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Bad news: The influence of news coverage and Google searches on Gardasil adverse event reporting

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ABSTRACT

Background: Human papilloma virus vaccines are a safe and effective tool for reducing HPV infections that can cause cervical cancer. However, uptake of these vaccines has been suboptimal, with many people holding negative beliefs and misconceptions. Such beliefs have been linked with the experience of unpleasant side effects following medical treatment, and media coverage may heighten such concerns.

Methods: The present study sought to assess the influence of news coverage (number of news articles per month) on adverse event reporting in response to Gardasil vaccination in New Zealand over a 7.5-year period, and whether the influence of news coverage was mediated by internet search activity (Google search volumes). Multiple linear regression analyses and simple mediation analyses were used, controlling for year and number of vaccinations delivered.

Results: News coverage in the previous month, and Google search volumes in the same month, were significant predictors of adverse event reporting, after accounting for vaccination rates and year. Concurrent Google search volumes partially mediated the effect of prior news coverage.

Conclusion: The results suggest that some of the adverse events reported were not related to the vaccination itself, but to news coverage and internet search volumes, which may have contributed to public concerns about potentially unpleasant or harmful outcomes. These findings have implications for the importance of psychological and social factors in adverse event reporting, and the role of the news media in disseminating health information.

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The human papilloma virus (HPV) is responsible for causing virtually all cases of cervical cancer. In 2002, HPV was responsible for 5.2% of cancers worldwide [1]. In 2006, the first human papilloma virus (HPV) vaccine was licenced for use in young women [2]. Widely touted as the world's first 'anti-cancer vaccine', it was predicted that this ground-breaking medical treatment would prevent many cases of cervical cancer that are caused by HPV types 16 and 18 (approximately 70% of all cases). Because cervical cancer develops over a decade or more, it is too soon to assess the impact of vaccination on cervical cancer rates, but proxy outcomes are encouraging. For example, the introduction of HPV vaccinations has been linked to substantial reductions in both HPV infections [3,4] and pre-cancerous cervical lesions [5], and, since the Gardasil

vaccine was introduced in New Zealand, genital warts diagnoses have decreased significantly in vaccine-eligible women [6].

These successes are despite the fact that uptake of the vaccine has been poor [7], perhaps due to public concerns around both vaccine safety and encouraging risky sexual behaviour [8]. In New Zealand, responses to the vaccination were mixed. There was initial concern and outrage when the government announced that they would *not* provide funding to make the vaccine available to all young women in the country (e.g. Hill [9,12]). Following public pressure, the NZ government announced that Gardasil, the HPV vaccine produced by Merck, would be publicly funded and made available through GP clinics from September 2008, with vaccinations provided through school-based programmes starting in 2009 [10]. The vaccine was funded for 12- to 18-year old females [11]. However, this decision was not supported by all, and numerous media reports during this time highlighted concerns of groups like 'Family First' who took moral objection to the vaccine, claim-

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ing that it would promote promiscuity [12]. Media reports of adverse events associated with the HPV vaccination were published even before the vaccination was available in New Zealand.

Media reports about HPV vaccines often highlight adverse reactions following vaccination. This media attention to adverse events (AEs) has potentially important implications. Heightened concerns about the potential harms of medicines are associated with an increased risk of experiencing side effects [13–15], increased misattribution of unrelated symptoms as treatment side effects [16], and non-adherence to prescribed treatments [17]. Gardasil is a multi-dose vaccine – when introduced in New Zealand, the recommended immunisation schedule was three doses over a six-month period [11]. Negative perceptions of the vaccination, perhaps linked to news coverage, have the capacity to dissuade young women and their parents from either starting the course of vaccinations, or from getting all three doses, resulting in suboptimal protection from the human papilloma virus. One particularly ‘newsworthy’ episode occurred when young women in Melbourne, Australia, became ill after receiving the vaccination. No organic basis for these reported symptoms or link to the vaccine were identified. Instead, an outbreak of mass psychogenic illness (MPI) was suspected; symptoms were likely the result of heightened anxiety, negative expectations, and social contagion [18,19].

Episodes of MPI look, at first, much the same as illness caused by a pathogen or environmental toxin. Initially only one or a few individuals are unwell, and then illness spreads throughout an exposed group. In cases of MPI there is no identifiable toxin or pathogen [20]. Illness symptoms are instead caused by the perception of exposure to a hazardous agent, similar to the nocebo effect where the expectation of illness is sufficient to produce unpleasant symptoms in the absence of any toxic environmental or pharmaceutical agent [21–23]. MPI symptoms spread not through direct contact, but through social observation of other casualties [24], including via social media [25].

The fact that a potential hazard is deemed ‘media worthy’ can also amplify public perception of risk and heighten negative expectations [26]. Media reporting about vaccinations often has a disproportionate focus on negative health effects, with less consideration of the accuracy of this information, or the credibility of the source [27]. The most salient vaccine controversy of recent times has been the MMR vaccine, with misleading media coverage and scare stories inaccurately presenting the vaccine as risky [27–29], and diminishing public confidence [30]. Exposure to unbalanced media reporting about a possible vaccine-autism link reduces future vaccine intentions [31]. Media attention has also been linked with reduced MMR vaccination rates [32], and lower adherence to the second dose of the MMR vaccine [33]. Similarly, intense media coverage of influenza vaccine adverse events (likely MPI episodes) in Taiwan heightened public concerns and resulted in low levels of vaccine coverage [34], and news coverage of the HPV vaccine, in particular focusing on political controversy and gender, has been linked to lower vaccine uptake [35]. More broadly, negative media coverage about statin drugs has repeatedly been linked to higher rates of treatment discontinuation [36–38]. Greater exposure to health information through the mass media is associated with lower adherence to prescribed treatments, and less accurate beliefs about medical treatments [39].

A particularly salient piece of news coverage, or high rates of coverage over a limited time period, can also increase AE reporting and treatment discontinuation [36–38,40,41]. One previous study has assessed the role of media reporting and internet searches in AE reporting about HPV vaccination [41]. Results indicate that AE reporting increased after a short period of particularly high media coverage, and was mediated by internet searches. However, it is unclear whether fluctuations in news media coverage over a longer period also predicts AE reporting rates. The study by Eberth and

colleagues [41] was limited by a lack of data on the total number of vaccinations administered. It is possible that both media coverage and internet searches were prompted by the start of a vaccination programme or campaign, and that these findings can be explained by the vaccination rates themselves.

The current study uses population data from New Zealand. New Zealand presents an ideal environment for investigating the effects of media coverage on AE reporting: it is a physically isolated country with a relatively small population, a national healthcare system that funded only one HPV vaccine, and this vaccine was given primarily through school-based programmes. The Centre for Adverse Reactions Monitoring (CARM) makes anonymised AE data publicly available, and the New Zealand Ministry of Health provided data on the number of Gardasil vaccinations administered across New Zealand each month for the period under consideration.

The current study sought to investigate the impact of news coverage about the Gardasil vaccine (the only HPV vaccine available in New Zealand), and the volume of Gardasil-related Google searches, on adverse event reports made to CARM. It was predicted that increased media coverage, and increased Google search volumes in both the concurrent and previous month, would significantly predict the number of AE reports after controlling for the number of Gardasil vaccinations administered.

1. Methods

1.1. Data collection period

The period selected for analysis was from January 2009 to July 2016, when the school-based, publically-funded HPV Immunisation Programme began. At the time of data collection, AE reports were available only until the end of July 2016. This encompasses 91 months. The unit of measurement selected was per month – the smallest unit of measurement available for all outcomes.

1.2. Adverse event reporting

AE reporting data comprised all official reports made to CARM about the Gardasil vaccination. Reports can be made by anyone in New Zealand; most come from physicians, with fewer from patients, pharmacists, and pharmaceutical companies [42]. Data were retrieved from the Suspected Medicine Adverse Reaction Search (SMARS) database [43], and included information about the month and year of the report, patient age and gender, the suspected medicine, and reported symptoms. The number of AE reports made per month were calculated. Each report can contain multiple symptoms; the mean number of symptoms per AE report was 2.4, ranging from one to five symptoms.

1.3. Google search volumes

A Google Trends topic search for searches relating to Gardasil and originating from New Zealand provided Google search volume data. The search was conducted on November 16, 2016. Search volume data were downloaded from Google Trends, and are provided in numerical representations of search volume per month during the selected period. The month with the highest search volume has the numeric value of 100. A score of 50 indicates half the popularity of that search term compared to the month with peak search volume (from trends.google.com).

1.4. News coverage

Relevant newspaper articles were identified using a comprehensive search of the Factiva database on November 10, 2016. Data

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