

Measles, Mumps, and Rubella Vaccination and Autism:

Improbability of a Causal Link

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Autism, in any of its many forms, is a disease of the central nervous system (Volkmar and Pauls, 2003). Pediatric neurologist Isabelle Rapin (1997) explained that the overlap among these forms gives rise to a second name for the illness, Autism Spectrum Disorder (ASD). Rapin noted that children with ASD could exhibit a wide array of possible symptoms. The parent of an autistic child may observe common symptoms such as social deficits, unwarranted hostility or anxiety, issues with acquisition and comprehension of language, and impairment in the area of nonverbal communication (Rapin, 1997).

In the late 20th century, researchers noted a marked rise in cases of autism in the Western world (Kaye, Melero-Montes and Jick, 2001). Wing (1997) observed that the upsurge in the incidence of ASD temporally correlated with the introduction of vaccination against measles, mumps, and rubella, commonly known as the MMR vaccine. Wing then determined that a primary cause of concern about MMR vaccination safety was the timeline of vaccination in relationship to typical autism diagnoses, and specified that each of these events was likely to occur in a child's first three years of life. The parental apprehension toward MMR vaccination spiked after researchers presented findings in support of a hypothesis linking the MMR vaccine to the development of ASD in children (Wakefield et al., 1998). Numerous researchers have since set out to determine the viability of this concern and found evidence contrary to the conclusions drawn by Wakefield et al.

Study Methodologies

The investigations aimed to eliminate ambiguity on the topic at hand came from all over the world, and employed a range of differing methodologies. Four pertinent types of studies

include case-series, time-trend analysis, cohort, and case-control. It is useful to understand the differences between these methods, as this will aid in comprehension of the results of each study.

Case-Series Study

In a case-series study, researchers track subjects based upon known exposure to a specific medical treatment (Ankner, 2011). Researchers collect medical records of individuals diagnosed with a disorder and observe each case to determine the outcome of exposure to this treatment. For example, in a case-series study relating ASD and MMR vaccination, only information from children diagnosed with ASD would be included. Researchers would then determine the vaccination status of each case, to form a hypothesis relating the two areas of investigation.

Time-Trend Analysis

Ely, Dawson, Lemke and Rosenberg (1997) defined time-trend analysis as the examination of trends that occur over a period of elapsed time. By considering trends in relation to time, researchers may determine how distinct patterns relate to one another. Though researchers employ complex statistical approaches to arrive at numerical conclusions, understanding the intricacies of mathematical procedures is not necessary for comprehension of the results of time-trend analysis.

Cohort Study

In a cohort study, similarly to the case-series method, investigators examine patients to determine the outcome of exposure to a specific medical treatment. A cohort study, however, involves the data of an entire sample population, or cohort, classifying these subjects according to exposure. Researchers then track the cohort over a period of time, watching for the development of a disorder in both those who were exposed to the treatment in question, and those who were not (El-Masri, 2014). Masri indicated that a cohort study can be either

prospective or retrospective. Researchers who conduct prospective cohort studies analyze data from the present and future while retrospective analysis involves data from the past.

Case-Control Study

A case-control study is an investigation that begins with a known outcome and traces the history of cases and controls back to investigate exposures. Lewallen and Courtright (1998) defined cases as individuals diagnosed with a certain disorder, such as autism and controls as subjects without the disorder. Researchers study the frequency and incidence of past exposure to risk factors, such as MMR vaccination, in both groups. Researchers then compare sets of data via statistical analysis to determine the degree of difference between cases and controls.

Review of the Literature

The investigation of Wakefield et al. (1998) largely fueled the debate over health risks associated with the MMR vaccine. In the controversial case-series study, researchers followed the examination of 12 children referred to a pediatric gastroenterology unit. After extensive mental and physical testing at the clinic, eight of the children showed signs of developmental regression symptomatic of autism, which corresponded with receipt of the MMR vaccine. Wakefield et al. presented little concrete evidence that vaccination was causal in these cases, claiming that the vaccine caused adverse reaction due to a unique form of intestinal inflammation. Despite the absence of compelling scientific evidence, Wakefield et al. elevated suspicion concerning the safety of MMR vaccination.

In response to this unease, Taylor et al. (1999) conducted a case-series study on children with autism in the United Kingdom. Taylor et al. aimed to find evidence for a link between MMR vaccine introduction in 1988 and the trend in frequency or age at the time of diagnosis. The researchers gathered information from special school records and disability registers, in

conjunction with medical and immunizations records, from eight UK health districts. While Taylor et al. noted an upward trend in cases by birth year, no abrupt rise occurred upon the introduction of the MMR vaccine in 1988. Researchers found no evidence of clustering for developmental regression in the months following vaccination, nor for the age at which parents began to notice abnormalities in development (Taylor et al. 1999). The data contained one anomalous figure, which researchers attributed to inaccurate recollection by the parent. Receipt of the MMR vaccine did not affect the overall trends in age, parental concern and incidence.

Taylor et al. drew conclusions under the assumption that the interval between MMR vaccination and diagnosis of autism need be short. Prior to the study, the researchers specified a maximum data collection period of six months. Due to the ambiguous nature of autism symptoms, the public demonstrated concern that negative health effects linked to MMR vaccination may occur over a wide, highly variable period.

Farrington, Miller and Taylor (2001) identified, and attempted to correct for, the flaw in Taylor et al. In a follow-up investigation, Farrington et al. operated without a fixed interval of time following vaccination, and re-examined the same sample pool gathered for Taylor et al. The risk period was extended to include any time after administration of the first dose of the MMR vaccine. The results showed that, regardless of the number of vaccine doses the children received, diagnoses were made from ages 24-48 months. Further, researchers found no significant rise in the incidence of autism in vaccinated children, as opposed to those who were not vaccinated.

Another source of apprehension regarding vaccination safety stems from the exponential growth of incidences of autism over time. Kaye et al. (2001) addressed this issue, conducting time-trend analysis on information from general practices in the UK, and observed a seven-fold

increase in the incidence of autism from 1988 to 1999. Frequency of MMR vaccination over the same interval rose until 1993, after which time vaccination coverage remained above 95% (Kaye et al., 2001, p. 460). Researchers concluded that the MMR vaccine was not causal in the growing incidence of autism in the UK, since the rate of autism diagnoses continued to rise after vaccination frequency leveled out.

Despite a steady dearth of support for the conclusion drawn by Wakefield et al. (1998), concern over vaccine safety persisted. In 2002, Madsen et al. published a nationwide, retrospective cohort study, including data collected from every birth in Denmark from January 1991 through December 1998 inclusive. Utilizing various Danish National agencies, Madsen et al. gathered information on MMR vaccination status, autism status and potential confounding factors of each child. Researchers performed one data analysis adjusted for age exclusively, and a second adjusted for a diverse range of factors. The variables considered in the latter analysis included sex; gestational age; birth weight; socioeconomic status; age at diagnosis; mother's education; age at, and calendar date of, vaccination; and time elapsed since vaccination.

Upon thorough examination of the data, Madsen et al. (2002) determined that there was no evidence of a causal association between MMR vaccination and the development of autism. In both the analysis adjusted for age and the fully adjusted analysis, the calculated risk of ASD diagnosis in vaccinated children was found to be similar in comparison to that of unvaccinated children. There was no clustering of autism diagnoses during or following heavy vaccination periods, indicating no correlation between the two events (Madsen et al., 2002).

While a majority of subsequent investigations took place in the years immediately following Wakefield et al. (1998), the first study of this nature in Asia took place over a decade later. Uno, Uchiyama, Kurosawa, Aleksic, and Ozaki (2012) looked for a link between ASD and

various general vaccinations—including the MMR vaccine—in the genetically homogenous Japanese population. For this case-control study, the cases were a designated group of individuals diagnosed with ASD. The controls were an assemblage of volunteers from schools around Japan, matched according to birth year and sex to cases (Uno et al., 2012). Uno et al. examined immunization history and prenatal, perinatal and neonatal factors of both groups. Upon analysis of the data, researchers found no significant differences between cases and controls concerning any factors under scrutiny.

Discussion and Conclusion

While the findings presented by Wakefield et al. (1998) lack subsequent support, the possibility that MMR vaccination negatively impacts a small percentage of the world's population still exists. Flaws in the methodologies of the reviewed literature leave room for this prospect, as researchers failed to eliminate reasonable doubt that such rarities exist. The case-series studies of Taylor et al. (1999) and Farrington et al. (2001), for example, dismissed an outlier in the data as an inaccuracy in parental memory. It is conceivable, however, that the large sample size concealed a rare case of direct association between receipt of the MMR vaccine and diagnosis of autism.

Further, while this study—in combination with Farrington et al. (2001)—presented substantial findings, both demonstrated a lack of control for variables. These studies neglected to include the data of children without autism as a control group, along with the disregarding of possible anomalies in the upbringing and personhood of a child. Neither study accounts for the chance that atypical conditions may have influenced a child's reaction to the MMR vaccine, thereby altering the risk factor for the development of autism. By failing to control for such factors, researchers left data analysis open to misinterpretation and inaccuracy.

Madsen et al. (2002) improved upon the ambiguity in both of these studies by controlling for a diverse range of variables, as well as excluding data dependent on parental recollection. Madsen et al., along with Kaye et al. (2001) and Uno et al. (2012), presented substantial evidence that no causal association exists between MMR vaccination and ASD. While the possibility remains that, in extremely rare cases, the opposite is true, there is no scientific justification for failure to vaccinate children against measles, mumps, and rubella. The vaccination has been so effective that, in the decade following the introduction of the MMR vaccine to the United States, “each of the three diseases was dramatically reduced to inconsequential or near inconsequential levels (Hilleman, 2011, p. 207).” The benefits of immunization against measles, mumps, and rubella outweigh the minute possibility that vaccination will induce the development of Autism Spectrum Disorder. However, if the MMR vaccine was not the cause of the spike in autism diagnoses in the late 20th century, further research is warranted.

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Reflection

ENGL105 Writer's Portfolio

5 August 2015

A Critical Reflection: Literature Review

My interest in the subject of MMR vaccination was brought on by its prevalence in modern political debate. The possibility that autism may develop as a result of vaccination perturbed me, and I decided to review the existing literature on the topic. With a background in scientific inquiry, I felt confident in reviewing research studies as a method of consolidating the findings of each investigation. I attempted to convey consideration for the audience, precision of language, and organization.

During the collection of articles for review, I resolved to create a text that would appeal to the general public, especially expectant and new parents. To simplify studies geared toward a scientifically inclined discourse community, I included brief explanations of common research methodologies. The inclusion of this section widened the potential audience. Additionally, to avoid loss of the reader's attention, I excluded complex discussion of statistical and mathematical procedures.

Throughout the composition of the literature review, I employed various rhetorical devices. For example, I used parallelism in the introduction of Farrington et al. (2001), the follow-up study to Taylor et al. (1999). By stating that researchers, "identified, and attempted to correct for, the flaw [...] (Tirendi, 5)," I asserted that both the identification and the correction of Taylor et al.'s mistake carried equal importance.

A second device employed throughout the review was tone. Though the paper was meant to present each study in an objective manner, the tone and organization of the piece lead naturally to my conclusion. I resolved that any danger involved in the vaccination of children was negligible in comparison to the reverse option. By arranging the studies in chronological

order, placing the study by Wakefield et al. (1998) first, the general tone of the paper reflected this resolve.

In addition to the chronological organization of the literature review, I included a deliberate appeal to logic. Readers are likely to notice the isolation of the singular finding in support of a causal link, juxtaposed with the plethora of corroborating findings that denied such a link. This contrast was meant reinforce to the audience that the idea that MMR vaccination causes autism was unfounded.

While I attempted to construct a strong paper, there is still room for improvement. The flow of each paragraph into the next was choppy in places since I attempted to avoid the of arbitrary transition words. Though I am familiar with APA formatting, I need further practice with creating natural movement between topics of discussion. Improvement in the area of syntax may have made the literature review more appealing to my intended audience.

In my review of the literature, I attempted to create a source of information for anxious new parents. Through the use of parallelism, organization, juxtaposition and appeals to logic, I presented relevant findings concerning the relationship between MMR vaccination and autism. At the conclusion of this assignment, I identified APA syntax as a necessary area of practice. I believe that, in the years of scientific writing ahead of me, my writing will grow and improve.

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