PHARMAPACK
Drug Delivery & Packaging

Pharmapack Europe
2021 Market Survey
and Annual Report

Pharmapack Europe (13-14 October, 2021)

Market survey – including Pharmapack country rankings, innovation and sustainability indices – and expert contributions

informa markets

Contents

Pharmapack Innovation Index: India sees the fastest (12%) rise in innovation, as the United States extends its lead over Europe – where Germany retook the regional top spot from Switzerland

Pharmapack Sustainability Index: Europe leads on pharma packaging and device sustainability, well ahead of the United States

Introduction

Stimulated by the pandemic, R&D innovation has gone through a golden period of advancement and, as a result, the drug delivery and packaging markets have also seen a period of continual growth and innovation as well. Whether it be vials, auto-injectors, connected devices or the cold chain storage of lifesaving COVID-19 vaccines, the pharmaceutical packaging and delivery sectors have played a key role not just in the pandemic, but more generally in transforming the way we deliver and take medicines. With a rise in chronic diseases and a significant number of vaccine doses being manufactured for COVID-19, it is anticipated that there will be an increased demand for primary packaging, in particular glass containers. In fact, per new research by **Allied Market Research**, the glass segment is estimated to register the highest CAGR, 8.5%, between the period of 2020-2027[1].

But more widely, there has been a raft of changes across the pharmaceutical drug device delivery and packaging sector in the past few years, with a continued drive by drug delivery device and packaging manufacturers towards patient centricity. The aim is to improve the patient experience, but also, to increase patient compliance and reduce attrition rates. Yet with smart packaging

and devices proliferating, these goals have often worked against the industry's other main trend, namely, to improve sustainability.

Answering the concerns around the rising number of non-degradable plastic waste, drug delivery device and packaging companies have sought out greener, more sustainable solutions including the use of bioplastics and blister packaging.

R&D innovation has gone through a golden period of advancement

This report will dive deeper into these juxtapositions, evaluate the changing perception of innovation in the drug delivery device sector, as well as exploring how far long each country is in terms of achieving optimal sustainability of pharma devices and medicines. Looking further ahead, the findings will provide insights into what drug delivery devices will see the biggest areas of innovation over the next 5 years, as well as postulating what will be the most used primary oral dosage packaging.

Methodology

The report's key metric, the **Pharmapack Innovation Index**, saw over 350 companies score the most innovative countries, with a further 50+ companies supporting a deep dive analysis for the pharmaceutical drug delivery device and packaging sector as whole[2]. Not only do the results provide a key indication of the overall strength of

the industry, but they also deliver insights into the areas that have seen the biggest year-on-year percentage rise. In total, executives from all five continents – including all major pharmaceutical markets – provided responses, giving a diverse global perspective on the drug delivery and packaging market.

---

[1] https://www.alliedmarketresearch.com/pharmaceutical-packaging-market
[2] Survey data conducted among Pharmapack database in August 2021

Results

The report's key metric, the 'Drug Delivery Innovation Index' – scored out of ten – is designed to assess the perceived strength of each market's innovativeness, with the overall market perception rising by 1.81% year-on-year. This suggests, as many people would expect during pandemic, that the last year has indeed been a very good time for the industry in terms of new ideas, delivery mechanisms and devices.

The United States has remained unchanged at the head of the table, maintaining its position as the world's leading innovative country in the drug delivery field, with a score of 8.26. The other *tier one* markets, Germany (7.69) and Japan (7.52) – 2020's 2nd and 3rd placed economies – have both seen a slight year-on-year score increase. The United Kingdom (7.39) has moved narrowly ahead of last year's pre-eminent European market, Switzerland (7.38) – which has surprisingly fallen back. In fact, the UK has seen a flurry of innovative drug delivery device announcements in the last 12-months including, the much publicized and discussed acquisition of UK asthma inhaler company, Vectura – which is reportedly set to be acquired by Philip Morris after a number of prominent offers (including one from the private equity house, The Carlyle Group)[3].

However, by far the biggest surge came from India – a country that had already seen a massive 25% increase in 2020 – with a year-on-year increase of around 13%. Consequently, India has moved ahead of China (6.18), Spain (6.23), Korea (6.57) and Italy (6.58) to firmly consolidate itself in the third tier of the most innovative nations. India's rise will seem surprising to some. However, there has been significant interest in the drug delivery industry, and this is none more so reflected than by the world's first DNA vaccine, ZyCoV-D. While the vaccine is itself a world's first, interestingly, the delivery mechanism is equally novel with subcutaneous administration using a needle-free device pressed against the skin[4]. India's ongoing rise could also signal wider changes ahead, as the emerging nations been to compete on innovation as well as cost.

More broadly the back-to-back double-digit improvements in its 'Drug Delivery Innovation Index' score indicate positive sentiments towards the developments taken in manufacturing, biosimilars and the rise of new biotech targets that are permeating through the market into drug delivery and devices innovation. Another major driver in India's significant development within the space is the introduction of R&D initiatives such as 'Start Up India' and 'Make In India', with foreign direct investment and manufacturing sites increasing significantly during the pandemic[5].
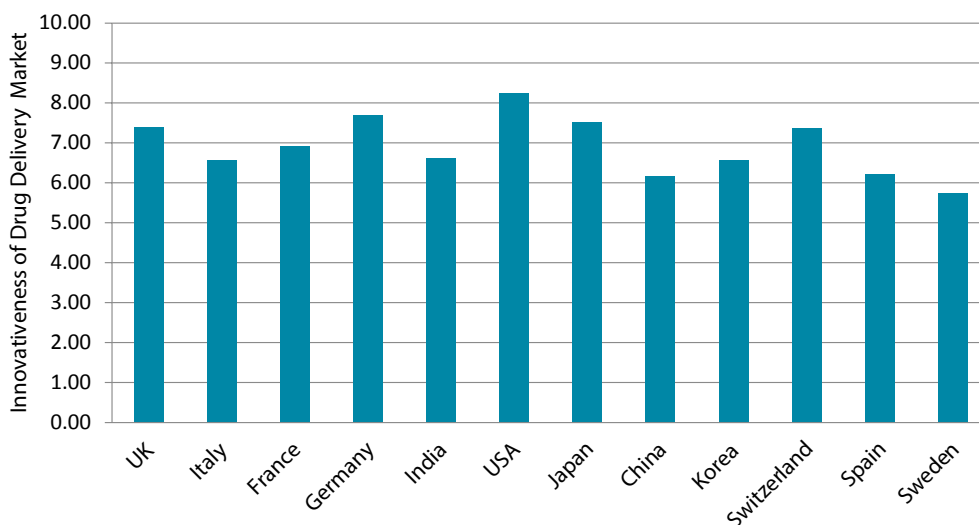

Figure 1: Drug Delivery Innovation Index 2021 - scores by county out of 10

---

[3] https://www.ft.com/content/ec2a5103-2b98-4bf8-85b6-2a9e0fb975bc
[4] https://www.nature.com/articles/d41586-021-02385-x

What does the overall score tell us about the direction the industry is heading?

The reputations of most markets displayed a healthy increase, perhaps reflective of the new confidence and positivity around pharma post pandemic – and the overall index has risen 6% since 2019, which bodes extremely well for the industry.

The direct impacts of the pandemic impacted the supply chain especially early on, but it has also generated a plethora of opportunities in new methods across the industry. For example, one particular beneficiary has been the rapid growth in digital applications and connected devices. To list just a few: many countries have launched *track and trace* schemes, vaccine passports, virtual appointments, and rapidly scaled up the use of self-administration of therapies, with even the apps themselves now receiving FDA approval for therapeutics purposes – many experts have identified apps as potentially the new paradigm for mental health treatments[6].

In Europe, the size of the drug delivery device industry was circa $340 million in 2021 according to Market Data Forecast[7], and the market is expected to grow by a CAGR of 5.9% until 2026, reaching $452.83 million. This is driven by a multitude of factors including the prevalence of chronic diseases, increasing therapeutic options and the growth in the biologics and biosimilars market. In particular, as a consequence of rising numbers of cancer, diabetes and respiratory patients across Europe, there is now a huge number that will require regular drug delivery devices for diagnosis and treatment purposes.

Charbel Tengroth, MD of Tengroth Consulting, commented: *"there are more biosimilar products in Europe than in any other market. Here you have a much stronger instinct across the health sector to adopt biosimilars to reduce the costs of treatment. However, what we are also seeing is that the numbers of biologics that are offered with devices is increasing. This is something we we have to expect and is therefore a positive development for injectable devices".*

Another trend that is accelerating post-pandemic is the trend towards self-administration. One only needs to look at the effect of overburdened hospitals during the pandemic to see the benefits this could bring both long and short term. It is perhaps unsurprising – with an increasing number of patients now using injectable devices that can be also monitored in a home setting –that wearable injectors capable of delivering high-volume biologics, another area of recent innovation, is set to grow by $4 billion alone over the next three years[8].

The direct impacts of the pandemic impacted the supply chain especially early on, but it has also generated a plethora of opportunities in new methods across the industry.

Understandably, the usability of devices is therefore the critical part of future design of innovative medicines and there has been in a shift in how companies are conducting R&D, with patient experience teams and real-world usability studies now being expected and no longer being optional. The Pharmapack survey findings support this trend, with 78% of respondents stating that, with an increasing number of patients self-administrating drug therapies, 'patient centricity' is the most important factor in device decision - particularly in terms of the need to 'optimize safety and efficacy while minimizing potential user errors'. In fact, 87% of respondents cited 'patient adherence and ease of administration' as the primary consideration when manufacturing patient-centric devices. Other key considerations highlighted included the 'size and portability of the device' (65%), 'decreasing the number of dosing events' (43%) and 'limiting the need for patient training' (26%).

[5] https://news.bloombergtax.com/daily-tax-report/covid-19-and-r-d-tax-credits-tap-into-india-incentives
[6] https://www.mobihealthnews.com/news/himsscast-are-digital-therapeutics-future-mental-health
[7] https://www.marketdataforecast.com/market-reports/europe-drug-delivery-devices-market
[8] https://www.technavio.com/talk-to-us?report=IRTNTR40104&type=sample&src=report&newer=report&utm_source=pressrelease&utm_medium=bw&utm_campaign=Auto_BW_v3_rfs_wk22&utm_content=IRTNTR40104
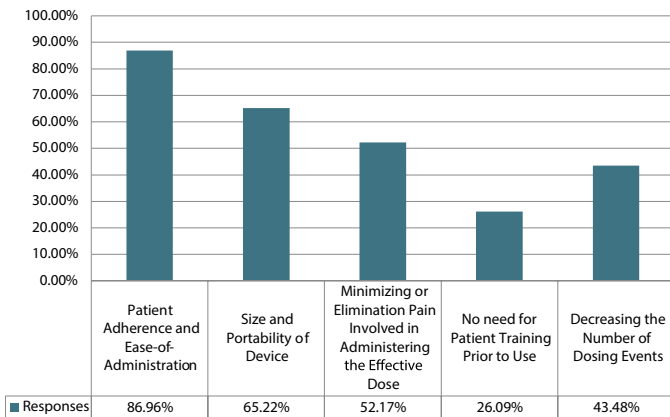
Figure 2: what are the main considerations when manufacturing patient centric devices?

	Patient Adherence and Ease-of-Administration	Size and Portability of Device	Minimizing or Elimination Pain Involved in Administering the Effective Dose	No need for Patient Training Prior to Use	Decreasing the Number of Dosing Events
Responses	86.96%	65.22%	52.17%	26.09%	43.48%

The case of smart devices continues to grow, as in addition to improved adherence, they offer the possibility for evaluation over a longer duration of time and not just in controlled hospital settings. Collecting real-time data empowers industry with real-world effectiveness against clinical efficacy. However, their use –primarily due to the high cost of introduction – will likely be limited to innovative medicines and they are, for example, unlikely to gain significant traction among biosimilar developers.

Tengroth, added: *"digitalization is probably not going to have much of an impact for some time in biosimilars, because it completely goes against affordability and market access. This is on top of electronics that will require a dedicated infrastructure and, potentially, interoperability between patients, healthcare providers and pharma companies. I think connected devices are very much catered for innovative drugs, there is more incentive for their use especially where we don't have much data on usage and adherence. However, if you have a biosimilar, you probably have a fairly good idea of what the clinical outcome is, what the work is of the treatment in terms of how and when the patients use it."*

One other important consideration highlighted by industry respondents was to minimize or eliminate any pain involved in administering an effective dose – consequentially, our experts predict that patients will increasingly wish to switch to needle-free, painless injectable forms that are easy to use and disposable (particularly new patients).

More widely, patient adherence has been an issue for many years, costing healthcare systems a significant amount across all chronic disease states. Therefore, is expected that the rise in use of painless delivery (60%) will continue with our respondents identifying smart dose injectors – that can that confirm adherence – as the delivery form most likely to see double-digit annual growth in the next calendar year. Wearable injectors were also selected by half of the respondents as a device that will double digit growth, with drug patches (45%), smart dry powder inhales (40%) and multi-dose delivery injection caps (40%) following. Significantly, the respondents reported strong percentages across all device types, this is perhaps a positive reflection of the likelihood of very strong growth in the next few years for all devices.
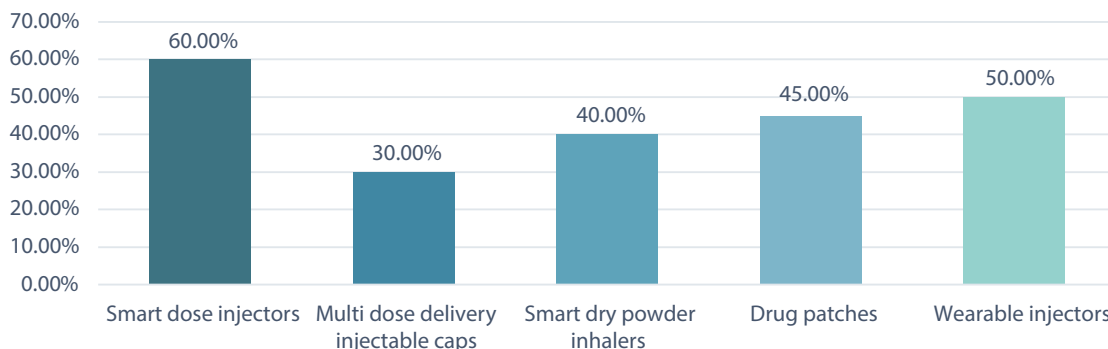
Challenges that could slow adoption of connected devices

Interestingly, cost alone (often blamed in other reports) was not seen by the industry as the main issue that could slow down adoption of connected devices. Instead, the complications around data security, privacy and processing were highlighted as potential issues that could hamper implementation in the next two to three years. This is an area of growing concern for both developers and pharma, as we have seen issues around hacking and, of course, devices must be interoperable with healthcare systems while simultaneously being compliant with regulations across regions. Our experts therefore predict that over the
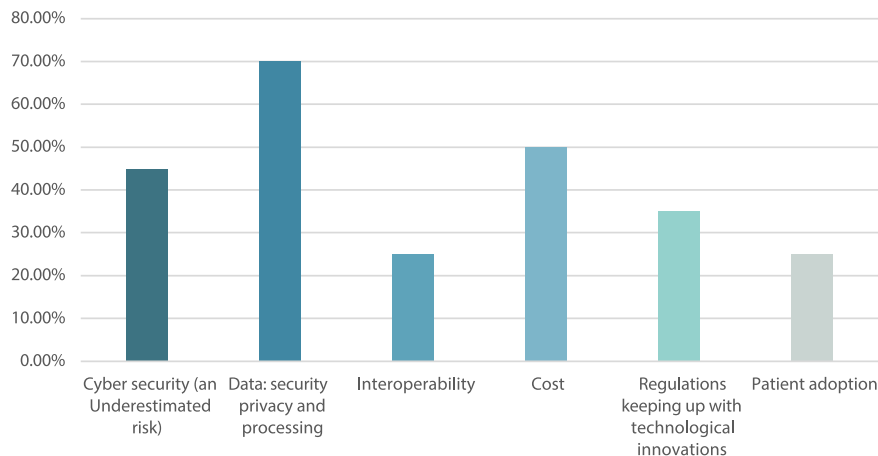

Figure 3: which delivery form has the greatest potential for double digit growth in 2022?

Figure 4: What is the biggest barrier facing connected devices and their widespread implementation over the next 3-years?

next few years the industry will attempt to move towards digital standardization to offset some of the complexities these newer intelligent devices will bring in compliance, and even, the ability for patients to take direct control of their data.

The Drive Towards Sustainability

While the COVID-19 pandemic has captured the attention of the world, including the pharma industry, there is also another looming issue on the horizon in the form of climate change. Pharma has seen a drive towards sustainability in the last five years, with an increasing number of companies looking to minimize their carbon footprint, reduce waste, lessen greenhouse emissions, and remove plastics. One major sector that has come into focus is packaging, and while packaging in pharma is used less than in industries such as food and FMCG, most medical packaging is derived from polymers, with the majority of medical waste disposed of via landfill. Governments are creating wider sustainability strategies across many industries and pharma is no different, with a recent drive towards green chemistry initiatives to reduce the use of solvents in API manufacturing just one example.

Almost half of the respondents believe that investment in eco-packaging will increase by at least 50% within the next two to three years, and this will be largely driven by companies looking to lower their carbon footprint in line with the global goals in the 2030 agenda, as set out by the United Nations. Pharmapack expert Gregor Anderson,

believes that there should be more done in terms of creating a sustainability index as it's usually measured as a CO_{2eq} value: *"With the wide range of medicinal packaging platforms available there is a large choice for patients and each platform has its own inherent sustainability index. The sustainability index is usually measured as a CO_{2eq} value and today there is no clear guidance on what standards the Pharma industry should meet when it comes to sustainability. Healthcare providers and customers are increasingly asking about metrics regarding the global footprint of medical devices, medicines and packaging and this especially ties into the former's own sustainability initiatives."*

How does the industry think different countries compare for pharma sustainability?

Pharmapack's new *Sustainability Index* (scored out of ten) – created to gauge the perception of how much is being done by each country in terms of plastic use, waste reduction, device recycling and which has the most progressed approach to sustainability – assesses how far long each country is in terms of achieving optimal sustainability of pharma devices and medicines among its population.

Leading the Index in its inaugural year is Sweden (6.87), whose adoption of a strategy for a circular economy in 2020[9] has been key in their drive towards a more sustainable approach to packaging. To give just one example, Svensk Plaståtervinning has invested in building the world's largest plastic recycling facility, 'Site Zero'.[10]

---

[9] https://www.government.se/press-releases/2020/07/sweden-transitioning-to-a-circular-economy/
[10] https://www.packagingnews.co.uk/news/environment/recycling/swedens-site-zero-become-worlds-largest-plastic-recycling-plant-02-09-2021
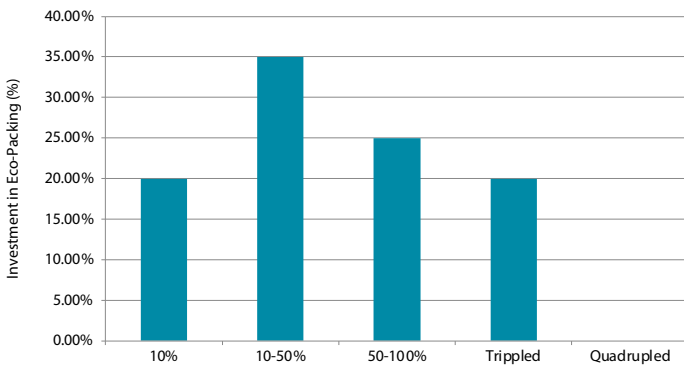
Figure 5: In the next five years by how much will investment in eco-packaging increase business confidence

pharma company can tackle the bigger opportunities such as recycling and standardization of packaging materials and pack formats. With a joined-up industry roadmap, real change can be implemented, and this will need all stakeholders onboard. Green solutions should ultimately be a competitive advantage for all."

The UK (6.04), who have implemented a tax on virgin plastic materials in disposable packaging, Germany (6.74), Switzerland (6.78) and France (6.09) are also all perceived by the industry to be leading Europe's efforts in sustainability.

While both the governments of India and China have made sizeable efforts at reducing their respective pharma industry's carbon and environmental impact, the market has yet to be convinced, with India (3.30) and China (4.22) having the lowest perception scores by some distance, and significantly this is the only [CPhI/Pharmapack] metric where the United States ranks lower than the majority of European nations. We surmise this is more likely due to the United States' weaker government commitments rather than a reflection of the relative commitment to sustainability of drug device companies from the USA.
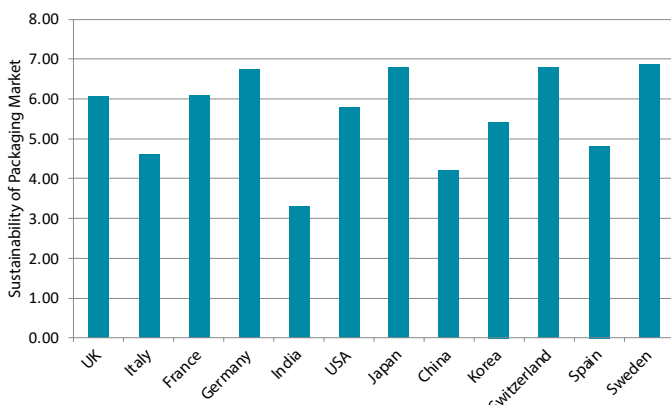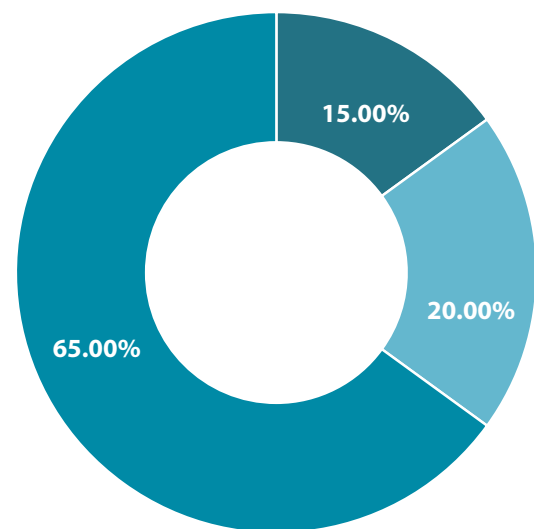
However, the two dominant trends 'smart packaging' and 'green packaging' are often diametrically opposed in practicality – as smart devices tend to be less recyclable – but encouragingly 65% of our respondents believe that both can coexist. The majority of the industry believes 'a shift towards better recycling and improved product lifespan' will help integrate sustainability goals without compromising device adoption over the next three years. However, 15% believe that consumer demands will take precedence, demanding greater ethical products to be used, while 20% believe that smart packaging will prevail as patient efficacy and adherence improvements will out-weigh environmental considerations for now.

Figure 7: The two dominant trends 'smart packaging/devices' and 'environmental/green packaging' are often diametrically opposed (It's hard to achieve both simultaneously). Which do you think will have the biggest bearing on product development over the next 3-years ?

Figure 6: Packaging Sustainability Index 2021 – scores by county out of 10

In order for the industry to transition to a greener future, Anderson believes that pharma should work together: *"the whole Pharma industry has to work together as an aligned partnership for solutions to be viable. This is because no single*

■ Environmental/green focus: as consumer demand greater ethical products even in healthcare (the trade off will be phone apps will be used instead of separate connected devices

■ Smart packaging/devices - the patient efficacy and adherence improvements will out-weigh environmental considerations

■ Both - but this will be combined with far better recycling and product lifespan to achieve sustainability goals

Conclusion

One fall-out of the pandemic is that novel drug delivery device innovation – other than novel injectors – was temporarily slowed and, as the industry returns to normality, we can expect a rise in new devices throughout 2022 [with over half industry surveyed expecting more than 10 new device approvals in 2022]. Significantly, future covid vaccines will further increase the demand for injectable devices and the pandemic has also clearly shown the benefit of both connected and self-use devices. We anticipate innovation in devices will accelerate post pandemic and that device manufacturers and pharma will increasingly collaborate to use them in conjunction with other digital assets (apps, phone, computer). Ultimately, this will bring the patient into far greater control of their own care. In the medium term, we anticipate these efforts to start aligning with much wider access to recycling schemes so that patient adherence [which is inherently green, since it seeks to optimize the use of medicines] and sustainability gains can be made in tandem alongside therapeutic improvements.

However, the pandemic has also altered perceptions and expectations on delivery settings and there is an increasing number of people now self-administrating. As this becomes the norm, companies will make patient experience the central component of drug delivery design. Potentially emerging from this trend – in combination with connected devices – will also be the use of real-time data to ensure that patient treatment can be evaluated over a longer duration of time and will allow for increased compliance.

In terms of the annual *Pharmapack Innovation Index*, it has been another good year for the industry as our respondents raised the overall index by nearly 2%, with India making sizable gains and the United States leading once again. Yet, in an industry so used to US leadership, sustainability goals are, in the view of the industry,

> **Expert perspective on innovation in China and India:**
>
> *"There has indeed been a lot of activity and interest from Indian and Chinese organisations focused on developing lookalike models of existing European or US devices, including DPIs and soft mist inhalers. Such developments could well morph into completely new devices, although it is common to see new inhaler technologies developed for a specific formulation at the behest of a pharmaco. Any trend in innovations will likely also be influenced by new formulations or Active Pharmaceutical Ingredients (APIs).*
>
> *As for pen injectors or auto injectors, there may be greater scope for a device suitable to a range of drug types or formulations which can licensed to a pharmaco, and hence there may be more scope for device innovation in these areas."*
>
> **Andy Fry, Founder, Team Consulting**

currently being driven forward by European nations. The EU's block-wide ability to regulate, is pressing the industry to (re)evaluate the materials it uses, but also, how post-use – when virgin materials are often required in pharma – we can then reliably collect and recycle these devices. We anticipate total lifecycle impact therefore to be talked about as the primary metric in two- or three-years' time.

Over the next few years, we also expect medicine delivery to be more efficient as the patient gains greater digital tools. Yet, sustainability may also see these very same digital tools being used to empower the patients to be part of the solution: using reminders, maps and instructions on how, when and where to responsibly dispose of packaging waste and devices.

Expert perspective on the next big innovations in drug delivery & devices:

"There is a lot of benefit for patient's that are taking a drug long-term to not have to inject each time. Implanted systems that can slowly release a drug would be great, however they don't really exist at the moment. Despite this, oral insulin may be nearer to becoming a reality than it was 10 years ago, and developments such as in-body implanted systems which generate insulin are definitely growth areas.

Ocular delivery is also an area which could see more innovation in the near future, focusing on drug delivery across the blood-brain barrier to improve how quickly it gets into the system. For a while this approach appeared to fall out of fashion, however it is beginning to be considered again as a key way to deliver into the blood. Such an approach would be particularly helpful in chemotherapy for example, as when these drugs are delivered orally or via injection, they can be harmful as they effect more than just the targeted area. Direct intra-tumoral delivery would be a brilliant breakthrough for cancer treatment, however there are a lot of hurdles to overcome before this can be achieved, such as further developments in highly focused, targeted drug delivery."

Brennan Miles, Managing Consultant – Drug Delivery, Team Consulting
Steve Blatcher – Head of Early Stage MedTech, Team Consulting

Additional Survey findings

Figure 8: Do you think tightening regulatory requirements could constrain the growth opportunities for the drug delivery device industry
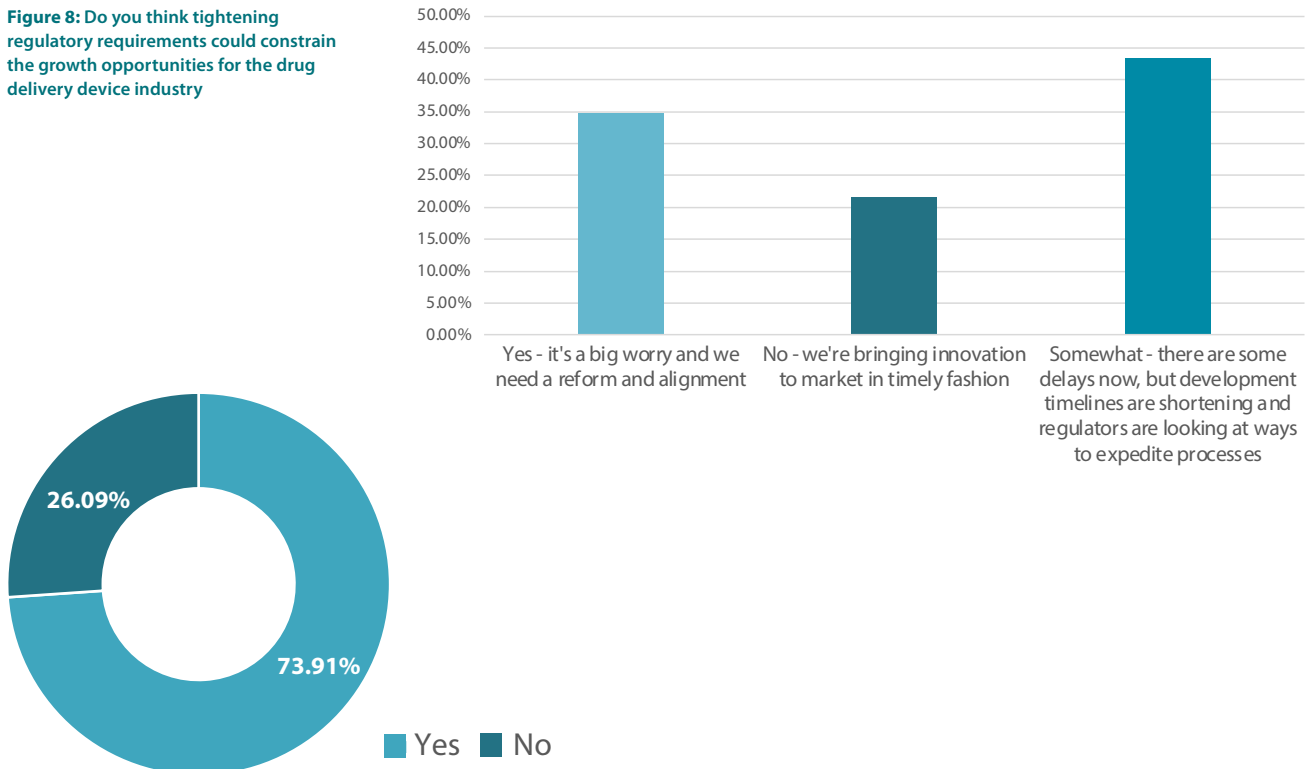

Figure 9: Do you think the EU will join the Medical Device Single Audit Program (MDSAP) program in the next 2-3 years (changing from being a pilot observer)?

Additional Survey findings - continued.
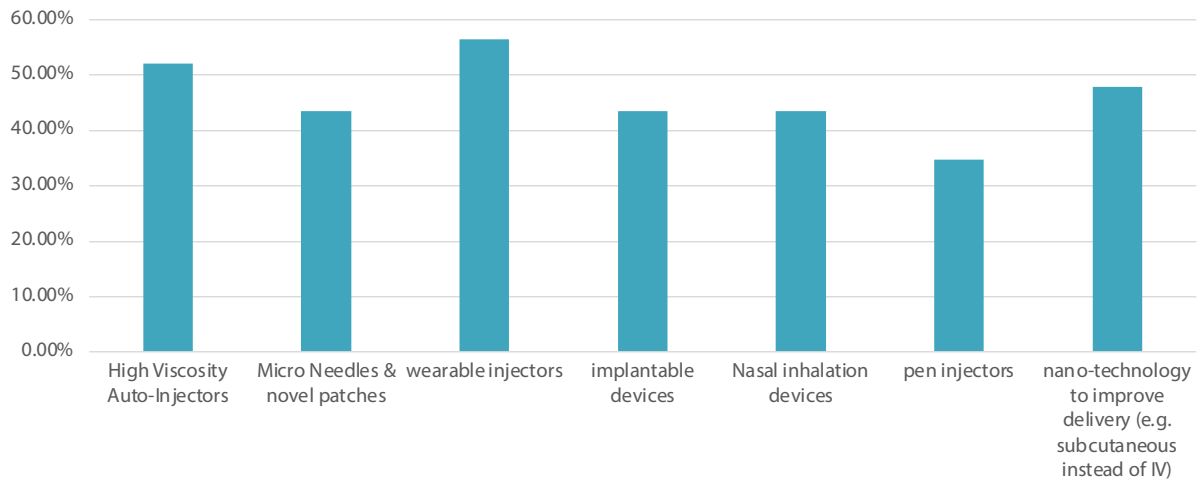

Figure 10: What drug delivery devices will see the biggest areas of innovation to support growth in biologics over the next 5 years?
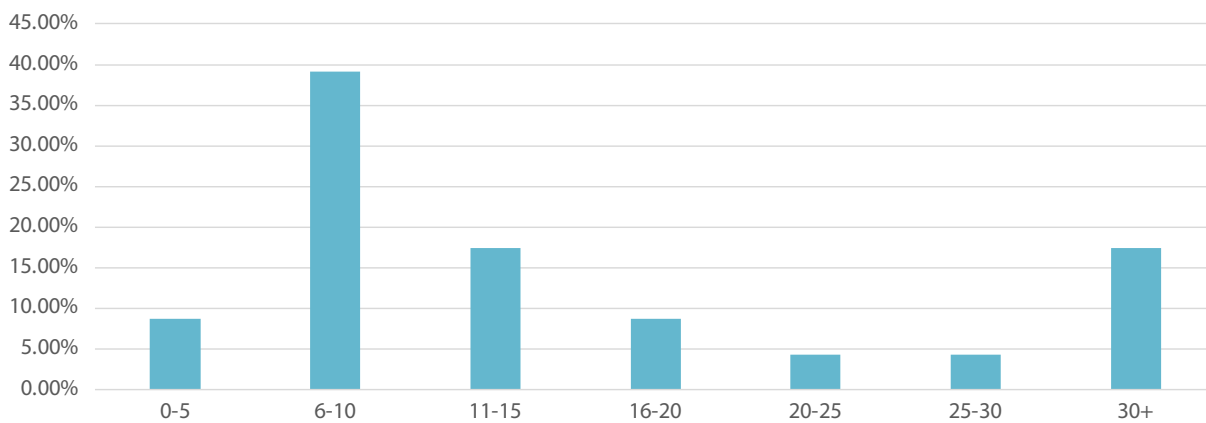

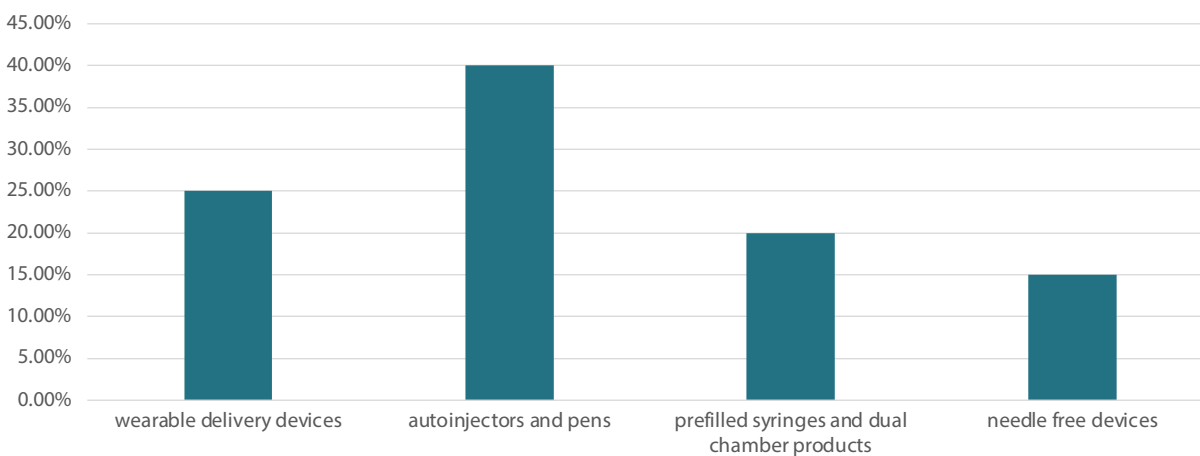**Figure 11: How many novel drug delivery devices or platforms will be approved by the FDA in 2022**

Figure 12: Which of the following product classes do you anticipate will have the most FDA approvals in the calendar year 2022?

Pharmapack 2021 report contribution – Team Consulting

1. Do you think tightening regulatory requirements could constrain the growth opportunities for the drug delivery device industry?

One of the most significant changes to regulatory requirements this year has been the introduction of the MDR. While the MDR was first published in 2017, it is still relatively new for the industry, having only officially been introduced in May 2021. As with anything of this nature, it will take some time for these regulations to become embedded and for the industry to have a clearer understanding of what is required to get products to market.

There are a few key changes that it will be important to keep an eye on. One of these is that the MDR has given increased responsibility to notified bodies, which are now required to assess drug delivery combination products. This change comes at a time when the number of notified bodies has been steadily decreasing, with only 22 notified bodies under the MDR in August 2021, compared to 75 under the MDD in 2013. Part of this drop off could be due to the fact that notified bodies must now reapply to be approved for the MDR, and must also become accredited to do the required assessments (a process that is both expensive and challenging). As a result, it seems that some have simply decided not to apply. Though it's too early to tell what impact this may have on time to market, the number of notified bodies will likely need to increase to avoid longer waiting time for approvals.

Mark Di Cioccio
Head of Quality Engineering, Team Consulting

2. There has been a lot of talk about how quickly COVID drugs have been approved. Do you think there will be a knock-on effect when it comes to improving the speed of drug delivery device approvals?

It's unlikely that COVID-19 will have an impact on the speed of drug delivery device approvals. The industry certainly showed itself capable of coming together in a time of emergency to push through devices and drugs, however it is important to note that while things may have happened quickly, no corners were cut. Thorough review and approvals will always be necessary in medical device development. For anything to be achieved in a shorter timeframe will simply require more effort and investment. This is something we can testify to from our own experience taking part in the UK Government's emergency ventilator challenge in March 2020, where we were tasked with designing, developing and preparing for manufacture an emergency ventilator in just six weeks. Such a shortened timeframe could only be achieved by committing much more time and resource to the projects, with employees working tirelessly throughout.

Mark Di Cioccio
Head of Quality Engineering, Team Consulting

3. Which drug delivery product classes do you anticipate will have the most FDA approvals in 2022 and what do you think will be the most prominent areas?

During COVID-19, novel drug delivery devices have generally slowed down due to the focus on the pandemic and changes to working environments. As we continue to emerge from restrictions and the pandemic, 2022 could well see an increase in the number of approved devices, though in which sectors is yet to become clear. There are however some emerging trends brought on in part by the pandemic that could have an impact on which product classes see an upsurge in approvals. For example, there has been an increase in demand for new novel injector devices, including suitable devices for larger volumes, i.e. large-volume autoinjectors, as well as a higher demand for re-constitutioned devices, i.e. pen injectors. While these devices are effective at drug delivery, they often lack in usability. Should demand continue to grow in this area, it will be important for developers to continue working to improve usability.

Another area which could see an increase in approvals is connected devices. The pandemic has done much to

highlight the benefits of digital health, with lockdowns, quarantining and social distancing meaning some patients have little choice but to self-administer therapies outside of hospital settings. Connected devices and companion apps help users onboard with their new therapy and subsequently track their conditions and dose history. Following the pandemic, developers may be looking to capitalize on this trend towards the democratization of healthcare.

Andy Fry
Founder, Team Consulting
Mark Di Cioccio
Head of Quality Engineering, Team Consulting

4. What do you foresee in the market in the next two to three years in terms of connected devices and smart devices? Do you think that there are any barriers that are currently holding connectivity back that we could address?

Digital health and the democratization of healthcare have begun to gain traction recently, with the aim of bringing healthcare to the hands of the consumer. Connectivity and smart devices will have a key role to play in this, offering a number of benefits including tracking treatments and patient adherence, assisting with device onboarding and more. However, there are several challenges that device developers will need to address as they begin to roll these products out. From a regulatory standpoint, one of the most significant of these will be data. Data can be lucrative for a business and offer a number of benefits, however it is important to note that by adding connectivity, medical device developers will need to adhere to evolving regulations around cybersecurity and data protection. On top of the regulatory hurdles, consumers themselves are also a lot more aware of the choices they are making around sharing their data these days. In order to get them to sign up and share their data via a connected device, they will first need to be convinced of the benefits. We are still some way off from connected medical devices becoming the norm, meaning device developers will need to work hard to convince their users to engage through their design and marketing.

Another potential barrier to the introduction of connectivity is the environmental concerns it raises. Single-use electronics are of particular concern here. While these components may use up only a fraction of a development cost, there may be push back from consumers or even reputational damage over environmental concerns about waste. Added connectivity also has a significant impact on carbon output during the development phase, as well as at end of life, meaning developers will need to carefully weigh up the benefits against the environmental costs. A case could be made that adding connectivity could go some way to offset environmental costs, as it could potentially improve patient adherence and lead to less costly hospital interventions as a result of patients not taking their therapy as prescribed. However, there is not enough data to accurately understand this impact at this time.

Peter Matthewson
Head of Electronic Engineering, Team Consulting

5. What do you believe will be the main post-pandemic legacies for drug delivery devices?

One of the main post-pandemic legacies we should hope to see is a change to supply chains. The COVID-19 pandemic has shown that companies can deliver quickly, however only if their supply chains are stable and reliable. As governments across the world seek to vaccinate millions, medical supply chains have become extremely stretched. From the raw materials needed to craft needles, to the dilutants used in drug development, many of these materials are often derived from a select number of facilities. Moving forward, it's likely we'll see an increase and diversification in the number of companies with the production facilities to create these materials. We may also see more localization of supply chains, with governments recognizing the need for internal supply options in the face of lockdowns. Such a change would likely have benefits for the environment too owing to a decreased need for international transport. We can also hope that more will be done in terms of managing waste. If raw materials are in short supply, we should begin looking at how to recycle and reuse materials that have already been processed, which would again have environmental benefits.

Steve Blatcher,
Head of Early Stage MedTech, Team Consulting
Brennan Miles,
Managing Consultant – Drug Delivery, Team Consulting

6. There has been lot of talk about booster vaccines, do you anticipate this to be a regular part of the drug delivery market in the next three to five years? How might this affect the market in terms of capacity, production etc.

Based on the existing vaccine types and the fact they have been formulated, trialed and approved for Intramuscular (IM) injection, there will be a continued high demand for syringes and needles / staked needle syringes. It's hard to imagine a big change from this in the immediate future, other than an increased demand for what already exists. Despite this, a recent white paper from the UK Government highlights their interest in supporting the development of new novel delivery techniques to support future vaccine delivery plans. The paper specifically mentions oral delivery methods, transdermal or intra-dermal, or intranasal delivery methods. Needle-free delivery is another area that has been considered for many years now, which could potentially see some traction as we look to new ways to improve how vaccines reach people. With lockdowns and social-distancing in place, having ways for people to self-administer vaccines at home could go a long way in improving access, while also supporting the democratization of healthcare. For us to reach a place where this is viable is not without its challenges however. Such devices would need ample evidence to prove their efficacy across all user types, while supply chains for the required cold shipment could also mean a slow and expensive distribution of doses.

Andy Fry
Founder, Team Consulting
Brennan Miles
Managing Consultant – Drug Delivery, Team Consulting

7. Are there any really big breakthroughs you can see happening in the foreseeable future?

There is a lot of benefit for patient's that are taking a drug long-term to not have to inject each time. Implanted systems that can slowly release a drug would be great, however they don't really exist at the moment. Despite this, oral insulin may be nearer to becoming a reality than it was 10 years ago, and developments such as in-body implanted systems which generate insulin are definitely growth areas.

Ocular delivery is also an area which could see more innovation in the near future, focusing on drug delivery across the blood-brain barrier to improve how quickly it gets into the system. For a while this approach appeared to fall out of fashion, however it is beginning to be considered again as a key way to deliver into the blood. Such an approach would be particularly helpful in chemotherapy for example, as when these drugs are delivered orally or via injection they can be harmful as they effect more than just the targeted area. Direct intra-tumoral delivery would be a brilliant breakthrough for cancer treatment, however there are a lot of hurdles to overcome before this can be achieved, such as further developments in highly focused, targeted drug delivery.

Brennan Miles
Managing Consultant – Drug Delivery, Team Consulting
Steve Blatcher
Head of Early Stage MedTech, Team Consulting

8. Are the United States and Europe still the predominant innovators in devices, or are there new hubs challenging these locations (e.g. Chine and India)? What innovations are coming out of these new hubs?

There has indeed been a lot of activity and interest from Indian and Chinese organisations focused on developing lookalike models of existing European or US devices, including DPIs and soft mist inhalers. Such developments could well morph into completely new devices, although it is common to see new inhaler technologies developed for a specific formulation at the behest of a pharmaco. Any trend in innovations will likely also be influenced by new formulations or Active Pharmaceutical Ingredients (APIs).

As for pen injectors or auto injectors, there may be greater scope for a device suitable to a range of drug types or formulations which can licensed to a pharmaco, and hence there may be more scope for device innovation in these areas.

Andy Fry
Founder, Team Consulting

Pharmapack 2021 report contribution – Cambridge Design Partnership

Authors: Uri Baruch & Clare Beddoes

Injectable drug delivery trends in 2021 and beyond
Delivering complex molecules, determining the value of digital tech, and providing a patient experience on a par with what we've come to expect as consumers – these are some of the challenges motivating innovation in injectable drug delivery in 2021.

Cambridge Design Partnership's Clare Beddoes, Senior Medical Innovation and Research Consultant, and Uri Baruch, Head of Drug Delivery, explore some of the themes engaging the attention of formulation and device teams alike that are set to shape future trends in this sector.

Drugs driving innovation
What's the dynamo for innovation in drug delivery – the drug or the device? The answer's, more often than not, the drug. Fundamentally, it's the drug – and the condition and patient group that it's treating – that directs what the device needs to do.

And then there was the move to enable patients to self-inject those drugs at home, driving innovation beyond the humble pre-filled syringe to user-friendly and lower-risk devices, many of which have been available to patients for decades. So, what next?

We don't see simple molecules – for example, ≤2ml, low-viscosity, single-dose – being a key feature in device innovation anymore. Those drugs are increasingly being launched in established, often incumbent devices, many of which have largely reduced the burden on the patient, for example, by reducing the number of user steps (though there is, of course, always room for improvement, even here).

However, problems remain around more complex molecules – for example, ≥2ml, high-viscosity, suspensions or lyophilised – and combinations of drugs that can't be co-formulated. The pharmaceutical industry has, as we know, been grappling with large-volume drugs for considerable time now. The jury still seems out on whether patients should continue to be given two or more devices to deliver larger volumes, or if large-volume devices should be used, and what format those large-volume devices should take – and what is large volume, anyway?

What's the dynamo for innovation in drug delivery – the drug or the device?

On-body delivery systems for larger volumes are still in their relative infancy and so can carry additional risk to a drug-device development programme from a time-to-market standpoint. However, as some of those drugs which currently require patients to inject from more than one device per dose go through patent expiry, we may see on-body delivery systems become more attractive as a means of lifecycle management and differentiation – if the patient experience can be streamlined accordingly.

Working out the value of digital
There are so many possibilities for the application of 'digital' in drug delivery. It's possible to put a load of sensors into a device to tell you all manner of things about it, such as temperature and drug integrity, or the injection process, like angle of hold and injection completion, to name but a few.

But here's the thing: just because you can, doesn't mean you should. You need to ask yourself who the digital aspect of the device is being developed for – patient, carer,

clinician, pharma company, payer, others? What data do any of those groups really need from such a device? What behaviour do you want to support, or change based on the data you'll gather? And what are the benefits of that data to all of the different groups you're designing for? Calculating the intention and associated value of digital in drug delivery is a huge question, and it's something clients are asking us to help them decipher more and more.

Unpicking this question and then determining the route to achieving that value is where having an insights and strategy capability comes in. Defining and talking to those intended end users of that data – for example, patients, the prescribing clinician, even the pharma company internal teams themselves – about the challenges they face can identify the jobs those user groups are trying to achieve and uncover many unmet needs and pain points that can be translated into themes of data requirements. One such theme for a clinician, for example, might be reassurance: *"I need to reassure my patient this drug works and that they're delivering it correctly."* Then, we can look at potential digital enablers that best meet those needs, be it via the physical device or associated user interfaces. For example, confirming correct injection technique, communicating to the HCP that the injection has taken place – and correctly. Yes, there are many possibilities indeed, and ensuring the device and the digital service are responding to high priority needs will be key.

User experience: learning lessons from consumer goods

Adherence, we know, is of great importance, and engaging the patient as early in their therapeutic journey as possible is a huge part of achieving longevity of following – often complex – treatment regimens. So often, the patient disengages early in their therapy because they're not having a good experience.

Adherence to – particularly injectable – medication is, of course, hugely complex and another challenge the industry has long been grappling to get to grips with. For one thing, it's often condition specific. For example, a patient taking a drug for a painful condition like arthritis is

highly incentivised to take it – avoiding a painful flare-up is a strong motivator.

However, there being many new molecules for asymptomatic conditions, a patient taking a drug for high cholesterol, for example, doesn't feel any better for adhering to their injection regimen right now – and so it's harder to communicate the benefits. At the same time, some of the side effects of biologics are harsh, and patients often take holidays from their injection to avoid them. They ask themselves why they'd take a drug that makes them feel worse than not taking it. While adherence issues aren't usually to do with the device, an injection journey that carefully considers user experience can go a long way to reducing the friction and can even give a less effective molecule the leading edge.

Unpicking this question and then determining the route to achieving that value is where having an insights and strategy capability comes in.

At CDP, we often help pharma clients learn about user experience from the consumer-goods space. People love unpacking a new piece of consumer technology – think of all of the unboxing videos that have flooded the internet in the past few years. So, why can't patients have an equally good experience unpacking – often extremely expensive, but poorly packaged – medication?

Think about smart packaging that integrates a digital experience into the physical packaging. For example, a patient who has a question while unpacking their drug could scan the box with their phone to access frequently asked questions, an interactive user guide, even augmented reality training. In addition, the experience could be hyper-personalised via digital. For instance, a patient could find suggestions for the best time of the week to take their drug, based on data from other patients with similar lifestyles.

Understanding and improving user experience isn't just about increasing adherence. A great user experience can help a drug stand out from the competition. Think of the drug that's known to be less efficacious than its competitor in clinical trials but outsells its competitor in every market via a better device and patient experience.

Keeping sight of sustainability

Whilst sustainability isn't top of the pharmaceutical industry's agenda right now, it's likely to become a more significant theme in drug delivery over the next decade. At the moment, there isn't regulation targeting the sustainability of drug delivery devices. However, as globally we target getting to Net Zero within a few decades, it seems unlikely the pharma industry will be exempt, and we'll start to see this trickle down. The UK NHS, for example, has said it's setting out to achieve Net Zero, including its supply chain, by 2045. Given that drug delivery devices tend to have long product development cycles, we need to start thinking about this sooner rather than later.

There are reusable injection devices on the market, but they inevitably add user steps. For example, the device needs to be retrieved from storage, prepared, loaded, cleaned, possibly charged, safely re-stored and so on. That's often viewed, particularly by clinicians, as reducing the user experience and increasing the risk of user error. However, sustainability is something that obviously becomes of even greater importance when considering connected devices. Many companies are currently proposing building digital into single-use devices, raising questions around how electronics waste should be dealt with – this may be a driver for innovation in years to come.

Leading the trends

These are just some of the challenges catalysing the trends we're seeing in injectable drug delivery. The question of how to deliver complex molecules isn't new but ensuring a design approach that is people-centred is essential. A people-centred methodology will help answer the questions of when and how to apply digital – and unlock its value - in drug delivery, too. Improving adherence could also benefit from an original approach – one that takes learnings from the leading edge of consumer goods and applies them to drug delivery. And it's by looking into the future that drug delivery device teams can take leading positions for the possible sustainability challenges ahead.

Pharmapack 2021 report contribution – EMEA Thought Leadership, IQVIA

Authors: Yasemin Bettina Karanis, Senior Consultant

Innovation in Drug Delivery Devices: Key Market Trends

The rise of specialty and the increasing importance of biologics

The global pharmaceutical market is expected to reach about $1.6 trillion by 2025.(1) However, the value growth we see is decelerating across major markets. This is happening even though there are more products being developed and launched and the level of innovation is high. This creates an environment that is highly competitive yet increasingly squeezed, exacerbated by the economic pressure brought by the ongoing pandemic.
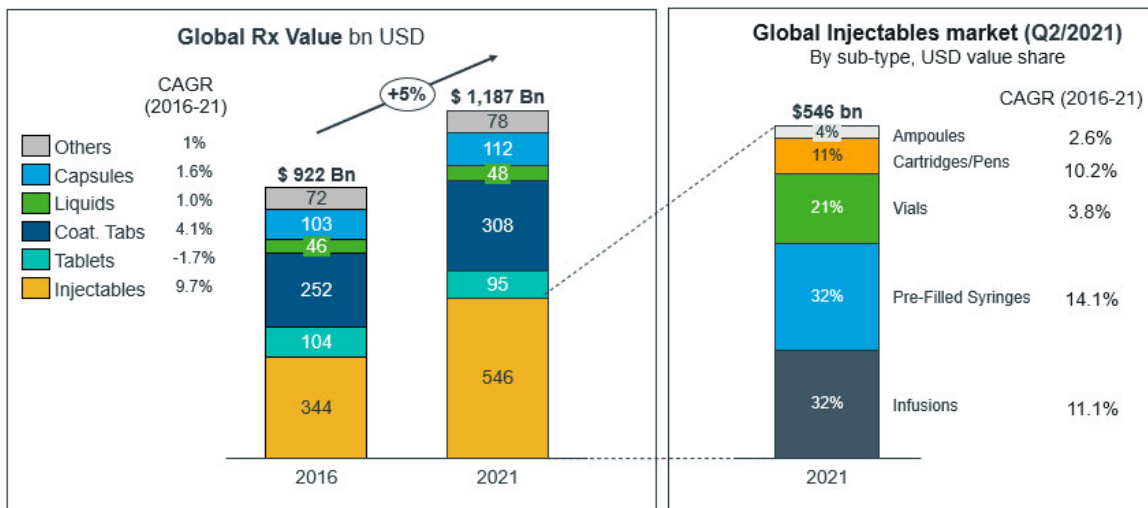
When we look at trends in innovation, we see that specialty medicines are key drivers of value growth. It is expected that most products launched in the next five years, approximately two thirds, will be in the specialty segment. Today, non-specialty medicines are still the biggest

segment by value however, specialty is predicted to be the dominant market, with over 60% value share in most developed markets by 2025 (2)

The top three leading therapy areas by list price today are oncology, diabetes and immunology. Together they contribute to 61% of absolute positive global growth. These are all therapy areas that have been revolutionised by biologics.

Biologics make up 34% of the global pharma Rx market growing at 12% (10 Year CAGR) whilst small molecules still contribute most of the value at 66% but only growing at 3% (3). Looking ahead, we expect biologics to play an even bigger role globally as 45% of the pipeline today are biologics. (4)

Figure 1: The rise of injectables has implications for treatment capacity and setting of care, as well as the supply chain

Notes: Injectables defined as Parenteral NFC2: Ampoules, Infusions, Pens & Cartridges, Prefilled Syringes and Vials;
Source: IQVIA European Thought Leadership; IQVIA MIDAS MAT Q2 2021; Constant Exhange Rate, Rx only.
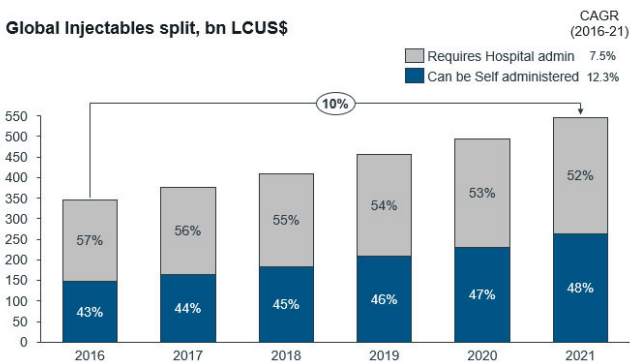
Trends in Delivery Mechanisms

The changing make-up of the prescription market is having direct implications on drug formulations, delivery and packaging. Whilst oral solids still account for 43% of value globally, as a result of the increasing importance of complex formulations, the injectables market value growth is strongest with a 9.7% 5 Year CAGR. (Figure 1)

Within injectables, pre-filled syringes are the fastest growing segment with a 14% CAGR (Figure 1). The strong growth of these types of injectables may be attributed to the convenience these delivery systems provide in the administration process. In comparison to intravenous infusions, they are quicker to prepare and administer as well as more convenient for patients. Fixed dose pre-filled syringes have the potential to alleviate pressures on hospitals increasingly struggling with infusion capacity.

The Trend Towards Self-Administration

In the greater context of the patient journey, more emphasis is often assigned to molecular innovation, rather than the delivery of the drug. However, in face of the COVID-19 pandemic, pharmaceutical and drug delivery companies have had to respond to capacity constraints of the healthcare system. One such change is that patient visits have plunged during the peak of the pandemic and levels have still not recovered to full capacity, as seen by IQVIA's EU5 physicians' survey. Mechanisms to improve medicine access and delivery for patients, such as moving toward self-administered rather than hospital-administered formulations, therefore will enter the priority lists for the industry.

We see that injectables that can be self-administered, which we define as certain delivery forms that can be administered outside the hospital setting such as auto-injectors, pens and cartridges and pre-filled syringes, demonstrate growth both in relative and absolute terms, from occupying 43% of the market in 2016 to 48% in 2021. Within the injectables market, self-administered forms are emerging as important drug delivery systems, outpacing the overall injectables market growth by an extra 4.8% CAGR (Figure 2).

The top performing therapy areas for self-administered injectables are autoimmune, antidiabetics, oncology, and multiple sclerosis (Figure 3). Autoimmune and diabetes drugs dominate the market share by far, with a combined worth of $157bn. Growth is also driven by the autoimmune segment, which comprises the largest CAGR of 20% and the largest market share of $88bn. Across the past five years, it singly contributes to 44% of the overall self-administered growth.

Figure 3: Self-administered injectables experience high value growth led by autoimmune

Global self-administered injectables value, bn USD

Figure 2: The global injectables market experiences a steady rise in value, and also in growth of self-administered products
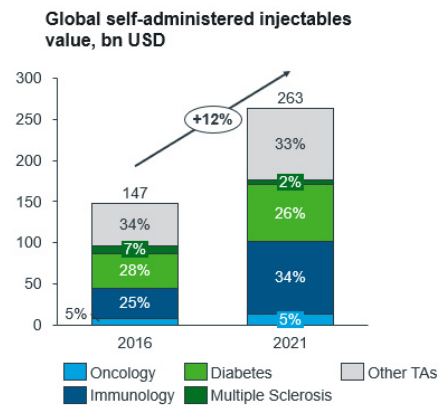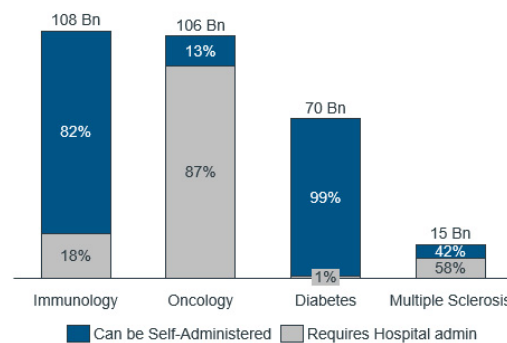

Global Injectables split, bn LCUS$

Diabetes is an area where we see some of the most innovative injectable delivery systems. This is due to the insulin market having matured over the many past decades. The treatment area, chronic in nature, has long demanded patients to have the freedom to self-administer. Hence, the injectable diabetes market is nearly completely saturated with self-administered products, and further innovation aims to be more patient centric by looking beyond formulation, into digital and connected devices.

The immunology market also has a history of pre-filled syringe use and the high level of competition has meant brands are differentiating through the device in order to create better patient experiences by delivering self-administered options. Humira and Stelara, two top sellers, were conceived with the goal of serving patients through prefilled syringes. These two products alone grew in over $20bn in sales from 2015 to 2020, with the latter growing with a 30% CAGR in its prefilled syringe subsegment, quadrupling in value.

The segments that lag in growth are oncology and multiple sclerosis. The launch of blockbuster hospital-administered monoclonal antibody Ocrevus in 2017 in Multiple Sclerosis (MS) has meant that the majority of value in MS comes from infusions which require hospital administration. However, we're are seeing the trend of more convenient forms of administration coming to fore in MS too with the approval of Novartis' Kesimpta, that comes in a pre-filled syringe or pen that is delivered sub-cutaneously once a month, therefore eliminating the need for patients to travel to a hospital or infusion centre for their treatments. (5)
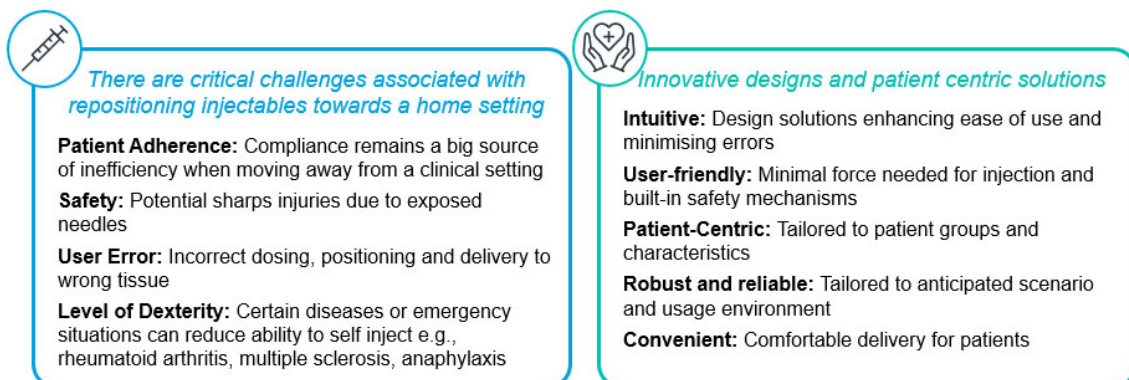
Repositioning injectables: technical considerations
There are various technical barriers to repositioning injectables from specialist centres towards the home setting. (Figure 4) Patient adherence remains a big source of inefficiency when moving away from a clinical setting and is lowest when it's chronic, not immediately life threatening. We also see that as daily dose increases adherence rates drop significantly. Connectivity and improving patient experience through easy to use drug delivery devices, for example with discreet needle systems and designs, could help reduce this burden non-adherence has on the global healthcare system.

Safety issues, such as needlestick injuries and incorrect usage in regards to dosing and delivery of the medicine also present key risks to users when repositioning injectables from specialist centres. Therefore, features to address this in drug delivery systems will be important in patients managing their own diseases in a home environment.

Finally, certain diseases or emergency situations can reduce the ability to self-inject such as patients with advanced rheumatoid arthritis or multiple sclerosis as well as life-threatening situations such as anaphylaxis. This is where the design of the drug delivery device, it being tailored to an anticipated scenario and patient group can make a huge difference in the correct treatment of the patient.

Figure 4: Repositioning injectables from specialist centres towards the home setting requires safe efficient solutions

There are critical challenges associated with repositioning injectables towards a home setting

Patient Adherence: Compliance remains a big source of inefficiency when moving away from a clinical setting

Safety: Potential sharps injuries due to exposed needles

User Error: Incorrect dosing, positioning and delivery to wrong tissue

Level of Dexterity: Certain diseases or emergency situations can reduce ability to self inject e.g., rheumatoid arthritis, multiple sclerosis, anaphylaxis

Innovative designs and patient centric solutions

Intuitive: Design solutions enhancing ease of use and minimising errors

User-friendly: Minimal force needed for injection and built-in safety mechanisms

Patient-Centric: Tailored to patient groups and characteristics

Robust and reliable: Tailored to anticipated scenario and usage environment

Convenient: Comfortable delivery for patients

As the industry experiences a shift towards self administration, these attributes will be more frequently sought after in a wider set of therapy areas

Source: IQVIA European Thought Leadership

Industry needs and opportunities for the packaging industry

With more and more biologics coming to market, drug delivery and packaging companies must innovate to ensure these complex products, with very specific needs, will be delivered to patients safely. Compared to small molecules, biologics are harder to manufacture, keep and administer. This is where packaging, formulations and devices can play a key role in addressing some of the challenges and help companies create differentiation in a highly competitive landscape.

Figure 5 outlines some of the benefits drug delivery, packaging and formulations can provide across the value chain with some examples from the industry ranging from increased shelf life, easier administration to development solutions for pharmaceutical companies. The importance of focusing on the patient is increasingly recognised by companies and other stakeholders. Therefore, simple, and patient centric solutions often provide a shortcut to navigating the complex stakeholder landscape. Improving patient experience through easy to use devices and technologies could also reduce the burden non-adherence has on the global healthcare system.

Innovative Trends in Drug Delivery Devices

There has been much innovation in the drug delivery devices space to address the unmet need and challenges brought by the shifting pharmaceutical landscape. Whilst there are still industry bottlenecks limiting the widespread adoption of innovative drug delivery systems, below are a few examples where companies have pushed the bar in

design, connectivity, and sustainability. These examples also showcase the importance of collaboration and partnerships between companies in an industry where highly specific, technical delivery challenges are prevalent.
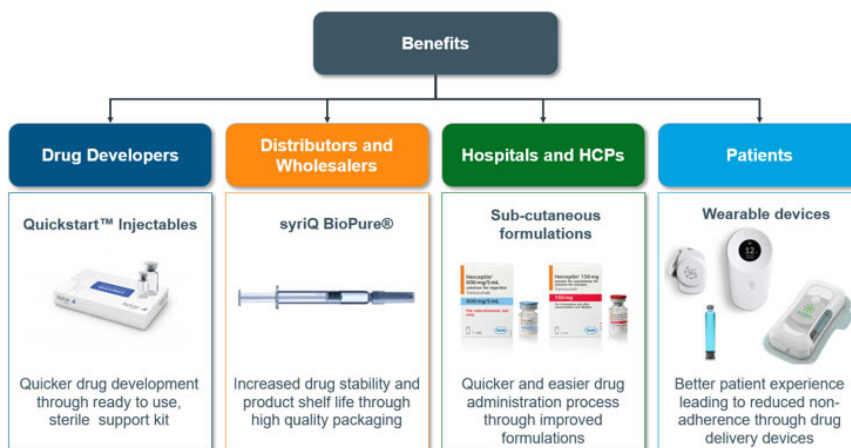
Innovation in Design:

Design has always been a key differentiator for more sophisticated drug delivery systems, playing an important role in meeting unmet need across various therapy areas, patient groups and administration scenarios. One example to this is the SG Maverick emergency use auto-injector, which is designed to perform in one of the most immediately life-threatening situations of severe allergies, and anaphylactic shock. The SG Maverick delivers safe intramuscular injections through an intuitive two-step triggered automatic injection and needle retraction. (6)

Another example of design innovation is the Cimzia pre-filled syringe (PFS) that is the result of a collaboration between UCB and OXO Good Grips. The Cimzia PFS is designed for patients with various autoimmune disorders, where several indications such as severe active rheumatoid arthritis affects movement and dexterity. Cimzia PFS is therefore fitted with a nonslip finger grip, a large thumb pad and a rounded finger loop for easy cap removal, ultimately allowing patients to self-inject after being trained to do so. (7)

Whilst the ultimate purpose of better design is to benefit patients, delivery platforms and systems can also be designed to benefit pharmaceutical companies looking for product differentiation whilst also managing

Figure 5: Inovation in drug delivery, packaging & formulations can provide a range of benefits

additional costs, time, and risk. The Molly device platform by SHL Medical is designed to benefit both patients and pharmaceutical companies through standardised and well thought out solutions. The Molly platform requires minimal number of components which brings down manufacturing costs and the proven technology/system allows for reduced timelines in the development process. (8)

Innovation in Connectivity:

Connected devices play a very important role in the path towards more convenient forms of administration through improving patient support remotely. Connectivity allows patients and HCPs to monitor successful injections, user errors and patient adherence which are all important considerations when taking the patient out of the hospital setting.

Further innovation in connectivity has been centred around guiding patients through the injection process which is a key feature of the AdhereIT connected medical device solution developed by Noble in partnership with Aptar Pharma. The connectivity in AdhereIT provides real time feedback to train patients to correct their self-injection techniques. It also enables remote monitoring to improve adherence overall. Looking ahead, features such as these will be key enablers in moving the patient out of the hospital setting safely. (9,10)

Innovation in Sustainability:

Environmental sustainability has been at the forefront of global discussions, yet the pharmaceutical industry has been relatively slow to react. In regards to drug delivery and packaging, the industry focus to improve sustainability has been on replacing single use devices with reusable ones through modular systems, in an attempt to reduce waste. The Aria smart autoinjector consists of a reusable drive and disposable cassette, claiming to reduce waste by up to 50%. (11) The Respimat inhaler also reduces plastic waste by moving away from a single use device to a reusable one, making it the first reusable and propellant free inhaler on the market for patients with asthma and COPD. (12)

The path ahead

Looking at the prescription medicines market, we still see that the adoption of these drug delivery solutions or technologies happens at a later stage during lifecycle management, mainly as a way to defend against generics and biosimilar competition. There are a few key reasons why pharma companies are hesitant to pursue such options at an earlier stage of drug development such as added risk, cost and time to market.

Connectivity allows patients and HCPs to monitor successful injections, user errors and patient adherence which are all important considerations when taking the patient out of the hospital setting.

Yet undoubtedly there is a greater industry push for more convenient drug delivery systems to be pursued earlier and there are potential solutions which can be achieved through close cross-discipline partnerships. Fit for purpose, platform solutions alongside utilising real-world insights to better define the value and benefit of drug delivery devices could be important enablers in bringing innovative technologies to patients sooner.

References

(1)   IQVIA Market Prognosis Q1 2021

(2)   IQVIA Institute Global Medicine Spending and Usage Trends: Outlook to 2025

(3)   IQVIA MIDAS MAT Q1 2020

(4)   IQVIA Pipeline Intelligence, Sep 2021

(5)   https://www.novartis.com/news/media-releases/fda-approves-novartis-kesimpta-ofatumumab-first-and-only-self-administered-targeted-b-cell-therapy-patients-relapsing-multiple-sclerosis

(6)   https://www.stevanatogroup.com/en/offering/drug-delivery-systems/proprietary-and-licensed-devices/sg-maverick/

(7)   https://www.cimziahcp.com/how-to-use-prefilled-syringe

(8)   https://www.ondrugdelivery.com/development-molly-platform/

(9)   https://www.aptar.com/news-events/noble-and-aptar-pharma-launch-adhereit-connected-onboarding-solution/

(10)   https://www.aptar.com/products/pharmaceutical/adhereit/

(11)   https://www.fiercepharma.com/drug-delivery/phillips-medisize-creates-low-waste-digital-drug-delivery-device

(12)   https://pharmaceutical-journal.com/article/news/first-reusable-propellant-free-inhaler-launched-to-cut-plastic-waste