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MICE TIMES

Preventing diseases and avoiding disasters

Polio, tuberculosis, measles, tetanus – if you want to protect yourself, you get vaccinated. Hundreds of millions of diseases are voiced each year in this way. And yet there is hardly any medical procedure that has come in for such criticism and become the object of such a veritable war of faith as vaccination. But vaccinations prevent the outbreak of dangerous diseases in individuals and epidemics in the wider population. Nevertheless, opponents of vaccination refuse to countenance an objective risk assessment and animal rights activists pillory animal experiments in the development of vaccines as well as the production of flu vaccines from hens' eggs.

At present, vaccinations are available for a great many infectious diseases of viral and bacterial origin. A vaccination serves to activate the immune system against specific substances. If you are vaccinated, this minimizes your personal risk of being affected by a particular disease. The more people in a population who are vaccinated against a particular disease, the less able the pathogen is to spread. In the best case, vaccination can result in a situation that specialists describe as herd immunity. Once a certain threshold vaccination rate in a population is reached, the pathogens are unable to multiply in sufficient numbers leading to a collapse of the pathogen population, so the disease can no longer circulate in the human population. And the immunity to a pathogen within a population that is generated by vaccination or acquired by infection is so widespread that non-immune individuals are also protected because the pathogen cannot spread. Herd immunity is particularly important for people who cannot be vaccinated – for example people with immune suppression (disorder of the immune system; organ transplantation) or newborns who are still too young to be vaccinated. In the best-case scenario, a disease can even be eradicated if the vaccination rate is sufficiently high, meaning that the pathogens will cease to be endemic. This is precisely what was achieved in the case of pox diseases as the result of a systematic, global vaccination and control programme, so the WHO was able to declare the world pox-free in 1980. The same has now almost been achieved globally for polio as well.

Vaccination fatigue

The vaccination rate – i.e. the proportion of the vaccinated population – that is needed to achieve herd immunity varies depending on the disease. Experts estimate that a vaccination rate of 92 to 94 percent is needed in the case of whooping cough, while 83 to 85 percent is sufficient for pox. Herd immunity largely frees the population from what can be serious diseases in some cases and eases the burden on healthcare systems accordingly. Vaccination fatigue therefore poses a risk for herd immunity in particular. Vaccination campaigns that do not achieve the necessary herd immunity may increase the frequency of disease complications among the non-vaccinated under certain circumstances. If too small a proportion of the population is vaccinated, this «only» reduces the likelihood of an infection in the non-vaccinated, instead of preventing an infection through herd immunity. This means that, if an infection occurs, then it often no longer does so in childhood, which is more dangerous in some diseases, such as mumps, rubella, polio and chicken pox. In the early 1990s, for example, Greece saw an increase in cases of rubella embryofetopathy after the vaccination rate fell below 50 percent throughout the 1980s.

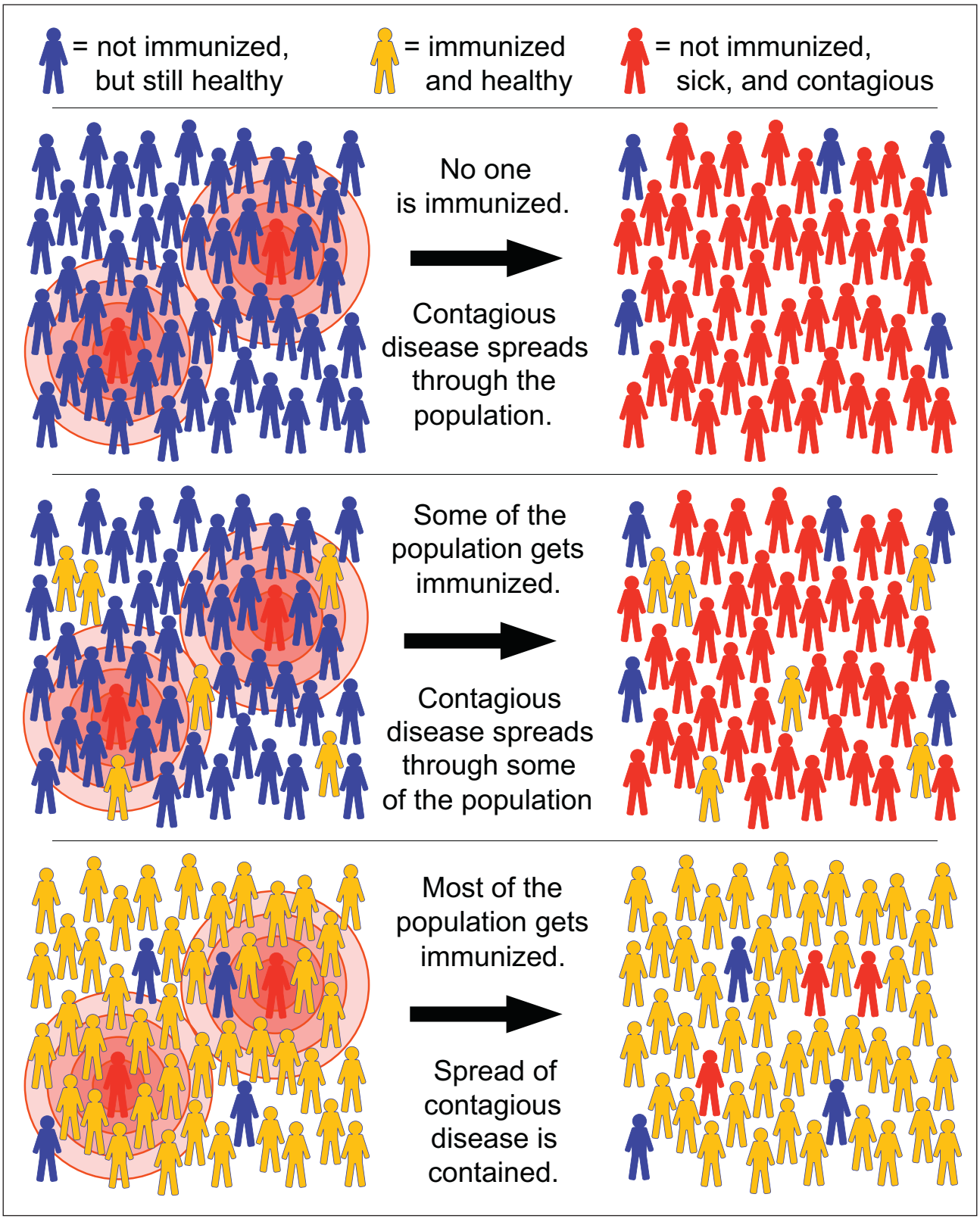

Fig. 1

Opponents of vaccination

While the availability of vaccines is frequently a problem in developing countries, the developed world is seeing an increase in the number of opponents to vaccination – people who are not prepared to get themselves and their children vaccinated. On countless websites, they denigrate vaccination campaigns and cast doubt on both individual and health policy benefits. Many arguments are put forward, but few are rational. As a rule, the main argument is the risk of vaccination, which opponents exaggerate from their subjective and social reality. As a medical intervention, vaccination is certainly not without risks, but opponents overestimate these risks and underestimate the benefits. This distorted perception of risks is reflected in a correspondingly low level of willingness to get vaccinated.

A further central component of the arguments used to criticize vaccination is the urge to get «back to na-

ture». The opponents of vaccination are susceptible in particular to the major fallacy that, if something is unnatural, then it must be wrong. This false conclusion is as old as vaccinations themselves.

Measles as bone of contention

It is difficult to distinguish between reliable and untrustworthy information when it comes to vaccination. Opponents of vaccination spread untrue stories, distorted facts and unproven associations on the internet and thereby influence vaccination behaviour. The issue of measles vaccination has been particularly fraught. Anyone who ready the falsely «exposed» rumour that the MMR vaccine against measles, mumps and rubella can cause autism will tend to hesitate getting his or her child vaccinated, although measles is one of the most common childhood diseases. The most dreaded complication of measles is subacute sclerosing panencephalitis (SSPE), in which the virus enters the brain and become active after five to seven years, causing encephalitis. The brain tissue is permanently damaged, and the patient consequently suffers retarded motor and mental development. There is no cure for SSPE. Experts warn against dismissing measles as a harmless childhood disease, because recent findings show that the risk of serious long-term consequences of an infection is much higher than assumed. While the risk for SSPE was previously put at between 10 000 and 100 000 per case of measles, today it is estimated to be 1700 to one.

One of the most persistent cases of disinformation is already more than 20 years old. It revolves around MMR vaccine and the gastroenterologist Andrew Wakefield. In 1998, the British doctor published a case study in the prestigious medical journal The Lancet involving 12 autistic children, who had been treated in the Royal Free Hospital in London from 1996 to 1997. In this study, he claimed that there was a correlation between the MMR vaccine, a disturbance of the intestinal flora and the development of autism. After the publication, the vaccination rate fell; many parents were afraid of exposing their child to this risk. Years later, Wakefield was revealed to be a lobbyist: at the time of the Lancet study, he had received £55 000 from third parties – namely from lawyers who had an interest in establishing a link between autism and the MMR vaccine. Wakefield was struck off the medical register. But the myth of vaccine-induced autism continues to wander around the world like a spectre. Parents are still letting their children grow up

Fig. 2

without a measles vaccine even today because of the falsified Wakefield study.

Animal rights activists as freeloaders

Animal rights activists have long since jumped aboard the bandwagon of the vaccine opponents. They point to the animal experiments conducted in the research and development of new vaccines, consequently enhancing the resistance to vaccination per se. The fact is that animals also have their own immune defence mechanisms, which differ from those of humans and can be a starting point for new vaccines. Added to which, animal models are indispensable in the case of vaccines as they are in the development of medicines. The arguments deployed by opponents of animal experiments are largely the same as those deployed to oppose vaccinations – amplified by a few special cases such as the cultivation of vaccine sera in hens' eggs, which for a long time was standard for the development of flu vaccines.

It needs to be made clear to animal rights activists that animal experiments have played a crucial role in almost all medical breakthroughs over the last decade. Almost every winner of Nobel Prize for Physiology or Medicine since 1901 has relied on data from animal experiments for their research. As Albert Sabin, developer of the polio vaccine, put it: «Without animal experiments, polio would still leave thousands of people dead every year.» And Professor Stefan Treue from the Primate Centre in Göttingen said in relation to Ebola: «Nonhuman primates play a small, but essential role not only in basic research, but also in applied biomedical research. The overwhelming majority of nonhuman primates are used for the development and testing of new medicines and vaccines. The current outbreak of Ebola demonstrates the life-saving importance of such research and controls.»

Hope thanks to research

Thanks to vaccinations, epidemics of suddenly emerging diseases can be curbed or even prevented. Not only do they help to avoid major burdens on healthcare systems, entire societies and national economies, but they also allow a vast number of individual lives to be saved. A new vaccine, for example, offers hope that the spread of dengue fever can be curbed. According to WHO figures, dengue fever is the mosquito-borne infection with the most rapidly growing incidence of disease. The worldwide incidence is estimated at 390 million cases a year, about a quarter of which require medical treatment with about 12 500 patients dying as a result of the infection. There is also hope that Zika virus, which is «related» to the dengue virus, can be overcome with a vaccine.

The importance of vaccines is illustrated in the case of malaria, where there is not yet any vaccine protection. This tropical disease is the scourge of almost the entire African continent and large areas of Asia from Turkey to Korea. A vaccination would come as a huge relief to billions of people in these regions.

Sources:

[1] https://en.wikipedia.org/wiki/Herd_immunity
[2] www.istock.com

It would be ideal if we could understand the complicated mechanisms of a body without stressful animal experiment. Unfortunately that is not yet possible today. But the dilemma will remain for a long time to come: basic research without experiments in animals would mean abandoning any medical progress. Mice Times aims to explain why and therefore reports on medical success stories that were only possible thanks to animal experiments.

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