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Scientific support for restricting non-medical vaccination exemptions in New York State

This report summarizes psychological and neuroscientific evidence from over 20 peer-reviewed studies.
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In New York State, school officials, rather than medical doctors, arbitrate the validity of religious requests for vaccine exemptions. Proposals to allow for "philosophical" exemptions would make it even easier to exempt one's child from vaccination, merely requiring a written request to the school.

Easy access to non-medical vaccination exemptions (including religious and philosophical exemptions) puts communities at risk by decreasing the proportion of vaccinated children. Here, we review the importance of a high vaccination rate to achieving herd immunity, emphasize how easy access to non-medical vaccine exemptions facilitate costly preventable outbreaks, especially in New York State and outline how legislation can keep vaccination rates high with better public health outcomes.

1. Individual vaccinations help ensure the safety of the entire community. The goal of vaccination is two-fold: to provide immunity for the individual being vaccinated, and to prevent the spread of disease to others who may not be able to be vaccinated themselves.

- **Vaccines provide safe, long-lasting protection against diseases by strengthening the immune system's response.** Exposure to viruses or bacteria through a vaccine triggers the immune system to respond to prevent infection. It is a common misconception that vaccination involves risky exposure to pathogens: the pathogens in vaccines have already been weakened substantially. Further, some avoid vaccination due to fears that vaccines cause autism. On consensus of the scientific community, the link between vaccines and autism has been investigated and thoroughly refuted.[1–3] Only a select few individuals should avoid vaccination for medical reasons, such as people with weakened immune systems and pregnant women. The CDC provides detailed information on possible allergies and reasons for medical exemptions for all vaccines currently in use.[4]

- **A community can achieve immunity to a disease if a sufficient proportion of the population is properly vaccinated.** An outbreak is a higher-than-expected occurrence of disease.[5] The most effective way to prevent an outbreak in a community is through herd immunity. Herd immunity offers indirect protection to unvaccinated or non-immune individuals by disrupting the chain of infection. When most individuals are immune to infection, the spread of disease is slowed or stopped altogether (see Supplementary for more information).

- **The greater the proportion of immune individuals, the smaller the chance for any one person to become infected.** The herd immunity threshold is the proportion of individuals in a population that need to be vaccinated to prevent the spread of disease,[6] this threshold is different for each disease. For instance, to eradicate smallpox, around 80 % percent of the population must be immunized, compared to 90-95 % for measles.[7] (see Supplementary for more information)

- **Herd immunity protects vulnerable people.** To protect the elderly, immunocompromised, very young, and those who are vaccinated but not immune, a population must maintain vaccination rates above the herd immunity threshold, achieving immunity at the population level.[8] Easy access to non-medical exemptions decreases the proportion of vaccinated individuals which causes the population to lose its herd immunity, allowing outbreaks to occur and putting vulnerable populations at risk.

2. Ease of access to religious and philosophical vaccine exemptions decreases vaccination rates and threatens residents of New York State. Currently, in order to enroll their children in public school or kindergarten, parents in New York State have to present evidence for several immunizations.[a] Medical exemptions are given if a doctor believes an individual would have an adverse reaction to the vaccine. In contrast, religious exemptions are afforded by school officials at the request of a parent or guardian of the child. Currently in NYS, a letter from a religious leader must accompany a religious exemption request,[9] leaving school officials in the problematic position of having to arbitrate the validity of religious exemption requests. Proposals to allow for "philosophical" exemptions would make it even easier to exempt one's child from vaccination, with a simple written request to the school.

- **Vaccine exemptions are rising.** Religious exemptions have increased in both public and private schools in NYS from 2000-2012.[10,11] In NYS, private schools tend to have

[a]Vaccine requirements for NY public schools: tetanus, pertussis (whooping cough), polio, measles, mumps, rubella, hepatitis B, chickenpox, diphtheria, meningococcal conjugate, haemophilus influenzae type b conjugate, and pneumococcal conjugate (NYSIR)

more medical and religious exemptions compared to public schools.[11] This increasing trend in non-medical vaccine exemptions could have detrimental effects on the health of the population.

- **Rising exemption rates may lead to outbreaks of preventable disease**.[12–14] During the 2008-2015 measles outbreaks, substantial proportions of unvaccinated individuals had non-medical exemptions (Figure 1, dark red). Increases in the ease-of-access to non-medical exemptions are associated to decreases in immunization rates, which lead to decreased herd immunity and more disease outbreaks.[14–18] Within counties in New York State, religious exemptions have had an adverse effect in recent years: counties with high exemption rates ($\geq$1%) experienced higher pertussis rates (whooping cough) than counties with lower exemption rates, for both vaccinated and unvaccinated children.[10]

- **Past outbreaks in New York required extensive and costly interventions to treat and contain.** Though widespread vaccination eliminated measles from the US by the year 2000, unvaccinated people travelling to other parts of the world can still encounter the measles virus and get infected. In 2013, an adolescent who refused or intentionally delayed vaccination returned from London with a measles infection, causing an outbreak in an Orthodox Jewish community in Brooklyn, New York.[19]

  The disease burden of the 2013 measles outbreak was substantial for the 58 infected cases, with total direct costs to the Department of Health and Mental Hygiene of $394,448. It cost 10,054 personnel hours to respond and control the outbreak. Of 3,351 individuals who were in contact with the infected patients, only 2,214 (66%) of the exposed had evidence of immunity to measles.[19]

  The current outbreak of 182 cases of measles in NYS almost exclusively among members of the ultra-Orthodox Jewish community can be traced to travelers from Israel and Europe. Many schools in Rockland County had vaccination far below the state average of 92.5 percent. Even with rates as low as 60 percent, audits found that some schools were overreporting vaccination.[20]

- **Disease outbreaks spread more easily in dense communities.** New Yorkers are frequent travelers, and NYC has 239 million tourists each year, making imported vaccine-preventable diseases a major concern. More densely populated regions allow for infections to spread more easily and thus require higher rates of vaccination coverage to achieve the immunity of the community as a whole (see Part 1, herd immunity). Additionally, outbreaks are much more expensive to treat and contain compared to preventative measures.[21,22]

3. Case studies from other states

- **Easing access to exemption reduces immunization rates.** After Arkansas enacted legislation in 2003 allowing philosophical vaccine exemptions, total exemptions in the state increased by an average of 23.1% per year from 2003-2010; in the 2009-2010 school year, 72.4% of exemptions were philosophically grounded.[17] In a case-control study in Colorado, from 1996-2007, children with parents who had refused pertussis (whooping cough) vaccines were at an increased risk for pertussis compared to those whose parents accepted vaccines.[15] Specifically, 11% of pertussis cases in Colorado in this period were attributed to parents refusing the vaccine for their children. This gives a sense for the extent to which increased vaccine compliance could reduce the burden of disease.

- **Vaccination requirements increase immunization rates and decrease disease.** States where vaccines are mandatory tend to have higher vaccination rates than states without mandated vaccines. A 2004 study surveyed 950 adolescents from 23 states and found that Hepatitis B vaccination rates were 75% for states that mandated the vaccine for middle school entry vs. 39% for states that did not.[12] Furthermore, a cost savings of about $29 million was predicted from vaccination of the estimated 1.3 million eligible adolescents (costs associated with complications from hepatitis B infection as of 2004).[12] Another case study examined the effects of enacting strict measles vaccination laws for school children in 1975-1976 in six states.[13] Prior to the enforcement of this law, the measles incidence rate was similar across the country; one year later, the rate of measles incidence in these 6 states was reduced by half.[13]

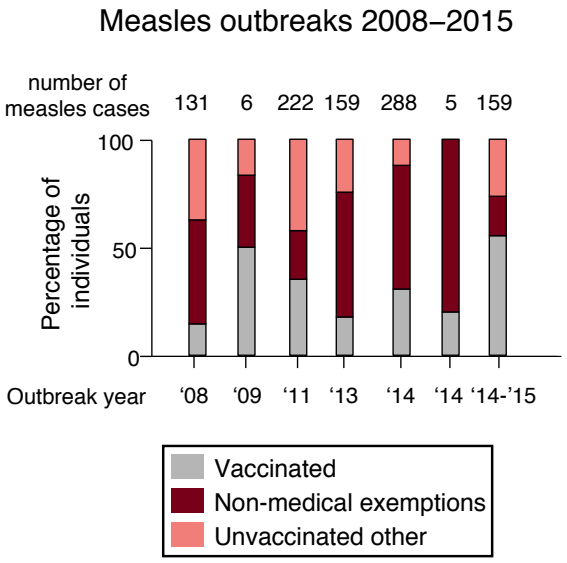

Figure 1: *Affected individuals during measles outbreaks from 2008-2015. Note that individuals with non-medical exemptions constitute a large percentage of affected individuals each year. Adapted from Table 1 in.*[18]

Conclusion. Legislation which increases the ease of access to religious exemptions, or which allows for philosophical exemptions, decreases immunization rates across New York State. This increases the risk of outbreaks of preventable diseases, putting children and the elderly at risk, and placing a significant financial and public health burden on the state. Epidemiological research supports restricting vaccination exemptions to medical exemptions only.

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