Running head: AUTISM AND VACCINES

# Autism and Vaccines: Where does the Evidence Stand?

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In the past 20 years, the prevalence of autism has on the surface increased dramatically. The Center for Disease Control (CDC, 2007) has reported that 1 in 150 children have a diagnosis of autism. This prevalence is controversial, however, since some experts question if more children are actually autistic or rather, if the diagnostic criteria for autism have expanded, encompassing more children (CDC; Taylor, 2006). Nonetheless, fervor has developed among many parents and certain health care professionals that this increase in prevalence may be associated with childhood vaccinations (Autism Research Institute [ARI], 2005). The following paper reviews current research to determine if any causal relationship has been found between autism and vaccines.

The CDC (2007) has defined autism as neurodevelopmental disorders marked by deficiencies in social and language skills combined with unusual interests and behaviors. Autism is thought to exist on a spectrum with some children reasonably functional and others strikingly disabled. At one time autism was considered a purely psychiatric disorder; currently, a gene-environment interaction is thought to be associated with the development of autism. Some children with autism have associated medical diagnoses such as Fragile X and mitochondrial disorders. Developmental and communication regression is often sudden and is likely to develop before the age of 3 years. No tests are available to diagnose autism requiring physicians to base diagnosis on specific behaviors. (CDC, 2007)

Vaccines as a cause of autism was suggested as early as 1995 by the ARI (2002), a group comprised of parents and professionals whose self-reported mission is to “improve the methods of diagnosing, treating, and preventing autism” (ARI, 2008). The ARI’s (2002) concerns with vaccines have addressed two areas: vaccines containing the mercury-based preservative thimerosal and the Mumps, Measles, and Rubella (MMR) vaccine. However, research on both sides of the issues continues

to be unsatisfactory due to the reported poor quality of most studies (Dimecheli, Jefferson, Rivetti, & Price, 2008; Parker, Schwartz, Todd, & Pickering, 2004).

Thimerosal is an organomercurial compound composed of 50% mercury by weight in the form of ethylmercury that is bound to thiosalicylate, which functions as a preservative in vaccines (Baker, 2008). The apparent increase in autism diagnoses coincided with the burgeoning awareness of the dangers of environmental mercury in the 1990's and the increase in the number of vaccines children received (Baker). In turn, as parents grasped for reasons why autism was so prevalent, a comparison was made between methylmercury and ethylmercury. Although no evidence was produced indicating that thimerosal was dangerous, leading government agencies and the American Academy of Pediatrics (AAP) recommended removal of thimerosal from vaccines based on the Environmental Protection Agencies guidelines for methylmercury exposure safety limits (Baker). Despite thimerosal's progressive removal from vaccines (except the influenza vaccine) based on the recommendation of the Federal Drug Administration, the CDC, the AAP, and the National Institute of Health, among others, autism rates have not decreased (CDC, 2007; Schechter & Grether, 2008).

Heron and Golding (2004) conducted a longitudinal study in the United Kingdom on a large sample of children (N = 12, 956) with most (n = 12,810) receiving three doses of immunizations and the rest (n = 146) receiving zero to two doses of immunizations at two, four, and six months of age. The results were adjusted for confounders such as birth weight, gender, gestation, and breastfeeding. The researchers found an interesting relationship between receiving thimerosal containing vaccines and beneficial behaviors including motor development, speech, and activity levels that persisted even after the results were adjusted. They reported that only one in 69 resulted in developmental problems consisted with their hypothesis while eight in 69 demonstrated beneficial developmental effects.

A study by Thompson et al. (2007) replicated similar beneficial outcomes of thimerosal containing vaccines in a study of 1047 children. The researchers conducted a cohort study where they administered a battery of 42 neuropsychological tests to children age seven to 10 years. They reported that increased mercury exposure from immunizations obtained in the first seven months of life was linked to better outcomes on some measures of fine motor coordination, attention, and executive functioning. They found no causal relationship between thimerosal containing vaccines and neuropsychological dysfunction.

Geier and Geier (2006) conducted an ecological study of the Vaccine Adverse Event Reporting System (VAERS) from 1991 to 2004 to determine if there were any changes in the number of neurodevelopmental disorders reported, including autism, since the removal of thimerosal from vaccines. The researchers concluded that there was a significant downward trend observed in reported neurodevelopmental disorders. The researchers Geier and Geier (2008) repeated this study to assess if additional time passing resulted in any new diagnoses of neurodevelopmental disorders. They again concluded that thimerosal removal was correlated with a reduction in the number of neurodevelopmental disorders. Geier and Geier's report of decreased notifications of neurodevelopmental disorders to VAERS contrasts with the CDC's (2007) account of possible increasing prevalence of autism.

A review of the literature conducted by Parker et al. (2004) found 12 studies that addressed the thimerosal-autism link, which met their inclusion criteria but varied in design and quality. Three of the studies reported previously were included in their review. Parker et al. criticized the studies conducted by Geier and Geier (2006; 2008) for their analytical approach, specifically the method of calculating prevalence. They also criticized Geier and Geier's for their implication that correlation implies causation. The third study analyzed by Parker et al. was conducted by Heron and Golding (2004). The

reviewers concluded that the study by Heron and Golding had both strengths and weaknesses, but that the researchers were transparent in the study's flaws.

The MMR vaccine has also been under suspicion as a candidate for causing autism. The Wakefield et al. (1998) controversial study implicated the MMR vaccine as a causative agent for viral encephalitis and gastrointestinal disorders such as Crohn's disease in children with neurodevelopmental disorders. The researchers suggested that an interaction could occur between viruses that affected a child's immune system leading to gastrointestinal inflammation and permeability, also known as leaky gut, and resulted in encephalitis manifested as autism spectrum disorders. The study came under scrutiny due to flawed methodology, small sample size, and failure to provide adequate evidence to support their claims. A number of the study's authors later partially retracted the results (Murch et al, 2004).

Libbey at al. (2007) investigated the role of the MMR and diphtheria toxoid vaccine n the development of autism based on the claims that these vaccines may cause an autoimmune response that might induce autism. The researchers measured antibody titers to the viruses in four groups: classic onset autistic children (n = 33), regressive onset autistic children (n = 26), a neuro-typical control group (n = 25), and children with Tourette's syndrome (n = 24). No significant difference was found between the four groups for Immunoglobulin (Ig)G or IgM.

A Cochrane review by Dimecheli et al. (2008) identified 139 studies relevant to the MMR-autism link but only 31 studies met their inclusion criteria. Dimecheli et al. stressed that those studies included in the review contained errors, biases, low internal and external validity, and selective reporting of results. Nonetheless, Dimecheli et al. concluded that no evidence exists that point to a relationship between the MMR vaccine and autism. They highly recommend more studies of better quality.

The National Academy of Sciences (NAS, 2004) executive summary on vaccine safety and autism has maintained that due to the devastating nature of autism, the link between autism and vaccines cannot be casually rejected. They concur that current research has been flawed in many areas, as was reported by the Cochrane review. The NAS has stressed that the significance of devastating nature of autism compels further research, however they do not believe further research is needed addressing the link between autism and vaccines. The NAS at this time does not recommend any changes to the current immunization schedule.

Unfortunately, a growing number of parents are responding out of fear, real or not, by not vaccinating their children (CDC, 2007). Outbreaks of diseases such as measles and pertussis have been observed in scattered communities. Smith, Kennedy, Wooten, Gus, and Pickering (2006) have reported that parents who choose to not immunize usually have fears about vaccines. These same parents generally have reported that they are not influenced by their health care practitioner. Conversely, parents who are likely to vaccinate have reported that they are influenced by their health care practitioner. This behooves practitioners to build relationships with patients and families to increase vaccination rates. Additionally, families have responded positively to practitioners who respect their concerns and are willing to provide vaccines on a flexible schedule, i.e. giving fewer vaccines at one visit or holding off on vaccinating if the child is ill (Smith et al.).

Whether or not autism is actually increasing in prevalence is not easily answered. A faction largely comprised of parents and health care professionals with autistic children question the safety of vaccines. Unfortunately, research to date has been overwhelmingly flawed and biased on both sides of the argument. The CDC and the NAS both encourage further research concerning autism but both agencies, as do most leading government agencies, reject the causal relationship of vaccines and autism. Before rejecting the link between autism and vaccines, evidence must be produced that expands on the

current state of knowledge. One would imagine, however, that if leading government agencies are rejecting the vaccine-autism link, that researchers may have a difficult time obtaining funding to conduct appropriate studies. The public health benefit of vaccines has been recognized for years, however, as the memory of infectious disease outbreaks fade and noise of adverse advents spreads, parents are questioning the wisdom of vaccines. Health care providers are in position to help parents make sense of the information being put forth and to make decisions that are best for the child and for society.

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