Novel technologies can successfully activate positive behaviors of stakeholders involved in vaccine purchasing and usage

Pierre A Morgon
MRGN Advisors, Switzerland

Abstract

The vaccine segment is anticipated to be one of the fastest growing one of the healthcare industry and several leading firms have stepped up vaccine investments in recent years. Unlike therapeutic agents, vaccines are administered to healthy individuals only once or very infrequently during a life time. Vaccines generate well-documented positive externalities, yet their poor awareness and acceptability among vaccine end-users may contribute to resurgence of transmissible diseases and consequently trigger governmental interventions such as mandating vaccination. In addition to technical and clinical development per the highest quality standards, bringing new vaccines to market requires carefully orchestrated programs targeting the multiple types of stakeholders along the entire value chain and addressing their respective purchasing behavioral drivers. Against a backdrop of anti-vaccination buzz and vaccine fatigue, successful global launch and sustainable usage of a vaccine requires the development of a multi-pronged strategy addressing all aspects in relation to acceptability (e.g. the motivation to immunize despite the quasidisappearance of the disease), accessibility (e.g. supply chain services), availability (e.g. mechanisms ensuring reliability of supply) and affordability (e.g. tiered pricing policy taking country differences in per capita income into account). Leveraging novel technological advances can positively influence the ability to activate these levers successfully. A vaccine is a biological preparation that provides active acquired immunity to a particular infectious disease. A vaccine typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins, or one of its surface proteins. The agent stimulates the body's immune system to recognize the agent as a threat, destroy it, and to further recognize and destroy any of the microorganisms associated with that agent that it may encounter in the future. Vaccines can be prophylactic (to prevent or ameliorate the effects of a future infection by a natural or "wild" pathogen), or therapeutic (to fight a disease that has already occurred, such as cancer).

The administration of vaccines is called vaccination. Vaccination is the most effective method of preventing infectious diseases; widespread immunity due to vaccination is largely responsible for the worldwide eradication of smallpox and the restriction of diseases such as polio, measles, and tetanus from much of the world. The effectiveness of vaccination has been widely studied and verified; for example, vaccines that have proven effective include the influenza vaccine, the HPV vaccine, and the chicken pox vaccine. The World Health Organization (WHO) reports that licensed vaccines are currently available for twenty-five different preventable infections. The terms vaccine and vaccination are derived from Variolae vaccinae (smallpox of the cow), the term devised by Edward Jenner (who both developed the concept of vaccines and created the first vaccine) to denote cowpox. He used the phrase in 1798 for the long title of his Inquiry into the Variolae vaccinae Known as the Cow Pox, in which he described the protective effect of cowpox against smallpox. In 1881, to honor Jenner, Louis Pasteur proposed that the terms should be extended to cover the new protective inoculations then being developed.

There is overwhelming scientific consensus that vaccines are a very safe and effective way to fight and eradicate infectious diseases. Limitations to their effectiveness, nevertheless, exist. Sometimes, protection fails because of vaccine-related failure such as failures in vaccine attenuation, vaccination regimes or administration or host-related failure due to host's immune system simply does not respond adequately or at all. Lack of response commonly results from genetics, immune status, age, health or nutritional status. It also might fail for genetic reasons if the host's immune system includes no strains of B cells that can generate antibodies suited to reacting effectively and binding to the antigens associated with the pathogen. Even if the host does develop antibodies, protection might not be adequate; immunity might develop too slowly to be effective in time, the antibodies might not disable the pathogen completely, or there might be multiple strains of the pathogen, not all of which are equally susceptible to the immune reaction. However, even a partial, late, or weak immunity, such as a one resulting from cross-immunity to a strain other than the target strain, may mitigate an infection, resulting in a lower mortality rate, lower morbidity, and faster recovery Emerging technologies are technologies whose development, practical applications, or both are still largely unrealized, such that they are figuratively emerging into prominence from a background of nonex-

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istence or obscurity. These technologies are new, such as various applications of biotechnology including gene therapy (which date to circa 1990 but even today have large undeveloped potential). Emerging technologies are often perceived as capable of changing the status quo. Emerging technologies are characterized by radical novelty (in application even if not in origins), relatively fast growth, coherence, prominent impact, and uncertainty and ambiguity. In other words, an emerging technology can be defined as "a radically novel and relatively fast growing technology characterised by a certain degree of coherence persisting over time and with the potential to exert a considerable impact on the socio-economic domain(s) which is observed in terms of the composition of actors, institutions and patterns of interactions among those, along with the associated knowledge production processes. Its most prominent impact, however, lies in the future and so in the emergence phase is still somewhat uncertain and ambiguous." Emerging technologies include a variety of technologies such as educational technology, information technology, nanotechnology, biotechnology, cognitive science, psychotechnology, robotics, and artificial intelligence. New technological fields may result from the technological convergence of different systems evolving towards similar goals. Convergence brings previously separate technologies such as voice (and telephony features), data (and productivity applications) and video together so that they share resources and interact with each other, creating new efficiencies. Emerging technologies are those technical innovations which represent progressive developments within a field for competitive advantage; converging technologies represent previously distinct fields which are in some way moving towards stronger inter-connection and similar goals. However, the opinion on the degree of the impact, status and economic viability of several emerging and converging technologies varies.

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