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Center for Occupational and Environmental Health Continuing Education at the University of California, Berkeley

Supporting Surgical Smoke Evacuation Legislation Through a Policy Analysis

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Objectives



Upon completion of this webinar, attendees will be able to:

- Discuss surgical smoke exposure potential in the health care industry
- Identify the potential health risks to perioperative personnel exposed to surgical smoke
- List actions to help protect perioperative personnel and patients from the dangers of surgical smoke
- Analyze surgical smoke as a health policy issue

Background

- Perioperative personnel*and patients are frequently exposed to surgical smoke by-products created by thermal devices used to destroy tissue
- Devices are often used in procedural areas including gynecology, dermatology, orthopedics, dentistry
- Surgical smoke plume may contain toxic gases, vapors, dead/live cellular material
- NIOSH Health & Safety Practices Survey of Healthcare Workers indicate that only 14% reported evacuating surgical smoke during electrosurgery procedures

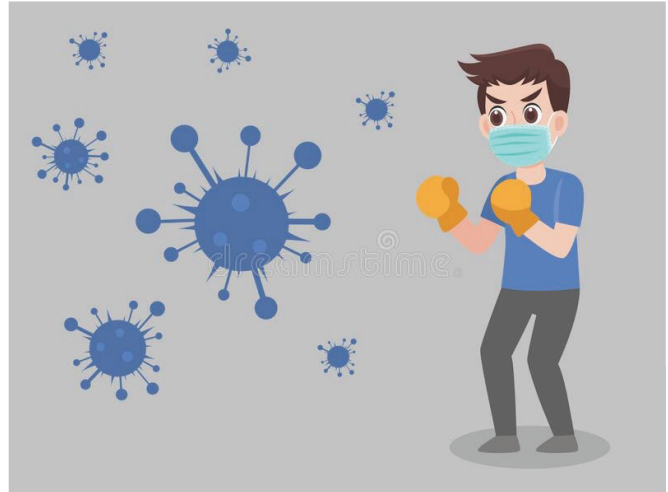
Surgical Smoke Defined: Concept Analysis

- Principle-Based concept analysis conducted to define surgical smoke and identify implications for perioperative personnel, patients, researchers, and policy makers.
- Phenomenon-Surgical smoke, is a well defined, mature, concept



Defining Characteristics of Surgical Smoke

- Appears in an environment when specific surgical tools are used to cut, resect, destroy or cauterize tissue
- A vapor, smoke, or plume is created in a highly controlled environment (air flow, humidity, personnel, temperature)
- Without proper smoke evacuation from the environment, immediate and long-term health effects for perioperative personnel may occur
- Unlikely to be confused with other odors



Vortman, R., McPherson, S., & Wendler, CM. (2021). State of the science: A concept analysis of surgical smoke. *AORN Journal*, 113(1), 41–51. <https://doi-org.proxy.cc.uic.edu/10.1002/aorn.13271>

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Surgical smoke and the anesthesia provider

- Scarce data available linking human disease with SS exposure
- Costs for routine smoke evacuation difficult to determine due to proliferation of companies manufacturing surgical smoke evacuation devices (SEDs)
- Most cost between \$1 - \$2K USD
- Single patient use accessories:
 - Associated filters, tubing, electrosurgical pencils (several hundred dollars)

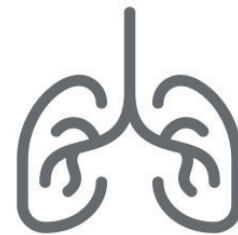


Swerdlow, B.N. Surgical smoke and the anesthesia provider. *J Anesth* 34, 575–584 (2020). <https://rdcu.be/cIFCB>

Impact of Surgical Smoke

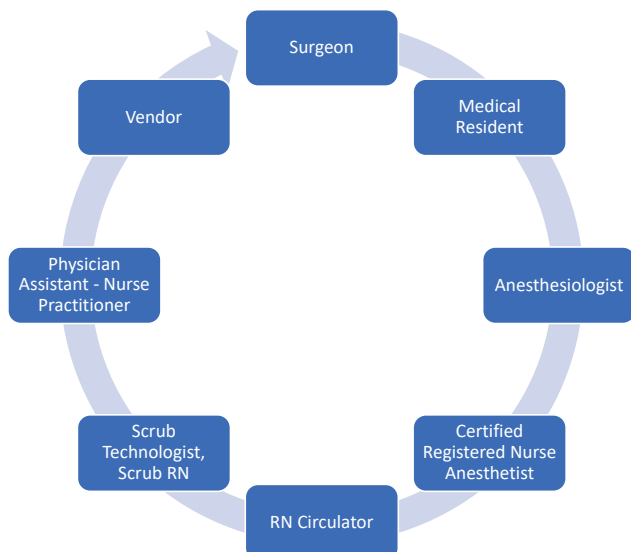


- OSHA (2017): Over 500,000 US healthcare workers exposed annually
- Perioperative nurses report twice the number of respiratory issues compared to the general US population (Ball, 2012)










Images from ConMed Corporation (2021): https://product.conmed.com/clear-the-air_2/

Impact on Perioperative Personnel



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Potential Health Risks of Surgical Smoke Exposure		
	Respiratory System	Nasal/throat irritation and lesions, sneezing, inflammatory changes (e.g., emphysema, asthma, bronchitis)
	Eyes	Eye irritation, tearing
	Integumentary System	Dermatitis
	Gastrointestinal System	Nausea, vomiting
	Hematological System	Anemia, Leukemia
	Infections	Human Immunodeficiency Virus (HIV), Hepatitis, Human Papilloma Virus (HPV)
	Other	Carcinoma, shortness of breath, dizziness, headache, anxiety, weakness

Source: Alp, E., Bijl, D., Bleichrodt, R. P., Hansson, B., & Voss, A. (2006). Surgical smoke and infection control. *The Journal of Hospital Infection*, 62(1), 1–5.
<https://doi.org/10.1016/j.jhin.2005.01.014>

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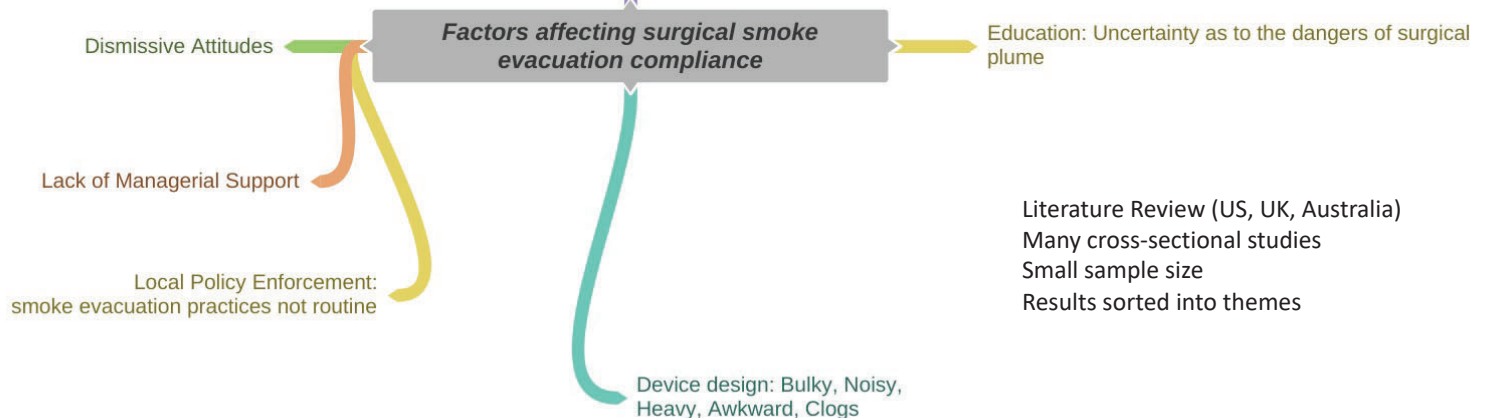
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...the frequency of smoke evacuation reflects clinician perception of the relative hazard...

Edwards & Reiman (2008)

Surgeon refusal



Holmes, S. (2016). Factors affecting surgical plume evacuation compliance. *Journal of Perioperative Nursing*, 29(4). <https://doi.org/10.26550/2209-1092.1010>

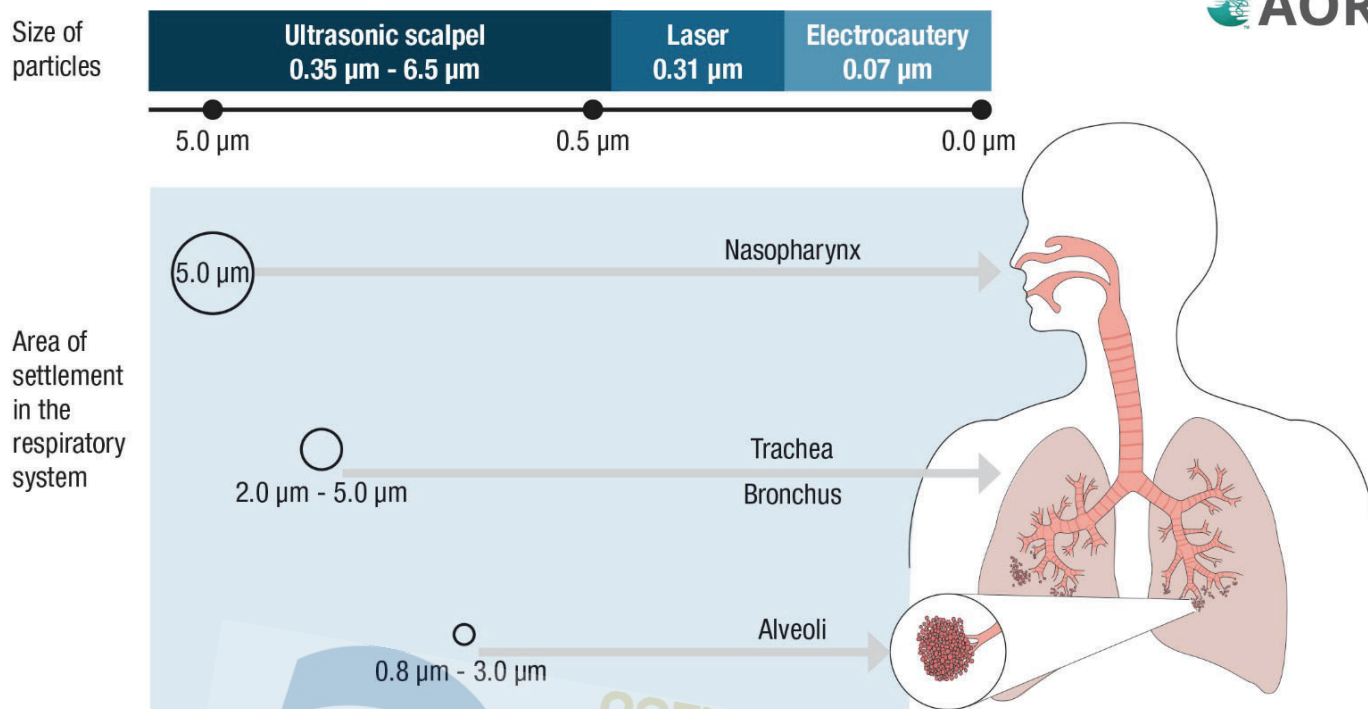


Figure 2. Surgical Smoke Particle Size. From the AORN Guidelines for Perioperative Practice Reprinted with permission from Guidelines for Perioperative Practice. Copyright © 2021, AORN, Inc, 2170 S. Parker Road, Suite 400, Denver, CO 80231. All rights reserved.



Surgical Smoke Lawsuits

- As the public and perioperative personnel become aware and possibly experience the associated health hazards, employers should be aware of legal implications from a lack of supplies and facility policies to evacuate surgical smoke
- Highlights the importance of evacuating surgical smoke

Employment Law Lookout

Insights for Management

Home » Holy Smoke! Health Care Employers Must Abate Surgical Smoke Hazards In The Operating Room

Holy Smoke! Health Care Employers Must Abate Surgical Smoke Hazards in the Operating Room

By Seyfarth Shaw LLP on May 23, 2019

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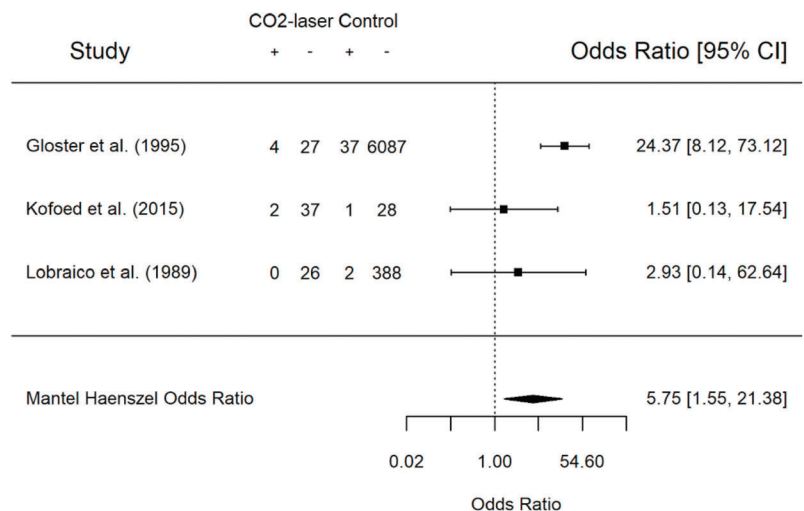
- Centers for Disease Control & Prevention
- National Institute for Occupational Safety & Health
- American National Standards Institute
- International Organization for Standardization
- Professional Organizations (Association of periOperative Registered Nurses, Operating Room Nurses Association of Canada, Australian College of Operating Room Nurses, International Council on Surgical Plume)



Airborne human papillomavirus (HPV) transmission risk during ablation procedures: A systematic review and meta-analysis

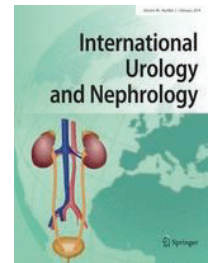
- Background: HPV is associated with development of oropharyngeal cancer
- Aim: to assess airborne transmission risk of infectious particles from HPV lesions to airway mucosa of medical staff in ablation procedures
 - occupational risk of airborne HPV transmission and safety measures during ablation procedures.
- Methods:
 - Systematic Review: literature relevant to airborne HPV transmission (prior to 9/2020)
 - Meta-Analysis: Controlled studies reporting prevalence of HPV upper airway disease in staff performing ablation procedures on HPV lesions

Forest plots of meta-analysis regarding prevalence of reported oral/nasal/pharyngeal lesions amongst CO₂ laser users versus controls with any warts



Evaluation of fine particles in surgical smoke from urologist's operating room by time and distance

- **Introduction:** Electrocautery and other surgical techniques can generate surgical smoke with high proportion of 'fine particles' (PM 2.5) $<2.5\ \mu\text{m}$, which is known to have adverse effects on human health.
- **Methods:** The study included various urology surgeries; five of each. A particle counter was placed at three different distances from the incision site, and the real-time PM(2.5) concentration was displayed after each cut. Air Quality Index (AQI) revised by the US Environmental Protection Agency and the calculated inhalation dose were used to evaluate the severity of PM(2.5).
- **Conclusion:** During surgeries, the concentration of fine smoke particles could reach a very unhealthy status, especially for the chief surgeon who is the nearest to the incision site.
- Surgical smoke evacuation in the first few seconds of a cut is essential; however, using smoke evacuators such as a wall suction alone may not be enough.



[Wang, H. K., Mo, F., Ma, C. G., Dai, B., Shi, G. H., Zhu, Y., Zhang, H. L., & Ye, D. W. \(2015\). Evaluation of fine particles in surgical smoke from a urologist's operating room by time and by distance. *International Urology and Nephrology*, 47\(10\), 1671–1678.](#)

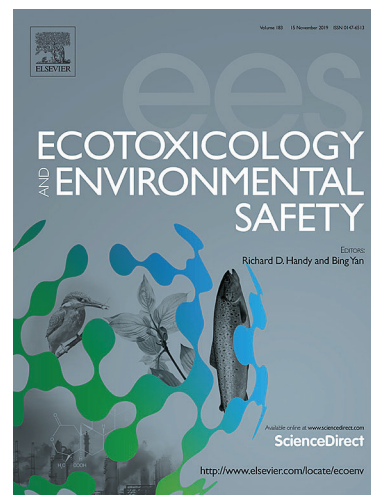
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Fine particles in surgical smoke affect embryonic cardiomyocyte differentiation through oxidative stress and mitophagy

- Investigators proposed that fine particles in surgical smoke and atmospheric fine particles exhibit similar levels of toxicity toward **embryonic development**.
- Fine particles in surgical smoke potentially affect the beating of cardiomyocytes by damaging mitochondria and increasing oxidative stress.

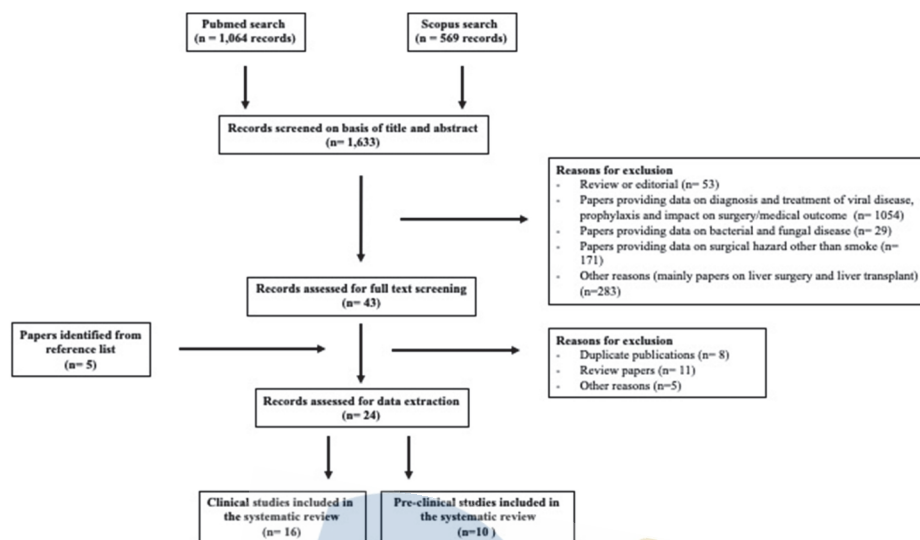


[Zhou R, Xia M, Zhang L, Cheng Y, Yan J, Sun Y, Wang J, Jiang H. \(2021\). Fine particles in surgical smoke affect embryonic cardiomyocyte differentiation through oxidative stress and mitophagy. *Ecotoxicology Environmental Safety*, 217, 112259.](#)

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Risk of Virus Contamination Through Surgical Smoke During Minimally Invasive Surgery: A Systematic Review of the Literature on a Neglected Issue Revived in the COVID-19 Pandemic Era



- In this systematic review of 24 studies, investigators looked at the risk of virus spread from surgical smoke exposure during surgery.
- Although no study was found investigating severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) or any other coronavirus, we found that the theoretical risk of virus diffusion through surgical smoke cannot be excluded.

Pavan, N., Crestani, A., Abrate, A., et al & Research Urology Network (RUN). (2020). Risk of virus contamination through surgical smoke during minimally invasive surgery: A systematic review of the literature on a neglected issue revived in the COVID-19 pandemic era. *European Urology Focus*, 6(5), 1058–1069.

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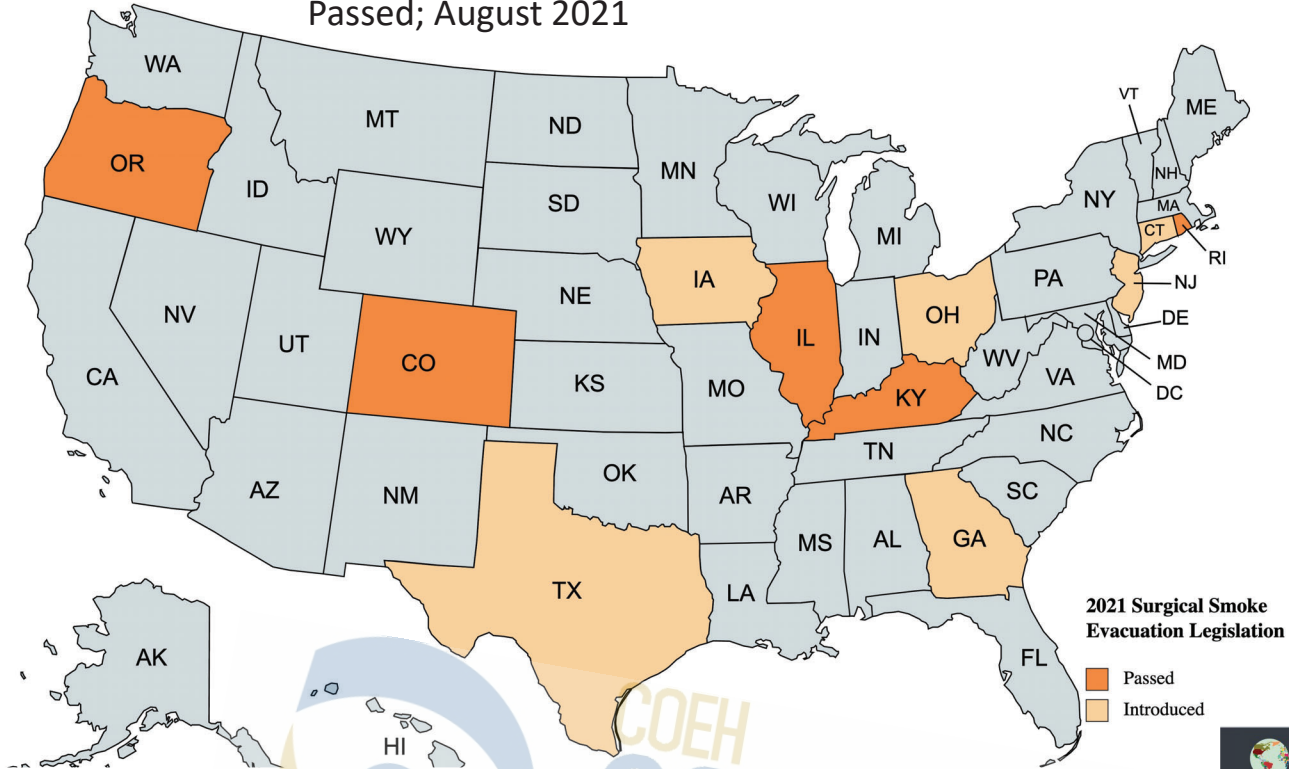
Delphi technique study to understand nurses' knowledge and concerns regarding surgical smoke



- **Methods:** A two-round Delphi technique study via e-mail correspondence was conducted surveying perioperative nurses from a national nursing association. Perioperative nursing experts were queried with open-ended questions during Round 1. Round 2 consisted of surveying a larger sample of perioperative nurses about issues identified in Round 1.
- **Results:** Consensus was reached by perioperative nurses that surgical smoke exposure was a major concern in their work environment. Nurses were concerned with their personal long-term health risks, as well as their surgical team members' health.
- **Conclusions:** Evacuation devices for surgical smoke are readily available but not always used, which may put the health of surgical team members at risk, which many fear. Further research and education on using smoke evacuation devices and the health risks of SS may provide an opportunity for increased usage.

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Surgical Smoke Evacuation Legislation Introduced or Passed; August 2021



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Illinois 5th State to Enact Surgical Smoke Plume Evacuation Law

"The most common way people give up their power is by thinking they don't have any" Alice Walker



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Actions to Take in Areas with Pending Legislation

- Policies and procedures for reducing, eliminating exposure
- Personal protective equipment to protect from smoke by-products
- Use smoke evacuation system that has 0.1µm filter to evacuate
- Engineering controls (air exchange; room ventilation)
- Administrative controls (staff education and training)
- Awareness of environmental hazards of smoke plume created during surgical procedures



Locating Resources and Support

- Device companies
- Professional organizations
- Experts in the field

Surgical smoke evacuation equipment

Education and training

Award recognition programs

Templates for policies and procedures

Advocacy support



Smoke Evacuation Market is estimated to reach \$223 million US dollars by 2024.

Current Congress

Examples: hr5, sres9, "health care"



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Rep. Kevin McCarthy
[R-CA-23]

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Kamala HarrisDemocratic Leader
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TODAY'S SCHEDULE

Sat, May 15, 2021

WELCOME

Welcome to the California Legislative Information website! In response to your feedback, we are pleased to announce improved legislative research capabilities available with the new Advanced Search feature.

Using the new search options, you can now find bills using the following criteria: status, author, committee or floor location, and date ranges for various legislative actions on a bill. In addition, you may perform a more complex bill search by combining criteria available on one or more of the Advanced Search tabs.

Measures prior to 1999 can still be found at <http://leginfo.ca.gov> which will remain as an archive for legislative information.

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Policy Analysis Publication

Benefits

- Increases awareness
- Encourages advocacy
- Alerts executive leaders
- Encourages involvement in policy arena
- Establishes faculty mentor/mentee relationships for scholarly pursuit
- Guides and influences policy



Nurse Leader
Available online 20 November 2020
In Press, Corrected Proof



Empowering Nurse Executives to Advocate for Surgical Smoke-Free Operating Rooms

Rebecca Vortman DNP, RN, CNOR, Janet Thorlton PhD, MS, RN

Political skill is the art of using legitimate power wisely....
... Marquis and Huston (2015)

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Key Stakeholders

Professional Associations (Nursing, Medicine, Surgeons, Surgical Techs)

The National Institute for Occupational Safety and Health (NIOSH)

International Council on Smoke Plume (ICSP)

Healthcare Facilities

Hospital Associations

Smoke Evacuation Market

The Occupational Safety and Health Administration (OSHA)

Consumers

The Joint Commission (TJC)

American National Standards Institute (ANSI)

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Quick Safety

Issue 56 | December 2020

Alleviating the dangers of surgical smoke



The Joint Commission, a global driver of quality improvement and patient safety, published safety actions to help protect patients and perioperative personnel from dangers of surgical smoke

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Special Interest Groups



OpenSecrets.org
Center for Responsive Politics

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Policy Options

Option 1

- Health Care Facilities Develop and Institute Surgical Smoke Evacuation Policies and Procedures That Promote a Safe Perioperative Environment

Option 2

- Individual States Enact Smoke Evacuation Laws

Option 3

- “Do Nothing” Approach

Vortman R, Thorlton J. Empowering nurse executives to advocate for surgical smoke free operating rooms. *Nurse Leader*. doi: <https://doi.org/10.1016/j.mnl.2020.10.004>

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Recommendation



Individual states enact surgical smoke evacuation laws

Vortman R, Thorlton J. Empowering nurse executives to advocate for surgical smoke free operating rooms. *Nurse Leader*. doi: <https://doi.org/10.1016/j.mnl.2020.10.004>

Take-Away Messages

Surgical masks do not provide protection against airborne particles contained in surgical smoke

Surgical smoke can affect the beating ability of embryonic cardiomyocytes.

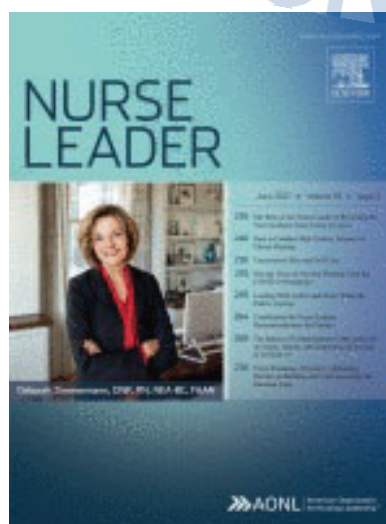
There are gaps in the literature which represent an opportunity for further studies

Smoke evacuation systems are recommended to minimize potential health hazards to perioperative personnel

Recommend states adopt surgical smoke evacuation laws

Advocate & support legislation in your state to ensure perioperative team members are working in healthy environments

- Vortman R, Thorlton J. (Epub before print). Empowering nurse executives to advocate for surgical smoke free operating rooms. *Nurse Leader*. doi: <https://doi.org/10.1016/j.mnl.2020.10.004>



Questions?



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