Mini review article

Central Eur J Paed 2017;13(1):42-45.
DOI 10.5457/p2005-114.168

MEASLES-MUMPS-RUBELLA (MMR) VACCINE – BENEFITS AND RISKS REVISITED

Mersiha MAHMIĆ-KAKNJO[1], Elma RUSTEMPAŠIĆ[2], Elida HADŽIĆ[3]

[1]Department of Clinical pharmacology Zenica Cantonal Hospital, Zenica, Bosnia and Herzegovina, [2]Paediatric Department of Primary Health Care Institution Bugojno Bugojno, Bosnia and Herzegovina
[3]Department of Medical Supplying Zenica Cantonal Hospital, Zenica Bosnia and Herzegovina

Correspondence:
mmahmickaknjo@gmail.com
Tel.: +387 32 209 811
Fax.: +387 32 226 576

Received: December 25, 2016
Accepted: February 7, 2017

Key words: Measles-Mumps-Rubella vaccine ▪ Autistic disorder ▪ Immunization.

The aim of this paper is to provide a concise, evidence-based mini review of the benefits and risks of the Measles-Mumps-Rubella (MMR) vaccine. Measles, mumps and rubella are highly contagious diseases that can cause serious illness, disability and death. Wakefield's fraudulent research, published in 1999, was retracted shortly after being published, but continues to fuel public distrust towards vaccination. A Cochrane systematic review, published in 2012, denied any causal relationship between MMR and autism, asthma, leukaemia, hay fever, Type 1 diabetes, gait disturbance, Crohn's disease, demyelinating diseases, bacterial or viral infections. The serious side effects of MMR are extremely rare (less than 1 in million doses) and it is hard to distinguish if they are caused by the vaccination. The refusal of some parents to have their children vaccinated has resulted in major outbreaks of once forgotten diseases, such as whooping cough and measles. An unvaccinated child poses a threat not only to his/her own health but also to public health. There is an abundant body of strong evidence that the risks from side effects are negligible compared to the benefits of being vaccinated. Falsified research, although widely debunked, has resulted in unsubstantiated claims; and the global anti-vaccination paranoia has done much harm worldwide. **Conclusion** – It is essential to restore confidence by explaining and disseminating scientific evidence on both the benefits and risks of the MMR vaccine, primarily to physicians who distribute vaccines, as well as to the parents of children who are to be immunized.

Introduction

If you were a baby born in the United States in 1900, you would stand 1:10 chance of dying before your first birthday (1), often due to infectious diseases. Meanwhile, the chances of dying at such a young age have decreased to 3:500 (2), and the expected life span has increased by 30 years of which 25 years may be attributed to advances in health care, immunization being a primary factor (3). Some diseases, such as polio, have been eradicated due to efficacious immunization (in the United States for example) (4).

Ironically, vaccines have become the victim of their own success, since eradication of these diseases has diminished the public's memory of them, which prevents the general public from understanding the burden of what were once fatal diseases. A major myth arose in 1998 when Andrew Wakefield published a study in The Lancet linking the Measles-Mumps-Rubella vaccine with autism. Proven to be fabricated, it was retracted (5,

6), but it still continues to cause damage to public health, since one quarter of American parents believe that vaccines cause autism (7). The activities of the anti-vaccination movement have resulted in several outbreaks of otherwise forgotten diseases, such as measles (8, 9), mumps (10) and whooping cough, leading to the worst epidemics of whooping cough in the last 70 years (11-14).

The efficacy and characteristics of MMR

MMR consists of three attenuated viruses, combined together in order to minimize the trauma of receiving the vaccine. It is at least 95% effective in the prevention of clinically evident measles and 92% effective in the prevention of secondary spread in the household (15). Children should receive 2 doses: the first dose at the age of 12-15 months, and the second dose at preschool age (16). The second dose is given in order to actively immunize 2–5% of people who do not develop immunity after the first dose; the second dose could be given earlier, at least 28 days after the first dose (16). The benefits in preventing illness, disability and death have been well documented; the measles component prevented 52 million cases, 5,200 deaths and 17,400 cases of mental retardation in the first 20 years of usage, in the USA alone (17).

The risks of vaccination – the side effects of the vaccines

There is practically no drug without side effects (18). Mild side effects of MMR vaccine include: fever (up to 1 person out of 6), mild rash (1 person out of 20), swelling of the glands in the cheeks or neck (1 person out of 75); moderate side effects include: febrile seizures (1 out of 3,000 doses), temporary arthritis – mostly in teenage or adult women (1 out of 4), temporary thrombocytopenia (1 out of 30,000 doses) (16). Serious side effects of MMR vaccine are extremely rare: serious allergic reactions (less than 1 in a million doses) and others are so rare that it is hard to distinguish if they are caused by the vaccination (deafness, long-term seizures, coma, lowered consciousness, permanent brain damage) (16).

Immediately after Wakefield's fraudulent study, another study was published in The Lancet in 1999 (19) totally denying any causal connection between MMR and autism: it described the steady increase in diagnosed cases of autism, which showed no peaks after the introduction of MMR. The most powerful evidence of all is found in systematic reviews (20). The Cochrane review is a more complete report than others (21, 22). The Cochrane systematic review, published in 2012, found that exposure to the MMR vaccine "was unlikely to be associated with autism, asthma, leukaemia, hay fever, Type 1 diabetes, gait disturbance, Crohn's disease, demyelinating diseases, bacterial or viral infections" (15). It presented a huge amount of evidence: 5 randomised controlled trials (RCTs), 1 controlled clinical trial (CCT), 27 cohort studies, 17 case-control studies, 5 time-series trials, 1 case cross-over trial, 2 ecological studies, 6 self-controlled case series studies, involving in all about 14,700,000 children (15). Another systematic review in 2014 (23) found strong evidence that the MMR vaccine is not associated with autism.

The risks of not being vaccinated

All three diseases have no specific treatment and can have serious complications (24). Measles continues to be one of the leading causes of death among young children (25), since it is a highly contagious disease; the virus can survive in the air and infected surfaces for up to 2 hours, which means that it can be widely spread without direct contact (26). It is estimated that immunization prevented more than 20 million deaths in children during the 2000-2015 period, which makes this

vaccine one of the most efficient health care interventions (25). An unvaccinated child is not only at risk of catching the disease; the more unvaccinated children there are, the weaker the herd immunity, and the greater the risks of contracting the disease and developing complications.

Conclusion

MMR is a safe, effective and inexpensive prevention mechanism for 3 viral diseases, measles being the most contagious and carrying the worst global burden and risks of complications. The benefits of being vaccinated are enormous and serious side effects are extremely rare. Parents trust their child's doctor more than government officials, family members, or celebrities, as the best source of information on vaccine safety (26, 27) and it is therefore crucial that practising physicians inform parents about the facts and dispel myths.

Authors' contributions: Conception and design: MMK; Acquisition, analysis and interpretation of data: MMK, EH; Drafting the article: MMK; Revising it critically for important intellectual content: MMK, ER; Approved final version of the manuscript: MMK, ER, EH.

Conflict of interest: The authors declare that they have no conflict of interest.

References

1. Stratton K, Ford A, Rusch E, Clayton AL. Adverse Effects of Vaccines: Evidence and causality [monograph on the Internet]. Washington (DC): National Academies Press; 2011 [cited 2016 Dec 25]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK190024/.
2. Centers for disease control and prevention [homepage on the Internet]. Reproductive health: Infant mortality [updated 2016 Sept 28; cited 2016 Dec 25]. Available from: https://www.cdc.gov/reproductivehealth/maternalinfanthealth/infantmortality.htm.
3. Centers for disease control and prevention [homepage on the Internet]. Ten great public health achievements-United states 1900-1999 [updated 2001 May 2; cited 2016 Dec 25]. Available from: http://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm.
4. Stratton K, Gable A, Shetty P, McCormick M. Immunization safety review: Measles-Mumps-Rubella vaccine and autism [monograph on the Internet]. Washington (DC): National Academies Press; 2001 [cited 2016 Dec 25]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK223375/#ddd0000063.
5. Horton R. A statement by the editors of The Lancet. Lancet. 2004;363:820-1.
6. Eggertson L. Lancet retracts 12-year-old article linking autism to MMR vaccines. CMAJ. 2010;182:E199-200.
7. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Parental vaccine safety concerns in 2009. Pediatrics. 2010;125:654-9.
8. Woudenberg T, van Binnendijk RS, Sanders EA, Wallinga J, de Melker HE, Ruijs WL, et al. Large measles epidemic in the Netherlands, May 2013 to March 2014: changing epidemiology. Euro Surveill. 2017;22. pii: 30443.
9. Hotez PJ. Texas and its measles epidemics. PLoS Medicine. 2016;13(10):e1002153.
10. Cui A, Zhu Z, Hu Y, Deng X, Sun Z, Zhang Y, et al. Mumps epidemiology and mumps virus genotypes circulating in mainland China during 2013-2015. PLoS One. 2017;12(1):e0169561.
11. Paradowska-Stankiewicz I, Rudowska J. Pertussis in Poland in 2014. Przegl Epidemiol. 2016;70(3):327-32.
12. Cardona D, Garzón MO, Calle M, Agudelo MC, Segura Á. Trends in pertussis mortality and morbidity in Colombia, 2002-2012. Biomedica. 2016;36:397-405.
13. Phadke VK, Bednarczyk RA, Salmon DA, Omer SB. Association between vaccine refusal and vaccine-preventable diseases in the United States: a review of measles and pertussis. JAMA. 2016;315:1149-58.
14. Damm O, Witte J, Wetzka S, Prosser C, Braun S, Welte R, et al. Epidemiology and economic burden of measles, mumps, pertussis, and varicella in Germany: a systematic review. Int J Public Health. 2016;61:847-60.

15. Demicheli V, Rivetti A, Debalini MG, Di Pietrantonj C. Vaccines for measles, mumps and rubella in children. Cochrane Database Syst Rev. 2012;2:CD004407.

16. Centers for disease control and prevention [homepage on the Internet]. Vaccine information statements (VISs) [updated 2012 Apr 20; cited 2016 Dec 25]. Available from: https://www.cdc.gov/vaccines/hcp/vis/vis-statements/mmr.html.

17. Bloch AB, Orenstein WA, Stetler HC, Wassilak SG, Amler RW, Bart KJ, et al. Health impact of measles vaccination in the United States. Pediatrics. 1985;76:524-32.

18. Terbeck S, Chesterman LP. Will there ever be a drug with no or negligible side effests? Evidence from neuroscience. Neuroethics. 2014;7:189.

19. Taylor B, Miller E, Farrington CP, Petropoulos MC, Favot-Mayaud I, Li J, et al. Autism and Measles, Mumps, and Rubella vaccine: no epidemiologicalevidence for a causal association. Lancet. 1999;353:2026-9.

20. Krleža-Jerić K, Gabelica M, Banzi R, Martinić MK, Pulido B, Mahmić-Kaknjo et al. IMPACT Observatory: tracking the evolution of clinical trial data sharing and research integrity. Biochem Med (Zagreb). 2016;26:308-17.

21. Moja LP, Telaro E, D'Amico R, Moschetti I, Coe L, Liberati A. Assessment of methodological quality of primary studies by systematic reviews: results of the metaquality cross sectional study. BMJ. 2005;330:1053.

22. Page MJ, Shamseer L, Altman DG, Tetzlaff J, Sampson M, Tricco AC, et al. Epidemiology and reporting characteristics of systematic reviews of biomedical research: a cross-sectional Study. PLoS Med. 2016;13:e1002028.

23. Maglione MA, Das L, Raaen L, Smith A, Chari R, Newberry S, et al. Safety of vaccines used for routine immunization of U.S. children: a systematic review. Pediatrics. 2014;134:325-37.

24. McCauley MM, Kennedy A, Basket M, Sheedy K. Exploring the choice to refuse or delay vaccines: a national survey of parents of 6- through 23-month-olds. Acad Pediatr. 2012;12:375-83.

25. White SJ, Boldt KL, Holditch SJ, Poland GA, Jacobson RM. Measles, mumps and rubeolla. Clin Obstet Gynecol. 2012;55:550-9.

26. World Health Organization [homepage on the Internet]. Measles [updated 2016 Nov; cited 2016 Dec 25]. Available from: http://www.who.int/mediacentre/factsheets/fs286/en/.

27. Freed GL, Clark SJ, Butchart AT, Singer DC, Davis MM. Sources and perceived credibility of vaccine-safety information for parents. Pediatrics. 2011;127:S107-S112.