# Comparative considerations for cartridges and staked-needle prefilled syringes in large-volume autoinjector applications

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## Introduction

Autoinjectors have become standard for many self-administered therapies with dose volumes of 2.0 mL and below, supported by a mature ecosystem built around 1.0 mL long and 2.25 mL glass prefilled syringe (PFS) formats.

As the industry advances larger-volume therapies through clinical development, new trade-offs emerge in primary container selection.

Relevant large-volume autoinjectors today are centering on two primary container formats: the cartridge (3.0 mL and 5.0 mL sizes) and the 5.5 mL PFS.[1]

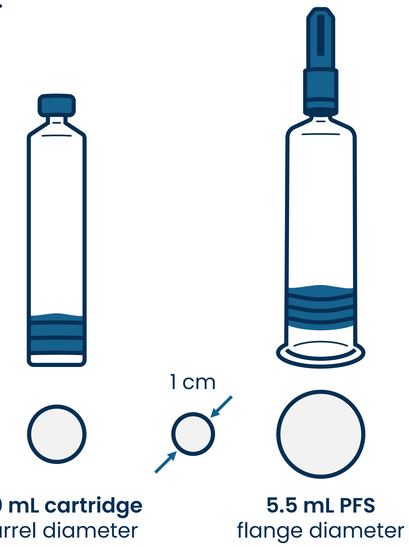



Figure 1: Scaled illustration of 5.0 mL cartridge and 5.5 mL PFS designs along with their respective maximum diametric dimension

## Ergonomics at higher volumes

A 5.0 mL cartridge has a maximum diameter smaller than that of a 2.25 mL PFS. This allows a cartridge-based large-volume autoinjector to retain dimensions similar to familiar 2.25 mL devices whilst delivering more than twice the volume.

In contrast, a 5.5 mL PFS necessitates a larger device to accommodate the increased flange diameter.

Maintaining a familiar form factor may support transfer of established ergonomic and handling principles, improving usability for naïve and experienced users alike.

## Fluid path configurability

In a cartridge-based architecture, the needle is separate from the primary container, allowing the fluid path to be configured independently. Patient-end needle depth and gauge can be selected for specific deposition requirements, while delivery performance can be configured to specification without incurring changes to either the primary container or autoinjector powerpack.

A staked-needle PFS integrates the needle and container into a single component. As such, there is a higher development barrier when a therapy-specific configuration is warranted.

## Packaging density and efficiencies

Ready-to-use containers stay nested through transport, storage, and fill-finish, as such, tub density has effects across the supply chain. More containers per tub means overall fewer tubs, nests, bags, boxes, and pallets per batch, reducing packaging waste and logistics demand while increasing the number of units processed during each tub-handling cycle, e.g., during filling.

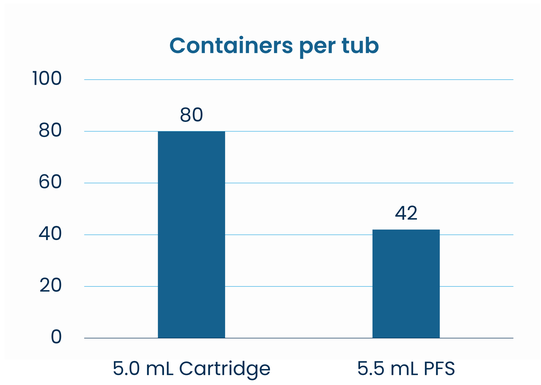



Figure 2: With a flangeless design, cartridges meaningfully increase packaging density[2]

## Clinical development pathways

A 5.5 mL PFS permits manual administration during early clinical studies while autoinjector development continues in parallel. A cartridge generally requires a dedicated delivery system; if the autoinjector is being developed in parallel, the vial presentation would typically be maintained until device readiness.

## Drug and formulation compatibility

Cartridges can offer compatibility advantages for certain products.

For example, silicone-sensitive drugs can benefit from baked-on and cross-linked siliconization processes common to cartridge manufacturing.[3]

With fewer materials of contact, products sensitive to steel, tungsten, or adhesives may have improved stability stored in a cartridge relative to a PFS. For container material, cartridges are available in both polymer and glass, while large-volume syringes are only supplied in glass today.

## Conclusions

Primary container selection is a critical development decision with impacts the ultimate autoinjector presentation.

| Cartridge attributes | PFS attributes |
|---|---|
| Compact device size | Manual injection in trials |
| Fluid path configurability | Integral staked needle |
| Higher packaging density | Simpler clinical pathway |
| Drug compatibility | Format familiarity |
| Glass & polymer available | Glass only |

Table 1: Differentiating attributes of each format

Neither container format is a universal solution. Container selection has knock-on effects throughout development and thus should be aligned with the considerations of the drug, device, patient, and supply chain.

References:
[1] *Zhou, M., Duffy, K., Mitchener, C., Shi, G. H., & Collins, D. (2026). Delivery devices and container closure systems for co-formulated and co-administered biologics. Antibody Therapeutics, 9(3), pp 437–448.*
[2] *Jeangoudoux I, Phole S, "Launching a Large-Volume Prefillable Glass Syringe System: Reliable Subcutaneous Drug Delivery". ONdrugDelivery, Issue 178 (Oct 2025), pp 91–94.*
[3] *Stelzl A, Keilhauer E. From Prefilled Syringes to On-body Devices: How Optimized Biologics Formulations Improve Patient Adherence. Pharma's Almanac. July 8, 2025.*

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