

Project Deliverable

The purpose of this document is to provide results from the Doctor of Nursing Practice (DNP) Surgical Smoke Study that was conducted from September 27, 2022 to October 27, 2022 by Anne Skuse, a Student Registered Nurse Anesthetist at the University at Buffalo, School of Nursing. Additionally, the intent is to raise awareness and provide education about surgical smoke, potential hazards associated with surgical smoke exposure and the availability of different masks to protect against surgical smoke.

What is Surgical Smoke and What are Hazards Associated With it?

Electrocauterization produces surgical smoke known to contain carcinogens, malignant cells, viruses and bacteria (Robertson-More & Wu, 2021). The amount of surgical smoke varies per case and the extent of electrocautery use; but, in some cases, it has been reported the amount of surgical smoke created was equivalent to inhaling the smoke of up to 27 to 30 cigarettes (Bree et al., 2017). There is documented evidence about the potential health hazards associated with surgical smoke exposure. Surgical smoke inhalation has resulted in cross infection of human papillomavirus (HPV) (Hu et al., 2020). Headache, watery eyes, cough, throat burning, respiratory infection, nausea, drowsiness, dizziness, sneezing, rhinitis, hematological cancer and central nervous system injury have also been reported (Ilce et al., 2016). Despite evidence of the detrimental health effects surgical smoke exposure can cause, efforts to reduce exposure have been minimal and slow to be implemented into practice. Hospitals and surgical centers do not always use smoke evacuation systems.

Current States With Laws Pertaining to Surgical Smoke:

Smoke evacuation systems are not required or always used in some states throughout the United States. Currently, only Rhode Island, Colorado, Illinois, Kentucky and Georgia have executed surgical smoke laws; these laws require hospitals and ambulatory surgical centers to implement protocols that ensure the use of smoke evacuation systems during procedures that will generate surgical smoke (Association of periOperative Registered Nurses (AORN), 2022). Oregon will require these policies by January 1, 2023 and Arizona, Connecticut and Washington will require policies for smoke evacuation system use by January 1, 2024 (AORN, 2022). Further, Washington's law states that hospitals with less than 25 beds, sole community hospitals and Medicare dependent hospitals have until January 1, 2025 for these policies to be implemented (AORN, 2022).

The Difference Between Level 1, 2 and 3 Surgical Masks:

Hospitals and surgical centers typically offer level 1, 2 and/or 3 surgical masks. The levels are awarded based on the American Society of Testing and Materials (ASTM) rating. ASTM is an international organization that defines and sets standards for surgical masks among other things (RDI Medical, 2020). Masks must meet the performance criteria stated in the ASTM Standard to meet National Institute for Occupational Safety and Health performance recommendations (Centers for Disease Control and Prevention, 2021). Masks are tested and differ in categories such as, fluid resistance, bacterial filtration efficiency, particulate filtration, breathability and flammability. The Level 3 mask offers the most protection of the three masks.

TEST	LEVEL 1	LEVEL 2	LEVEL 3
ASTM F1862 Fluid resistance (mmHg)	80	120	160
ASTM F2101 Bacterial filtration efficiency	≥ 95%	≥ 98%	≥ 98%
ASTM F2299 Particulate filtration at 0.1 micron:	≥ 95%	≥ 98%	≥ 98%
MIL-M-36954 C Breathability (mm H2O)	< 4.0	< 5.0	< 5.0
16 CFR Part 1610 Flame Spread	Class 1	Class 1	Class 1

(RDI Medical, 2020; Sante Group, 2020)

*Disclaimer: Data varies across sites, so this is only meant to raise awareness of the different types of masks one may encounter in practice. I have not personally researched or tested the efficacy and filtration abilities of masks. The data is obtained from referenced sources.

Pertinent Findings from the Surgical Smoke Study:

66 CRNAs that are members of either New York State Association of Nurse Anesthetists (NYSANA) or the CRNAs and SRNAs Facebook page and are currently working in cases in which electrocauterization is used were included in this study.

- 96.9% were aware of surgical smoke
- 77.3% reported they were aware of health hazards associated with surgical smoke
 - 22.7% reported experiencing side effects of surgical smoke exposure including, headache, cough, nausea, watery eyes, respiratory infection and asthma.
- 74.2% stated their facility uses local exhaust ventilation methods during electrocauterization that produces surgical smoke, 15.2% were unsure and 10.6% of participants reported their facilities do not use any smoke evacuation methods
 - Reported barriers to local exhaust ventilation method use are listed from the most common reason to least common reason reported: unsure, expense, ergonomic difficulties, difficult to set up or lack of training on how to set it up, noise and lack of requirement, lack of fear of surgical smoke, distraction, the circulator forgets or it is not used unless there is a lot of smoke and the surgeon requests it, or the participant stated they have no input on the matter.
- 36.4%, were unsure when asked which mask they felt they should wear for adequate protection against surgical smoke
- Only 12.1% reported that they agreed or strongly agreed level 1 masks provided adequate protection against surgical smoke and only 9.1% chose a level 1 surgical mask as the option for which mask they felt they should wear for adequate protection from surgical smoke.

- Yet, 43.9% participants wear a level 1 surgical mask during electrocauterization
- 27.3% of participants reported that their facility only supplied level 1 surgical masks
- Only 30.3% agreed or strongly agreed that their place of employment had a protocol for eliminating surgical smoke
- 54.5%, disagreed or strongly disagreed that their place of employment provided/(s) education about surgical smoke or methods of prevention
- 83.3% stated they never received any education about surgical smoke from their place of employment.
- 63.6% of participants denied receiving any education about surgical smoke, potential negative health effects from exposure or methods of prevention from their anesthesia program.

References

- Association of PeriOperative Registered Nurses (AORN). (2022). *Surgical smoke laws*. file:///C:/Users/annem/Downloads/Surgical_Smoke_Laws22.pdf
- Bree, K., Barnhill, S., & Rundell, W. (2017). The dangers of Electrosurgical smoke to operating room personnel: A review. *Workplace Health & Safety*, 65(11), 517-526. <https://doi.org/10.1177/2165079917691063>
- Centers for Disease Control and Prevention. (2021, May 18). *Making masks for the workplace*. <https://www.cdc.gov/niosh/topics/emres/pandemic/default.html>
- Hu, X., Zhou, Q., Yu, J., Wang, J., Tu, Q., & Zhu, X. (2020). Prevalence of HPV infections in surgical smoke exposed gynecologists. *International Archives of Occupational and Environmental Health*, 94(1), 107-115. <https://doi.org/10.1007/s00420-020-01568-9>
- Ilce, A., Yuzden, G. E., & Yavuz van Giersbergen, M. (2016). The examination of problems experienced by nurses and doctors associated with exposure to surgical smoke and the necessary precautions. *Journal of Clinical Nursing*, 26(11-12), 1555-1561. <https://doi.org/10.1111/jocn.13455>
- RDI Medical. (2020, October 29). *Difference between ASTM level 1, 2, and 3 face masks*. <https://rdimedical.com/differences-between-astm-level-face-masks-2/>
- Robertson-More, C., & Wu, T. (2021). A knowledge gap unmasked: Viral transmission in surgical smoke: a systematic review. *Surgical Endoscopy*, 35(6), 2428-2439. <https://doi.org/10.1007/s00464-020-08261-5>
- Sante Group. (2020, November 6). *What is the difference between level 1, 2 and 3 masks?* <https://sante-group.com/what-is-the-difference-between-level-1-2-3-masks/#:~:text>