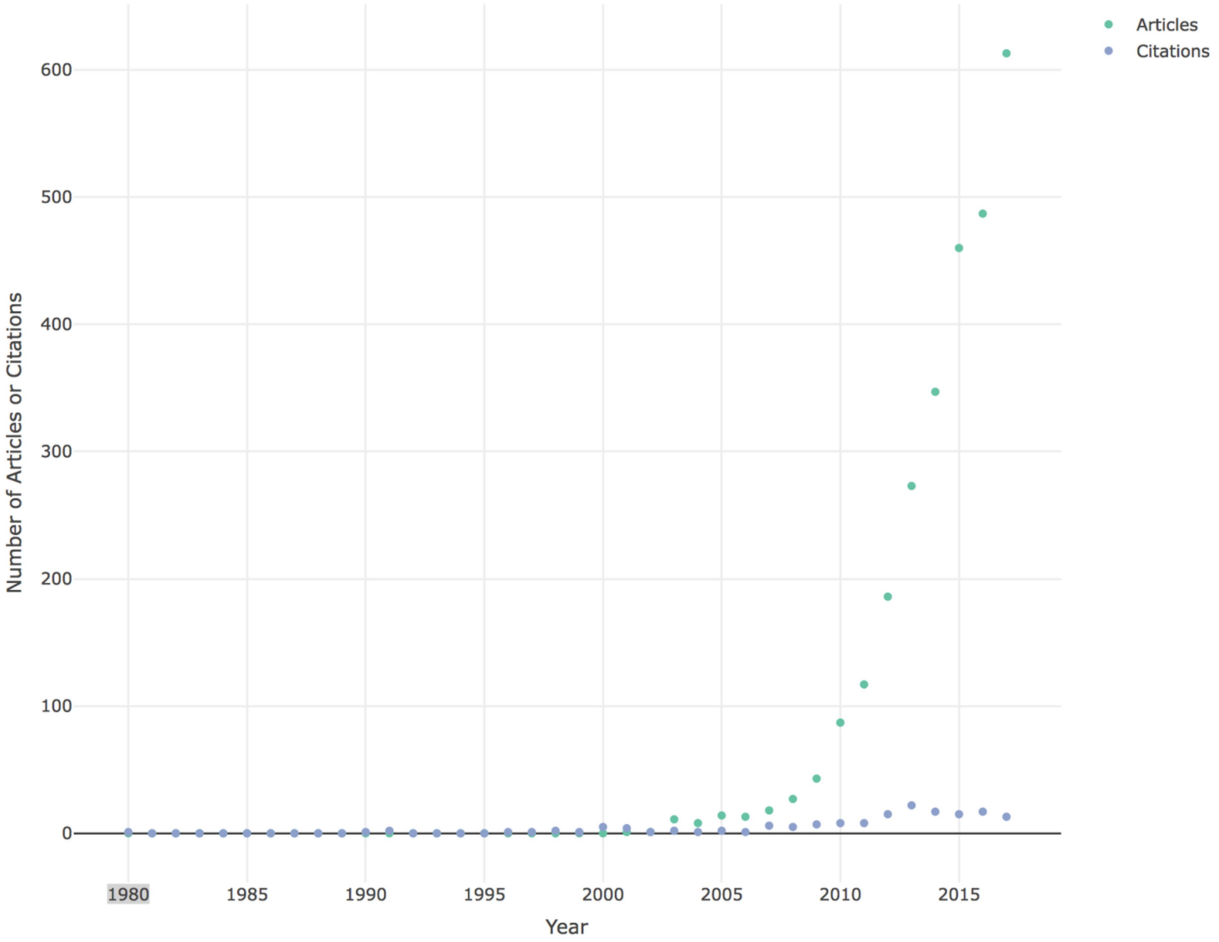

Figure 4. Number of articles containing the identified phrases relating to kinesiology tape published and accessible via Google Scholar since 1980 (teal). The number of citations of articles containing the identified phrases (as per identification via Google Scholar) are shown in grey.

The Davies' test revealed the presence of changes in slope ($p<0.0001$) for both the number of articles and number of citations. Although Davies' test indicates the presence of significant changes in slope, it was not considered as the appropriate option for estimating their position (breakpoints). Segmented regression estimated slope breakpoints for number of articles (2001, 2008, 2011) and citations (2005, 2011, 2013).

Discussion

The distribution of searches (Figure 1) is in general higher for English speaking countries and there is minimal search volume relative to total volume of searches for many countries such as China, Russia and most of Africa (with the exception of South Africa). This is unlikely to be related to other search engines being used and more likely due to a large volume of searches not being conducted in English. Whilst this lack of interest may be related to other terms being used for kinesiology tape based queries, it may also be due to kinesiology tape not yet developing in these markets. It is an interesting finding, though no underlying

mechanism is proposed for the high level of interest in kinesiology taping showed by Singapore as the country with the highest relative prevalence of the relevant search terms.

The August 2008, August 2012 and August 2016 peaks in Figure 2 interest coincided with the quadrennial Summer Olympics. It is likely that people watching athletes compete at the Olympics saw their use of kinesiology tape or were exposed to its use by the media covering the games and searched the phrases relative to find out more about kinesiology tape (or purchase it). The August 2016 peak coincided with the Rio Summer Olympics and Brazil was one of the countries with the highest traffic in South America. It was noted that the August 2012 peak coincided with the breakpoint identified via segmented regression. Although the other two Olympic peaks were not identified with segmented regression, they were clearly outliers via observation from the graph. The 2012 London Olympics breakpoint would imply that the London Olympics has influenced the ongoing popularity of kinesiology tape. Based on the increase in search trends during the Olympics, the cyclical pattern in Figure 3 with peaks each year between August and October may be due to other sporting events. As there is a clear pattern, it would be expected that there is an underlying construct causing this cyclical oscillation. Peaks in interest in kinesiology taping in the countries in Table 1 during Olympic and a yearly cycle (Figure 3), may be of interest to those selling or marketing kinesiology tape.

As can be expected the growth in the number of citations on kinesiology taping has dramatically grown in association with general interest in this topic. It is possible that some of this growth in research activity may be related to investigating unsubstantiated claims made relative to this product. It should be highlighted that the growth in citations has not matched the growth in publications on this topic. This may well be due to different capabilities of Google Scholar in terms of identifying publications as opposed to identifying citations. However, it should be noted that it could represent a deficit in research papers referencing other works on this topic. In this case this could contribute to the number of unsubstantiated claims and unanswered questions with regard to kinesiology taping. It should be considered that if each new paper making reference to kinesiology taping referenced at least one other paper on the topic of kinesiology taping, the number of citations should exceed the number of new publications in this field. It is unlikely that papers would not have at least one other associated reference on this topic, therefore it is most likely that this lack of citations is a limitation in the Google Scholar platform that most likely will improve over time. This analysis of citations can be revisited if changes to the process of identifying citations are made by Google Scholar.

The segmented regression indicated a breakpoint at 2013 for the graph of the number of citations. This breakpoint is also visually apparent from observation of the graph (Figure 4). This breakpoint would indicate that the number of citations is in a downtrend as opposed to the uptrend in articles. Some explanation for this could be that papers are currently in press or will be written over the next few years citing these papers and thus the citation counts for these earlier works will increase. This however does not seem sufficient to accommodate this downtrend whilst article count is in a strong uptrend.

Conclusion

This analysis demonstrated considerable growth in public interest and scientific research on kinesiology taping. A portion of this growth may be attributed to exposure of kinesiology taping to spectators of the Olympic Games. With the growth of interest in kinesiology taping,

there has also been a growth in claims pertaining to the benefits of such taping. Whilst research has also developed in this field, many of these unsubstantiated claims still persist. The growth of scholarly citations relevant to kinesiology taping has not kept pace with the growth of publication of articles, however this difference may be an artifact of the methods used.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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