

# Fresh Gas Flow Effects on Provider Volatile Gas Exposure

## Background

- Pediatric anesthesia providers often use inhalation induction, releasing waste anesthetic gases (WAG) during induction itself or when the circuit is disconnected for intubation or LMA placement.
- Occupational exposure to WAG: Differences identified between exposed and non-exposed hospital personnel using biological markers of exposure,<sup>1-3</sup> operating room (OR) and recovery room WAG levels,<sup>3</sup> and pathologic outcomes.<sup>4, 5</sup>
- Positive correlations between levels of exposure and:
  - rates of neutrophil apoptosis<sup>2</sup>
  - sister chromatid exchange rates<sup>1, 6</sup>
  - halogen-induced occupational asthma<sup>7</sup>
  - hepatic autoantibodies<sup>8</sup>
  - pregnancy outcomes<sup>5</sup>
- Pediatric anesthesiologists have higher levels of exposure, with increased biomarkers and pregnancy outcome risk<sup>3, 5, 8</sup>
- Current practice: provider-to-provider variation
  - Rest the circuit by the bedside
  - Ask assistant to cover the mask/circuit
  - Turn down the agent
  - Reduce fresh gas flow
  - Stopper to block the output of the circuit<sup>9, 10</sup>

## Specific Aims

- Determine whether adjusting the fresh gas flow rate during induction has a measurable effect on ambient sevoflurane levels, thereby reducing anesthesia provider exposure.
- If a simple modification in practice yields a reproducible reduction in WAG levels, then a “best practice” guideline can be recommended to reduce exposure.

## Study Design

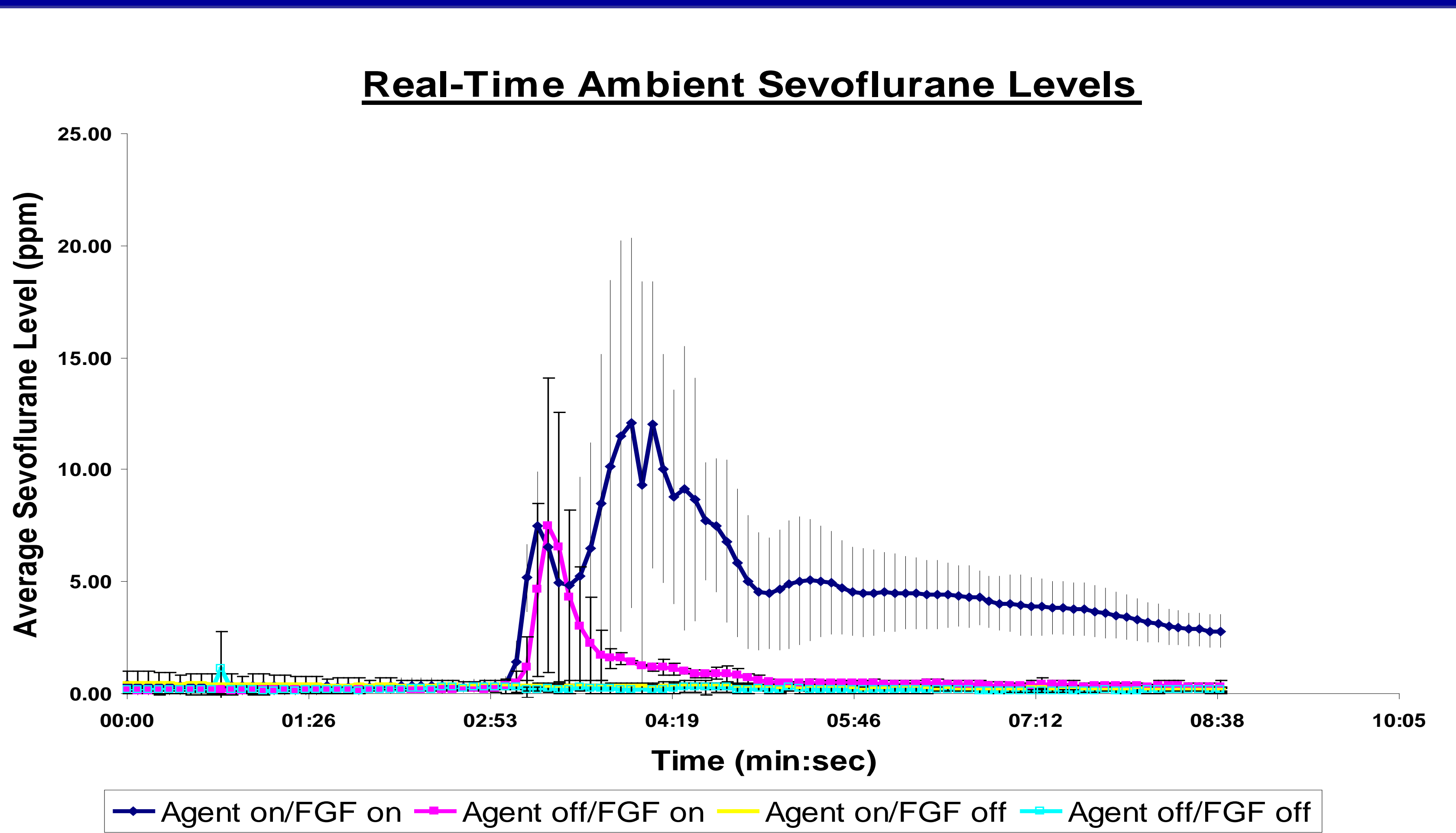
We measured and compared the ambient level of sevoflurane (agent) during simulated mask induction of pediatric patients with four different fresh gas flow (FGF) and agent settings:

- Mock inductions using an infant lung model
- Trials were repeated for an n=3 for each group, with conditions standardized to represent current anesthetic practice
- Sevoflurane levels were recorded every 5 seconds and compared between groups

Group	Sevoflurane	Fresh Gas Flow (O <sub>2</sub> )
1 (agent on/FGF on)	4 %	10 L/min
2 (agent off/FGF on)	Off	10 L/min
3 (agent on/FGF off)	4 %	Off (0.05 L/min)
4 (agent off/FGF off)	Off	Off (0.05 L/min)

Table 1 – Summary of Circuit Settings While Airway is Secured

## Results



- Significant reduction in max level shown in Groups 3 & 4 ( $p = 0.02$  and  $0.03$  respectively) but not in Group 2 ( $p = 0.25$ )
- With time-weighted averages, significant reductions were seen with all three experimental settings, Groups 2, 3, & 4 ( $p = 0.01$  for Group 2,  $p < 0.01$  for Groups 3 & 4)

## Discussion

- Ultimate goal: To reduce chronic occupational exposure of anesthesia providers to waste anesthetic gases during pediatric inhalation induction
- Real-time mass spectrometry showed reproducible difference in ambient sevoflurane levels by turning down flow in the anesthesia circuit
  - No adjustment was needed to the volatile agent level in order to see significant reduction
  - Peak levels occurred within a few minutes of mock intubation then returned to baseline

## Conclusion

- Single dial adjustment (FGF) prior to disconnecting patient from circuit yields significantly lower ambient sevoflurane levels, reducing both peak and time-weighted average exposure levels

## References

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