Personalised vaccinology: implications for future influenza vaccines

Global Influenza Initiative

Personalised vaccinology describes an approach to vaccine design and development designed to achieve optimum vaccination outcomes in different populations.[1,2] It takes into consideration several factors that can lead to variation in response to vaccination, such as age, gender and race/ethnicity.[3–5]

The purpose of personalised medicine is: "to combine the ancient philosophy of treating patients individually with modern tools made available by the advent of big data, to improve the efficacy, safety and effectiveness of the therapeutic approach"[6]

Some key challenges to realising personalised vaccinology:[2,4,7,8]

Thinking and perception

- Accepting a new paradigm of thinking
- Changing from a population-based to an individualised approach
- Countering the perception that it is expensive

Data and technologies

- Larger genotype: phenotype data sets needed
- Explaining vaccine-induced protection in different population groups
- Studies confirming modified vaccines improve protection in different population groups
- Need for improved technologies

Key factors that lead to variation in response to vaccination:

- Gender-based differences[3]
- Age-based differences[4]
- HLA system polymorphism[4,7]
- Race/ethnicity[5]
- Immune response gene polymorphism[9,10]
- Previous vaccination or infection[4,11]

COVID-19 highlighted the need for a more personalized approach to medicine.

Some vaccines, such as influenza and pneumococcal vaccines, have already achieved some degree of personalisation. However, more must be done to fully integrate personalised approaches to vaccination.

"It is conceivable we can personalise vaccines for individuals based not only on their age but on gender, HLA type and immune response gene polymorphisms"

Raina MacIntyre, Guest Editor

Footnote: HLA, human leukocyte antigen

For further information on this topic see the November 2022 edition of InFluNews which can be found on the GII LinkedIn page.

References: 1. Bragazzi NL, et al. Vaccines Meet Big Data: State-of-the-Art and Future Prospects. From the Classical 3Is ("Isolate-Inactivate-Inject") Vaccinology 1.0 to Vaccinology 3.0, Vaccinomics, and Beyond: A Historical Overview. Front Public Health 2018;6:62; 2. Poland GA. The case for personalized vaccinology in the 21st century. Presentation 2017. Available at: poland_presentation.pdf (hhs.gov). Accessed November 2022; 3. Shapiro JR, et al. Roadmap for Sex-Responsive Influenza and COVID-19 Vaccine Research in Older Adults. Front Aging 2022;3:836642; 4. Poland GA, et al. Personalized vaccinology: A review. Vaccine 2018;36(36):5350-5357; 5. Kurupati R, et al Race-related differences in antibody responses to the inactivated influenza vaccine are linked to distinct pre-vaccination gene expression profiles in blood. Oncotarget 2016;7(39):62898-62911; 6. Teodori L, et al. Mass versus personalized medicine against COVID-19 in the "system sciences" era. 18 June 2022. Available at: Mass versus personalized medicine against COVID-19 in the "system sciences" era - Teodori - Cytometry Part A - Wiley Online Library. Accessed November 2022; 7. Poland GA, et al. Personalized vaccines: the emerging field of vaccinomics. Expert Opin Biol Ther 2008;8(11):1659-1667; 8. Gorezynski RM. Personalizing Vaccination for Infectious Disease in the 21st Century. J Vaccines Vaccin 2020; S5:005; 9. Petrie JG, Monto AS. Untangling the Effects of Prior Vaccination on Subsequent Influenza Vaccine Effectiveness. J Infect Dis 2017;215(6):841-843; 10. Kim SS, et al. Effects of Prior Season Vaccination on Current Season Vaccine Effectiveness in the United States Flu Vaccine Effectiveness Network, 2012-2013 Through 2017-2018. Clin Infect Dis 2021;73(3):497-505; 11. Fanos V, et al. OMICS technologies and personalized vaccination in the COVID-19 era. JPNIM 2022;11(1):e110114.