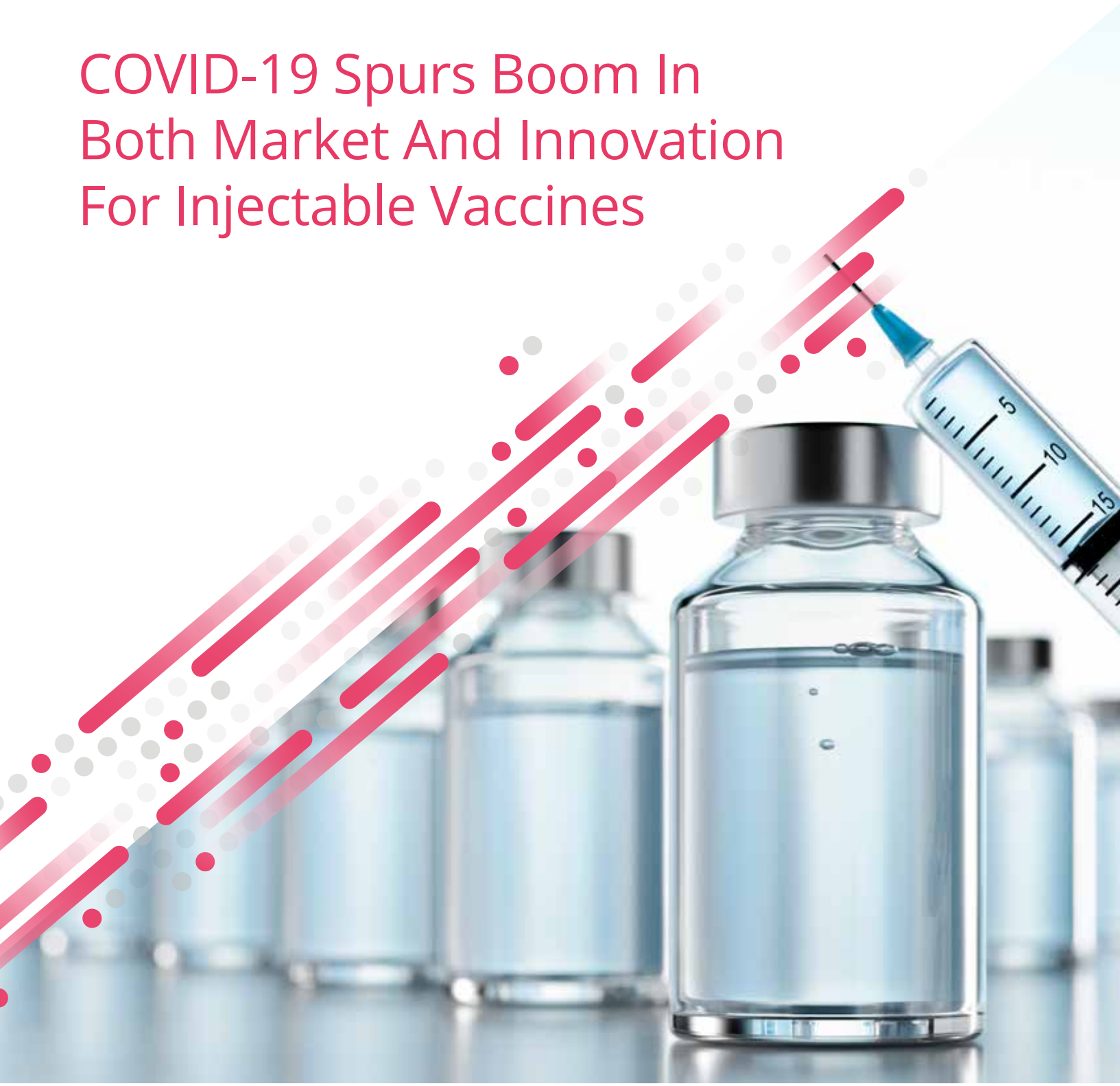
CITELINE

COVID-19 Spurs Boom In Both Market And Innovation For Injectable Vaccines



BROUGHT TO YOU BY IN VIVO

IN ASSOCIATION WITH West

COVID-19 Spurs Boom In Both Market And Innovation For Injectable Vaccines

The injectable vaccines market is very big – recent market reports estimate anywhere between $42 billion and $55 billion per year – and is growing rapidly, with compound annual growth rates projected at between 6.0% and 10.7% over the next five to ten years, depending on how the market is defined.[1-3] Much has changed recently, with first COVID-19 and then monkeypox driving rapid innovation in technology in a hitherto conservative market, substantial investment into pharmaceutical manufacturing, and a huge spike in volume demand as countries stockpiled vaccines. This has led to considerable challenges, but also opportunities, for companies in the supply chain.

Among them is West Pharmaceutical Services, the world's largest manufacturer of packaging components and delivery systems for injectable drugs and health care products. Based in the US, West has 50 sites worldwide, and manufactures around 47 billion components per year. Its systems are used, one way or another, in most of the top 50 biologic drugs. It has made considerable capital investments over the past 12 to 24 months to make its supply chain more robust and to support customers in addressing the pandemic.

"Resilience and robust supply chains are pretty integral to this kind of scaling the business - and also being very flexible to different demands," says Dr. Alex Lyness, Senior Manager, Research & Technology. "At times, components and containment can be an afterthought, and yet it's the components of the container systems that the drug is stored in before it gets to a patient. That drug is then either reconstituted or injected directly into the patient's body. It's therefore important that nothing comes out of the packaging that may alter

the drug and that the drug itself does not in turn alter the packaging in any material way ahead of delivery."

Victoria Morgan, Director of Marketing for Biologics, adds that the past ten years have seen a shift in the biologics pipeline, with more emerging companies taking their novel drug concept all the way to market, thanks in large part to fast-track approvals and access to venture capital funding. For suppliers like West this means more pharma companies who lack experience in bringing drugs to market and who are under pressure to condense the development cycle by using fast-track designations, resulting in a greater reliance on their experienced supplier network. Much of their later-stage development is now done post-approval, and they are under even more pressure to ensure their drugs are safe and efficacious.

"Anybody that brings a drug to market, especially if they use that fast-track designation, really should be proactively mapping out risk though their whole development process," Morgan says. "How do I minimize risk? How do I know which part of the development cycle poses most risk so that I can proactively manage that risk upfront?"

These companies also tend to lack the means to do all the work in-house and are much more reliant upon their suppliers. Thus, they will use experienced partners to help them plan their risk mitigation and rely heavily on these partners when, inevitably, problems occur.

Multiple Challenges

The COVID-19 pandemic brought both manufacturing and technical challenges. The sheer speed at which vaccines were developed and scaled affected West, along with many COVID-19 vaccines developers, because all these companies came to West for assistance, but it was impossible for all parties to know which vaccines would be most successful.

In response, the company established a global core working team whose function "was to understand the rapidly evolving market, balance customer demand and quickly build an infrastructure to support customers' requirements, all while servicing core business," says Morgan. "We quickly decided to invest in facility upgrades, equipment and personnel, which enabled us to support rapid scale up of vaccine development through to unprecedented demand for components. This decision to invest early on turned out to be a good one, as we played a pivotal role in the majority of COVID-19 vaccines development and commercialization programs."

> "The COVID-19 pandemic brought both manufacturing and technical challenges. "

One major technical challenge COVID-19 vaccines posed was the need for cold temperature containment and the related potential for extractable and leachable related particulates to be generated when vaccines are shipped at higher temperatures. The drug product can interact with the drug packaging, and there were instances of vaccines being rejected or pulled from the market because of particulates. Once West realized that the Phase I clinical trials

were promising, it drew on its experience in packaging for gene therapies to address the need to ship the vaccines at -80°C.

"There's now a lot more knowledge, not only about how vaccines work, but also how they can be stored and how safe they are over a certain amount of time," Lyness says. "Our research supporting those initial gene therapies customers to ship, typically on dry ice, came in very useful. We're now seeing those temperatures begin to move closer towards -40 or -20°C, and capable of being fridge-stable or even room temperature-stable for a month. We've learned a lot more and there are now other markets that will initially have cold chains that we have the data and products for."

"Injectables – or to be more precise, the intramuscular delivery of vaccines via 27-gauge needles – comprise by far the biggest part of the vaccines market"

New Routes Of Administration

Injectables – or to be more precise, the intramuscular delivery of vaccines via 27-gauge needles – comprise by far the biggest part of the vaccines market. This route of administration is a well-proven, well-scaled, cost-effective method, is generally well tolerated, and was utilised for the most widely dosed COVID-19 vaccines. However, there are alternative routes of administration in the injectable field that are growing in clinical evidence and interest to vaccine developers and by extension to their suppliers.

Lyness sees intradermal delivery, using microneedles for delivery to the upper layers of the skin, as particularly promising. It can remove the pain or perceived pain of injection as the microneedles penetrate less than 1 mm into skin. Studies done in the last ten years show that it can reduce the systemic side effects that can occur with vaccines.

As the skin is our first barrier against infection, it contains many antigen presenting cells, and therefore a smaller vaccine dose is needed to enable immunity versus injecting direct into muscle, an obvious advantage when vaccines are scarce or to reduce the costs per dose in countries where that is important. This was best evidenced during the height of the monkeypox pandemic in August 2022 when, faced with a shortage of supply in the US, the FDA issued an emergency use authorization for Jynneos® (Bavarian Nordic), which is normally administered subcutaneously as a 0.5 ml dose, to instead be delivered as a 0.1 ml intradermal injection.[4]

"This was an interesting development, as the FDA was acting on good data and quickly able to spread the existing vaccine supply," says Lyness, who envisages that there is much innovation to occur as regulatory agencies, pharmaceutical companies, and patients become more accustomed to recognizing the benefits of new routes of

administration. "In our core business, we have long seen there has been a trend to go from intravenous in hospital treatment and take those drugs to subcutaneous at-home delivery. So, for all that we now know of vaccines and immunology, there is no reason we could see a shift in vaccines from intramuscular to intradermal injection."

In 2022, West entered into a strategic relationship with Dublin-based start-up Latch Medical, whose hollow microneedle technologies enable a healthcare practitioner to deliver exactly the right dose intradermally at exactly the right depth.[5] Lyness concludes that "We hope that West can supply innovative devices that better enable governments, customers and patients to deliver vaccines safer, quicker, and more cost-effectively in the future".

Scalable Containment

The pandemic also reinforced an increasing trend towards fully integrated and scalable packaging solutions for vaccines. The pharmaceutical industry pipeline has become increasingly dominated by products originally developed by small biotechs or within universities. This is best evidenced by the COVID response where three of the major products supplied by Moderna, Pfizer-BioNTech, and AstraZeneca-University of Oxford can all trace the core of their technologies to academia.

Indeed, emerging biotechs accounted for two thirds of all new drugs in 2022, according to IQVIA.[6] These companies, Lyness said, are very innovative with regards to formulation and device platforms but can be naïve over packaging and what is required to scale up and ship their products on the way to approval.

At the most basic level, West offers the Ready Pack™ containment solution, via which customers can buy small quantities of glass vials, rubber stoppers, and seals, which are proven to work together to get into Phase I and II trials quickly, then scale with the same products to the point where they need to make millions of doses. "By offering a fully integrated, scalable solution, we can partner with some of those small companies. As they advance quickly through their clinical stages and/or they are bought by large companies, Ready Pack™ is compatible with their fill-finish process and ultimately how those drugs get to their patients as quickly as possible," Lyness says.

"The pandemic also reinforced an increasing trend towards fully integrated and scalable packaging solutions for vaccines."

Morgan highlights the NovaPure® plunger components among West's unique offers, because they are best-in-class, offer a tight particulate specification and offer the technical documents package to streamline customers' regulatory applications. Another is FluroTec™, a widely proven ETFE film which acts as a barrier reducing movement of drug product into the elastomeric stopper and movement of leachables into the drug product thereby reducing the potential for contaminants which may impact drug efficacy and safety.

Regulatory Matters

Among the key emerging regulatory challenges for bringing biologics and vaccines to market is the EU Medical Device Regulation (MDR) 2017/745/EU for combination products, which was updated with EU MDR 2023/607. The MDR is a binding regulation which builds upon the Medical Device Directive (MDD) This update extends the transition period for certain devices, including prefilled syringes, to end 2028, during which time drug developers can transition. Thereafter all integral combination product EU drug applications must be MDR-compliant. The MDR puts a greater expectation on the drug developer for quality management and a more extensive level of documented proof around quality.

"MDR puts a greater expectation on the drug developer for quality management and a more extensive level of documented proof around quality."

"That's time-consuming and confusing for the customer if they've never been through the process before and they don't understand what they need for each component," Morgan says. West will be required to provide more information to customers to support their filing and has been working through it proactively, creating new customer-facing materials, to ease the burden on the drug developer. It began by pulling together a customer-specific technical documents package for the NovaPure® 1-3 ml plunger, which includes all 30 of the required documents.

Another new item is EU GMP Annex 1, which is quite similar in its holistic approach of putting the emphasis on drug developers to have a strong contamination control strategy and focus on risk management. The FDA is also focused on particulates, with USP <382> slated to become official on December 1, 2025. This moves away from testing elastomeric components individually and moves towards a holistic evaluation of these components when assembled into drug product packaging and delivery systems.

Outlook

Following on from the advances made in vaccines formulation, the realisation of mRNA-based platforms, the incredible efficacy and ability to synthesize and manufacture these at scale, Lyness reflects on what innovations have occurred in the containment and delivery of future vaccines and what is yet to still be achieved in two key areas.

"In containment, there is now a push to remove or reduce reliance on the cold chain via using advanced process technologies, such as lyophilization. Can we get to the point where those therapies can be stored at room temperature as a powder, then reconstituted and delivered? That would see us being able to get mRNA vaccines – with their incredible efficacy and the speed of development we are now used to - into lower- to middle-income countries. Making it easier to access drugs in these territories would greatly help control mitigate outbreaks of diseases in the future."

When it comes to delivery, he says, "I want to see that same level of innovation can be applied to the delivery of the drugs. Can we deliver things in a better way next time round in a pandemic? This leads us back towards talking about intradermal delivery, via which we give patients the same amount of immunity in across population with less vaccine. This is vital when supplies are scarce, and manufacturing, cold-chain shipping and storage costs are prohibitive for some markets.

"We have all seen the impact of getting as many people as possible to get vaccinated and boosted against variants, and what this means for public health. Any new technology that can allow a further percentage of patients to have a choice and remove their vaccine hesitancy through either eliminating the needle or the possibility of a systemic adverse event, such as fatigue or myalgia, the following day is important. This will be on the mind of public health officials as they look to keep their citizens and key workers safe and productive without any lost days of work following a vaccination."

COVID-19 has shown what can be done with mRNA-based platforms, as well as paving the way for new viral vector and DNA-based approaches to drug delivery. "Now that we can all see the clinical efficacy and safety for pandemic response, there is the potential for these vaccine technologies to meet their true potential in cancer, HIV and other applications. These vaccines will be a game changer for the field and the progress made in the next five to ten years will be thanks to the huge scientific progress not only just to the past few decades, but in particular forged in the past three years."

West has a long history – the company is currently celebrating its centenary with 100 years in business this year. Lyness looks to the future by stating he is "proud with the role West plays and our responsibilities in supporting vaccine manufacturers through supplying high performing containment systems, scalable packaging, regulatory support and – soon – new drug delivery technologies to make sure they and we are all best placed to serve patients and population health through the next hundred years."

References

1. Fortune Business Insight, Vaccines Market by Size, Share and COVID Impact Analysis ... 2021-20298: https://www.fortunebusinessinsights.com/industry-reports/vaccines-market-101769

2. Future Market Insights, Vaccine Market Outlook: https://www.futuremarketinsights.com/reports/vaccines-market

3. Data Bridge Market Research, Global Vaccines Market – Industry Trends and Forecast to 2030: https://www.databridgemarketresearch.com/reports/global-vaccines-market

4. Katherine Dillinger, FDA authorizes change in how monkeypox vaccine is given, stretching supply amid high demand, CNN, 9 August 2022

5. Nick Paul Taylor, West takes stake in intradermal delivery startup Latch Medical, Fierce Pharma, 16 August 2022: https://www.fiercepharma.com/pharma/west-takes-stake-intradermal-delivery-startup-latch-medical

6. Gabrielle Mason, Stunning, 4% yearly rise in R&D share has emerging biopharma dominating pipeline, Fierce Biotech, 30 March 2023: https://www.fiercebiotech.com/biotech/emerging-biopharma-companies-dominate-rd-pipeline-22-iqvia-finds

In Vivo
Pharma Intelligence

West

About West

West is a leading global manufacturer in the design and production of technologically advanced, high-quality, integrated containment and delivery systems for injectable medicines. We are a trusted partner to the world's top pharmaceutical and biotechnology companies—working by their side to improve patient health.

www.westpharma.com