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Lessons Learned from Publicizing and Retracting an Erroneous Hypothesis on the Mumps, Measles, Rubella (MMR) Vaccination with Unethical Implications

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An article by Dr. Wakefield and colleagues in 1998 suggested negative gastrointestinal and behavioural effects of the mumps, measles, rubella (MMR) vaccine. This article rapidly gathered widespread media coverage and stirred one of the largest anti-vaccination movements in the history of humankind. It has affected the herd immunity of many vaccines including the coronavirus disease 2019 vaccination through anti-vaxx campaigns.¹ However, it fell into disrepute after several researchers brought the flaws in the paper's methodology to the fore which led to its eventual retraction 2010.² However, an unchecked, violent and wide dissemination of misinformation worldwide stood testimony of the perils of misinformation.

The paper was found to have wrongfully given credit to observations about the MMR vaccine without inclusion a control group of unvaccinated paediatric patients.³ Additionally, the authors claimed that autism is a consequence of intestinal inflammation but they investigated intestinal symptoms after, and not before, symptoms of autism in all eight cases. In addition to significant methodological flaws which seriously undermine the scientific validity of these observations, Dr. Wakefield's disregard to children in the study was another glaring concern.⁴ Blood samples for the study were collected from children at his son's birthday party, a serious unethical means of conduct. Allegedly Dr. Wakefield paid each child £5 and joked about it later, rendering this method of collection as unprofessional conduct in hopes of a financial gain.⁵ Moreover, the research was paid by lawyers representing parents that particularly sought to sue vaccine makers causing a significant bias. Consequent to wide circulation of the now maligned article on social media and among the academic community, many scientific papers attempted to draw up the association between autism and the MMR vaccine, although no viable links were made.⁶ Once publicized, the media seized the attention and created a large anti-vaccination community in fear of children developing autism.⁷ The published article in the *Lancet* had already gained significant attention before it could be discredited, and criticised for its authenticity and detrimental result.

Retracted articles are those that are pulled out from the sourced journal due to serious scientific misconduct, statistical errors, author and publisher oversights, and other reasons.⁸ The guidelines by the Committee on Publication Ethics state the following as ground for retraction: unreliability, redundancy, plagiarism, competing interests, and unethical

conduct.⁹ The total aim after retraction is to acquaint the public regarding the falsification or unintentional error in the article and to increase awareness in lapses during review.¹⁰ The retracted article in discussion most definitely played a major role in the anti-vaccination campaign but the additional media advertisement by Dr. Wakefield himself transcended the public health concern even further. After retraction of the article in 2010, the MMR-autism falsehood made headlines in 2016 with the release of *Vaxxed*, a movie Dr. Wakefield directed that alleges a cover-up by the Centers for Disease Control and Prevention (CDC).¹¹ The story features bioengineer Brian Hooker, who challenged a 2004 CDC study and decided to reanalyze the data. In 2014, Hooker claimed CDC had hidden evidence that the vaccine could increase autism risk in colored males. CDC particularly noted in their paper that rates of vaccination in the oldest age group were slightly higher in kids with autism. But CDC backed it up saying that this effect was “most likely a result of immunization requirements for preschool special education program attendance in children with autism.” The movie caused an out roar amongst parents and forced researchers to reinvestigate. Majority of reports found no correlation that MMR causes autism leaving Dr. Wakefield’s research weak yet again. Healthcare communities and research professionals condemned the article false and a danger to society as a multitude of families refused to fulfil the vaccination agenda for MMR.¹² Many other vaccines were also condemned for supposedly causing autism in children resulting in a disruption in the mandatory immunization program in the subsequent years.^{13,14} The problem was so severe that healthcare providers were advised to conduct a full education session with patients and online courses were also created to eliminate doubts and myths.

As of February 24, 2021, the retracted article had been cited a total of 1,588 times by Scopus-indexed documents (Fig. 1). Even after 11 years of retraction, the article still manages to be cited by more than 50 citations per year. Of 1,588 citing documents, 107 had been cited at least 107 times (h-index of the retracted article = 107). That would double the total exposure of the retracted article by the use of secondary citations. The initial citation activity gradually increased from 13 in 1998, to 99 in 2013, but slightly picked up again in 2018. The number of citations was high even after the article retraction in 2010. Overall, the top 5 sources of the citations to the retracted article are *Vaccine* (n = 55), *Pediatrics* (n = 23), *Lancet* (n = 17), *Archives of Disease in Childhood* (n = 15), and *Expert Review of Vaccines* (n = 14). One of the major sources was a 2014 meta-analysis in *Vaccine* that examined studies involving a total of almost 1.3 million people. The study rebuked all the false claims made by Dr. Wakefield in his article

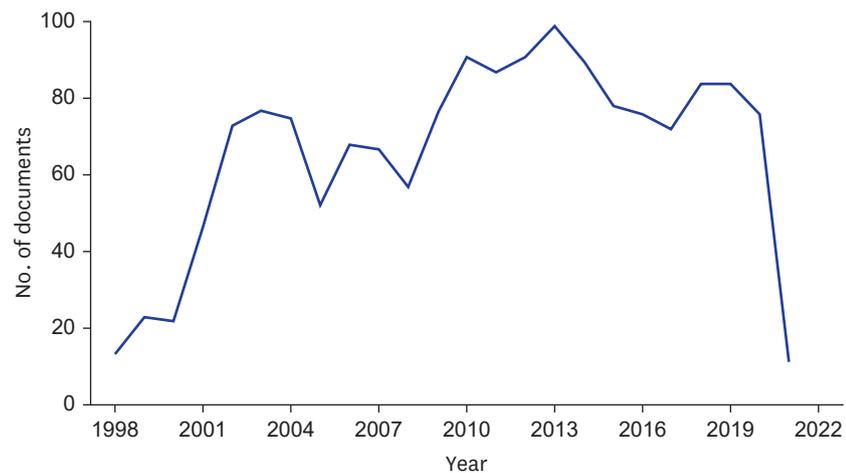


Fig. 1. Number of Scopus-indexed documents citing the retracted Lancet article in 1998–2021 (as of February 24, 2021).

and movie in order to silence the rumours for good. However, the social media presence of Scopus-indexed journals remains mainly through Twitter (14.2%) and Facebook (7.1%).^{15,16} Twitter carries an exposure of millions with the mass media (BBC, CNN, etc.) leading the viral spread of news.¹⁷ This supports the outburst of anti-vaxxers after the release of Dr. Wakefield's movie as it made headlines in multiple news industries. Studies show a flourishing impact of social media in the circulation of journal released articles within the last decade and a predicted increase in the future as well. The media play a large role in disseminating misinformation before and after retraction of the paper.¹⁸ Some studies indicate it as the main culprit of developing the anti-vaccination group across social media.^{19,20} More than half of secondary publications that cite retracted articles are either accidental or careless citations rendering them inadequate.²¹⁻²³ Thus, the consistent number of citations of faulty research must be correlated to the social media publicity that sprung about debates, misinformed anti-vaccination campaigns, and wrongly cited secondary publications.

As different media sources, news articles, and research articles claimed to support or defy the MMR vaccine- autism correlation, the citations of the retracted article fluctuated. Retracted Watch declared the second most cited article after retraction as of December 2020, was that written by Dr. Wakefield about the MMR vaccine-autism correlation.²⁴ This is a major issue as the main purpose of retraction is to rebuke the article's research and findings. Cited articles also result in their own citations being used causing a chain of disputed information being spread. Since many citations were made after the retraction, this poses the question of whether these citations were used to rebuke the article or support its hypothesis. A detailed study on Dr. Wakefield's retracted work was done in November 2019, to assess the citation context.²⁵ The top 5 citing authors were Fombonne E (n = 15), Wakefield AJ (n = 13), DeStefano F (n = 11), Fischhoff B (n = 10), and Leask J (n = 10). The US was the leading country in terms of citation activity with 683 related articles, followed by the UK (n = 393), Canada (n = 94), Italy (n = 67), and Australia (n = 65). The largest proportion of citing documents are articles (n = 736, 46.3%), followed by reviews (n = 376, 23.7%), and book chapters (n = 142, 8.9%). The main subject areas of the citing documents are medicine (n = 1,088, 43.8%), social sciences (n = 210, 8.4%), and immunology and microbiology (n = 186, 17.5%). The cross sectional analysis of the 1,153 citations found that although most citations negated the findings of the retracted article, they did not mention the retracted status. The study concludes with a strong recommendation for improvements required from publishers, bibliographic databases, and citation management software to ensure that retracted articles are accurately documented in all citations. Two other different researches, focusing on two different retracted papers, proved that their analysis of post-retraction citations were higher in number than pre-retraction citations.^{21,22} Moreover, they state that majority of post-retraction citations fail to mention the retracted status. This evidence supports the argument that most post-retraction citations diffuse misinformation rather than rebuking it.

In conclusion, retracted articles are still as capable of spreading their fraudulent information due to the weak scrutiny by publishers and their reference evaluation. With the greatest example of Dr. Wakefield's viral anti-vaccination stunt, the anti-vaxxers have distorted the significant progress that has led to herd immunity of many diseases and continue to set hurdles for the current severe acute respiratory syndrome coronavirus-2 pandemic.^{26,27}

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