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Dermatologists' Practices and Perspectives on Human Papillomavirus Surgical Plume, and Cancer Risk

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INTRODUCTION

This is the first study to examine Human Papillomavirus (HPV) vaccination rates, protective equipment use, and self-reported health outcomes among dermatologic surgeons in the context of surgical plume exposure. Dermatologists routinely perform electrocautery and laser procedures that generate a surgical plume—a bioaerosol containing toxic chemicals, cellular debris, and viral particles such as human papillomavirus (HPV) DNA.[1,2]The presence of HPV DNA in the surgical plume raises concerns about occupational exposure and associated malignancies.[2,3] Although smoke evacuators are recommended, protective practices among dermatologists remain inconsistent, and institutional policies vary widely. While HPV vaccination offers protection against HPV-related cancers, the vaccination rate among dermatologists is not well characterized. Our study aimed to assess HPV vaccination status, awareness of plume-related hazards, use of protective measures, and self-reported health outcomes among dermatologists. Findings may inform occupational safety guidance and highlight current gaps in protection practices.

We conducted an IRB-exempt, cross-sectional survey of 300 board-certified dermatologists, residents, and fellows affiliated with the Florida Academy of Dermatology from April to June 2025. A total of 62 responses were collected anonymously (21% response rate) using a 30-item, study-specific questionnaire administered via Google Forms. The survey assessed the frequency of plume-generating procedures, use of protective equipment, HPV vaccination status, prior training on plume safety, self-reported symptoms, and perceived barriers to implementing safer practices.

Among respondents, 84% reported using electrocautery or CO_2 laser daily or more often. Despite this frequent exposure, 65% lacked access to or never used smoke evacuators, and only 16% reported consistent use during laser procedures. Institutional mandates were rare (8%). While 74% were aware that HPV DNA can be present in the surgical plume and 69% perceived a moderate or significant transmission risk, only 8% consistently used N95 respirators when treating HPV-positive lesions. The most commonly used protective equipment included surgical masks (n=42), face shields or goggles (n=19), and local exhaust ventilation (n=9); notably, 11 respondents reported using no protective measures at all. Reported barriers included equipment cost (n=24), lack of awareness (n=17), lack of institutional support (n=16), and resistance to change (n=11); 10 respondents reported no barriers.

To examine whether clinical experience influenced risk perception, a chi-square test compared years in practice with perceived risk of HPV transmission via surgical plume. The association was statistically significant ($\chi^2(9) = 17.77$, $P=0.038$), suggesting that experience affects how dermatologists assess plume-related risks—but not in a linear fashion. More experienced dermatologists showed greater polarization: some perceived high risk, others no risk, potentially reflecting varying personal experiences. These findings underscore the need for standardized, evidence-based education across all stages of training.

HPV vaccination coverage was mixed: 47% were fully vaccinated, 29% had never received the vaccine, and 18% were above the recommended age range. Among unvaccinated respondents, 44% said they would be very likely to receive a booster if recommended, suggesting openness to protective measures when framed as occupational risk mitigation. Open-text responses revealed confusion regarding vaccine eligibility for providers over age 45, highlighting the need for clearer occupational guidance.

Formal training on plume safety was limited, with 58% reporting no prior instruction within the last five years. While ten early-career dermatologists lacked formal education on this topic, the majority without training were more experienced (n=26 with 11+ years, including n=18 with 21+ years in practice), suggesting that gaps are more prevalent among seasoned clinicians due to evolving safety standards.

Nine respondents reported symptoms they suspected were related to plume exposure, including throat irritation (n=6), nasal congestion or sinusitis (n=5), eye irritation (n=2),

headaches (n=2), chronic cough (n=1), and nausea (n=1). All symptomatic individuals reported daily exposure to plume-generating procedures. Meanwhile, 51 respondents reported no symptoms. Notably, 37% (n=23) reported knowing at least one colleague diagnosed with head and neck squamous cell carcinoma (HNSCC). Given the general population incidence of approximately 11 per 100,000 per year,[4] this observation may point to a disproportionate occupational burden among dermatologic surgeons and warrants further investigation. Encouragingly, 81% expressed interest in additional education or research on plume safety.

Our findings reveal a disconnect between procedural exposure and consistent protective practices among dermatologists. Despite awareness of HPV transmission risk, safety behaviors remain inconsistent due to systemic barriers, limited training, and unclear vaccination guidance. While limited by the cross-sectional design, modest response rate, and potential self-report bias, the results underscore the need for improved education, institutional support, and updated clinical guidelines. Future studies with broader participation and longitudinal follow-up are warranted to better assess causality and define occupational risk.

DISCLOSURES

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