

ARK – FAQs

Asthma Rescue Kit™ – Frequently Asked Questions

Q1: Isn't the flow, at 8 L/min, too low? How does it meet patient inspiratory flow demands?

A1: We realize that many people will regard 8 L/min as being insufficient flow to satisfy a patient's inspiratory demands. This is based largely on prevailing respiratory therapy dogma which, in turn, is based upon the fact that many prior devices have required high flowrates specifically because they are *open* systems. Open systems do require high flowrates in order to minimize dilution of inspired gas and aerosol with entrained room air. However, high flowrate open systems are wasteful and inefficient and, while they may ascertain undiluted inspired gas concentrations, they severely dilute the concentration (density) of aerosol available for inhalation. Ask yourself what happens to all the excess flow that the patient does not inhale? With the Asthma Rescue Kit we have intentionally created a new paradigm:

The Asthma Rescue Kit is a **low-flow, closed-system** device with integral exhalation filtration. It utilizes a portless mask, an elastic rubber reservoir bag, and is designed to conserve, rather than waste, both aerosol and heliox. Maximum gas flowrate into the device is only 8 L/min. Higher flowrates do not result in greater effectiveness and will only waste both aerosol and heliox. In fact, too much flow will cause the device to become less effective as an aerosol delivery device because the reservoir bag will not get an opportunity to work properly (it must alternately *fill and empty* in order to enhance aerosol delivery; staying filled does not enhance aerosol delivery).

The Asthma Rescue Kit is appropriate only for the acute severe asthmatic's breathing pattern but not for non-asthmatics who are breathing near normally or deeply. Severe asthmatics are typically hyperinflated and breathing rapidly and shallowly on top of a significantly elevated FRC. Their tidal volumes are, in fact, so high up on their total pressure/volume curve that they can not take a slow and deep breath even if they try. That is why they are breathing rapidly and shallowly. Although the instantaneous peak flow rate during rapid/shallow breathing may be high, it is not sustained for very long and therefore does not require a high continuous flowrate because the elastic reservoir bag and the unidirectional flow of the Asthma Rescue Kit adequately satisfies typical inspiratory demands. If patients do exceed the inspiratory capability of the system, they will be able to inhale room air retrograde through the expiratory filter. By the time an acute asthmatic can do this, he or she has probably recovered sufficiently from the severest phase of the attack and probably no longer requires heliox therapy, although the device can continue to be used for aerosol delivery if required.

Q2: Isn't there a lot of rainout in the 6 foot long tube?

A2: No. As we have seen in our testing, and as you will see for yourself during clinical application, there is no appreciable rainout. Physically, it is practically invisible. The only way we have been able to detect it is with radioactively-tagged aerosols. There is a small amount, a few percent of the nebulizer charge, but nothing of an amount sufficient to reduce aerosol delivery to the patient. There are three main reasons for this embodied within the design of the Asthma Rescue Kit: (a) as a low flow device there is less turbulence to cause rainout than is commonplace with high-flow systems, (b) the median particle size ranges between 1.0 and 1.5 microns (MMAD) instead of the typically larger particles produced by high-flow systems (larger particles predispose to rainout), and (c) when operated with heliox, the flow is even less turbulent due to the properties of heliox, and therefore less predisposed to rainout as a result. We know from our testing and the experience of other users that you will not experience any problems with rainout of particles in the tubing. The best proof is in actually using the device and seeing for yourself.

[continued ...]

Q3: Isn't there a lot of rainout in the reservoir bag?

A3: No. Again, for the same reasons as above, there is no significant rainout in the reservoir bag, just a few percent of the nebulizer charge when measured by radioactive tagging. This is also related to the fact that, by definition, *an aerosol is a cloud of particles that has the ability to stay suspended in gas for prolonged periods of time before settling*. So the vast majority of aerosol particles that enter the bag during the patient's exhalation phase also leave the bag on the subsequent inspiration. Very few particles make contact with the sides of the bag and remain there. However, the inside of the bag will be slightly moist due to condensation.

Q4: Doesn't the reservoir bag become an infection hazard?

A4: No. The reservoir bag is isolated from the patient by 6 feet of aerosol tubing plus the unidirectional flapper valve in the body of the Möbius device. So it is unlikely that any patient-generated pathogens are going to enter the reservoir bag. We have deliberately contaminated the bag with radioactive albuterol and after 15 minutes of operation could not detect any radioactive albuterol in the nebulizer or in a filter at the airway opening. This suggests that, even if the bag were to become contaminated, that contamination does not impart itself to the aerosol cloud that enters and subsequently leaves the bag.

Q5: Wouldn't it be better to use a clear vinyl plastic reservoir bag instead of that ugly green one?

A5: No. There is a very good reason why we deliberately use a Neoprene (non-latex) elastic rubber reservoir bag instead of a more-attractive looking vinyl bag. A vinyl bag simply does not work as well because it has no elasticity and tends to remain inflated. A vinyl bag will not tend to collapse during the patient's inspiratory phase; it will stay inflated. The tendency of the rubber bag to collapse on inspiration aids in emptying the stored aerosol from the bag and enhances aerosol delivery to the patient.

Q6: Is there any CO₂ rebreathing on account of the low flow?

A6: No. We have not been able to confirm any CO₂ rebreathing by capnography. We have measured end-tidal carbon dioxide tension (PetCO₂) on nose breathing subjects with a nasal sampling cannula and have found that PetCO₂ on and off the Asthma Rescue Kit with 8 L/min total gas flow are the same.

Q7: What is the purpose of the filter?

A7: Because acute severe asthmatics are commonly treated in Emergency Departments, and because EDs frequently treat patients that they do not know, and because unknown patients may have infectious respiratory diseases (TB, HIV, influenza, etc.), and because there is no valid justification for a healthcare worker to be breathing a patient's "second-hand" aerosol drugs, we thought it would be prudent to protect the healthcare worker from these potential hazards. Also, the very slight resistance of the expiratory filter (~1.0 cmH₂O/L/sec) encourages the flapper valve to quickly close at the beginning of the expiratory phase thereby directing the continuously generated aerosol into the reservoir bag where it is stored until the next inspiration.

Comprehensive details are available on the Web: www.asthmarescue.com

The Asthma Rescue Kit™ and Asthma Rescue Kart™ are trademarks of Healthline Medical, Inc. and sold only by Healthline Medical, Inc. and LifeGas, Division of Linde Gas, LLC.



Healthline Medical, Inc.

877.626.2626 • www.aerosol-medicine.com



LifeGas

866.543.3427 • www.lifegas.com