A validated syringe is critical for patient safety.

Learn how your syringe choice can help reduce the potential for serious adverse events during pump infusion.

BD

Your syringe choice can impact flow rate and dose accuracy.

Choosing a syringe that hasn't been validated for use with your infusion pump can put patients at risk of medication errors and flow rate issues, potentially leading to serious consequences.

According to FDA*, non-validated syringes can cause improper pump operation resulting in:

- Inaccurate fluid delivery[1]
- Insufficient occlusion (blockage) sensing[1, 2]
- Other potential problems[1]

The FDA and the BJA** also state that lack of flow continuity can have serious consequences, including:

- Delay of therapy[1, 2]
- Over-infusion or under-infusion[1]
- Abnormal or unstable blood pressure[1]
- Anxiety from loss of sedation[1]
- Increased pain in critically-ill infants[1]

Possible dosage errors from using non-validated syringes:

- 10% under-delivery[3]
- 24% over-delivery[3]

Possible dosage errors when using incorrect selection of syringe type from the syringe driver menu:

- Up to 22% over-delivery[3]

According to a study that investigated if using non-validated syringes or choosing the incorrect syringe from the menu would have an impact on drug delivery.[3]

* **FDA:** U.S. Food and Drug Administration

****BJA:** British Journal of Anaesthesia

Choosing a validated syringe can help minimise false alarms[1] and care disruptions.[4]

An important element to delivering safe, accurate infusions is being able to rely on infusion pump alarms and to react quickly.

All infusion pump alarms are continuous and require clinician intervention to silence/resolve. Most alarms will stop the infusion or prevent it from being initiated until the alarm condition is resolved by the clinician.[5]

Reducing false alarms may reduce patient risk.

False alarms not only concern patients and distract clinicians from other important patient care, they can also result in "alarm fatigue"—when an abundance of non-actionable alarms result in desensitizing clinical staff to all alarms, in turn affecting response time to those that are actionable.[5]

- For critical short half-life medications, alarm fatigue can be dangerous.[6]
- Any infusion interruption can have potentially serious hemodynamic consequences, including hemodynamic instability, severe hypotension and cardiac shock.[6]

In a study, the average resolution time was:

for 17% of alarms[7]

for 3% of alarms[7]

Table 1: Critical short half-life medications with plasma half-lives and sequelae to extended infusion interruption.[6]

Critical short half-life infusion	Plasma half-life in seconds	Possible impact of infusion interruption	Possible impact of post-occlusion bolus
Adrenaline/epinephrine	180	Hemodynamic instability and severe hypotension	Hemodynamic instability and severe hypertension Coronary artery contraction
Dobutamine	120	Hemodynamic instability and hypotension Cardiac shock	Hemodynamic instability and hypertension
Dopamine	60–120	Hemodynamic instability and hypotension	Hemodynamic instability and severe hypertension
Noradrenaline/norepinephrine	120–180	Hemodynamic instability and severe hypotension	Hemodynamic instability and severe hypertension Coronary artery contraction

Infusion-interruption of critical short half-life infusions was found to be a **significant problem** in all areas of the general critical care pump population, with a significant number of downstream (i.e., vein and access) occlusion events noted, according to a study of 1,183 infusion pumps used in critical care environments and in general care areas within the European region.[6]

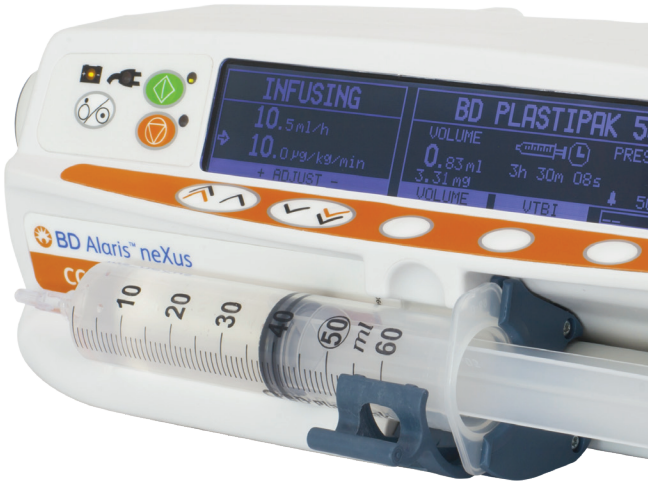
Average frequency of alarms per infusion[6]:

1.39
Whole hospital

4.5
General critical care

8.61
Pediatric intensive care unit (PICU)

The right syringe can help deliver medication safely and effectively.

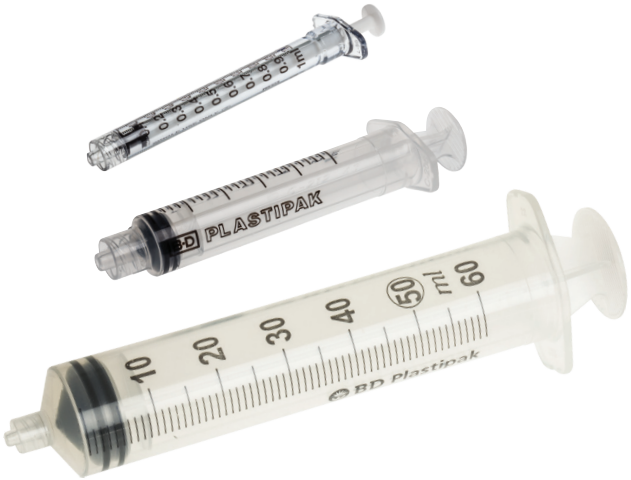


Choosing the most appropriately-sized validated syringe can help reduce medication errors and false pump alarms.

FDA pump infusion syringe recommendations

Ensure syringe sizes and product codes are validated by the syringe pump manufacturer (refer to the manufacturer's instructions for use).[1]

Choose the smallest compatible syringe size necessary to deliver the fluid or medication; this is especially important when infusing high-risk or life-sustaining medications at low infusion rates (e.g., less than 5 mL per hour).[1]



Validated syringe size matters

A study that evaluated the impact of syringe size on start-up delay and the time to reach 50% and 90% of target flow rates found an impact of syringe size on syringe infusion pump performance at low flow rates. Using a 50mL syringe, the start-up delay was **consistently higher** and the time to reach 50% and 90% of target flow were **significantly longer,** regardless of which syringe infusion pump was used.[8]

These study findings suggest that **smaller syringe sizes and higher infusion rates are preferable** for continuous drug infusions, particularly when prompt establishment of the drug effect is critical. This could be especially important when vasoactive medications are being used in the treatment of critically ill neonates and smaller infants where there are significant limitations to increase the infusion rates.[8]

Right syringe. Right size. Right choice.

Selecting the right syringe requires careful consideration. Not all syringes are validated for use on all infusion pumps. Not all infusion pumps can automatically recognise syringe brands and their specific product codes.[9] To keep patients safe throughout their infusion, it's critical to choose an appropriately sized syringe that has been tested and validated by the pump manufacturers.

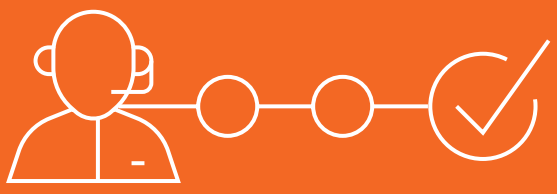
BD syringes are more widely used by healthcare professionals globally than any other brand and are validated for use on most major infusion pumps.

Designed to meet international standards for safety and efficacy

BD Plastipak™ validated syringes have been tested by most pump manufacturers and demonstrated to meet IEC 60601-2-24 international standards for accuracy, flow rates, safety and efficacy.

IEC 60601-2-24[10] is an international standard for information pumps and controllers and sets out specific requirements for:

- Accuracy tests
- Time to occlusion
- Bolus after occlusion release
- Prevention of over-infusion and free flow



BD can support your transition to safer infusions

At BD, our goal is to educate clinicians to choose and use a validated syringe to improve patient safety. Our broad portfolio offers a variety of validated syringes and hypodermic solutions to meet most needs.

References

1 U.S. Food and Drug Administration. Syringe pump problems with fluid flow continuity at low infusion rates can result in serious clinical consequences: FDA safety communication. Accessed on July 1, 2020, at: https://www.fdanews.com/ext/resources/files/2016/08/08-25-16-pumpsafetynotice.pdf?1480880246. **2** Baeckert M, Buehler PK, Weiss M et al. (2020). Performance of modern syringe infusion pump assemblies at low infusion rates in the perioperative setting. *British Journal of Anaesthesia*, 124(2):173-182. **3** Tooke LJ, Howell L. Syringe drivers: incorrect selection of syringe type from the syringe menu may result in significant errors in drug delivery. *Anaesth Intensive Care.* 2014 Jul;42(4):467-72. doi: 10.1177/0310057X1404200407. PMID: 24967761. **4** Insight research agency. MMS IV infusion system user research and exploration. 2015:46-47. **5** Glover KR, Vitoux RR, Schuster C, Curtin CR. Types and frequency of infusion pump alarms: Protocol for a retrospective data analysis. *JMIR Res Protoc.* 2018;7(6):e10446. Published 2018 Jun 14. doi:10.2196/10446. **6** Waterson J, Bedner A. Types and frequency of infusion pump alarms and infusion-Interruption to infusion-Recovery times for critical short half-life infusions: Retrospective data analysis. *JMIR Hum Factors.* 2019;6(3):e14123. Published 2019 Aug 12. doi:10.2196/14123. **7** Yu D, Hsu K-Y, Kim JH, DeLaurentis P. Infusion pump informatics approach to quantify impact of alerts and alarms on healthcare delivery. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 2017;61(1):681-685. doi:10.1177/1541931213601657 **8** Schmidt N, Saez C, Seri I, Maturana A. Impact of syringe size on the performance of infusion pumps at low flow rates. *Pediatr Crit Care Med.* 2010;11(2):282-286. doi:10.1097/PCC.0b013e3181c31848 **9** Chae YJ, Kim JY, Kim DW, Moon BK, Min SK. False selection of syringe-brand compatibility and the method of correction during target-controlled infusion of propofol. *Korean J Anesthesiol.* 2013;64(3):251–6. doi: 10.4097/kjae.2013.64.3.251. **10** Controllers, M., 2021. IEC 60601-2-24:2012 | IEC Webstore. [online] Webstore.iec.ch. Accessed on July 2, 2020 at https://webstore.iec.ch/publication/2635.

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