Reducing Waste in Dermatologic Surgery: An Evidence-Based Review of Sustainability Strategies

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Background

- Climate change is increasingly recognized as a major threat to global health, with healthcare responsible for 4.4–5.2% of global greenhouse gas emissions.[1-2]
- Dermatologic surgery generates substantial medical waste due to high procedural volume and reliance on disposable instruments, personal protective equipment, and packaging.[3]
- Each dermatologic surgery procedure produces approximately 0.52 kg of waste, equating to an estimated 300 kg of waste per Mohs surgeon annually.[4]
- Despite growing environmental concerns, specialty-specific guidance on sustainability in dermatologic surgery remains limited.

Objective

To present an evidence-based framework for reducing waste in dermatologic surgery while maintaining safety and efficacy.

Methods

- **Study design:** Narrative literature review of sustainability interventions in dermatologic surgery.
- **Search strategy:** PubMed search (2000–2025). Search terms included combinations of *sustainability, waste reduction, environmental impact,* and *dermatologic surgery*, as well as specific interventions including non-sterile gloves, reusable drapes and instruments, continuous suturing, absorbable sutures, and simplified dressings.
- **Inclusion criteria:** Randomized controlled trials, observational studies, life-cycle analyses, systematic reviews, and expert commentaries.
- **Evidence grading:** Oxford Centre for Evidence-Based Medicine (CEBM) Levels of Evidence (1a–5) and GRADE recommendations (A–D).

Results

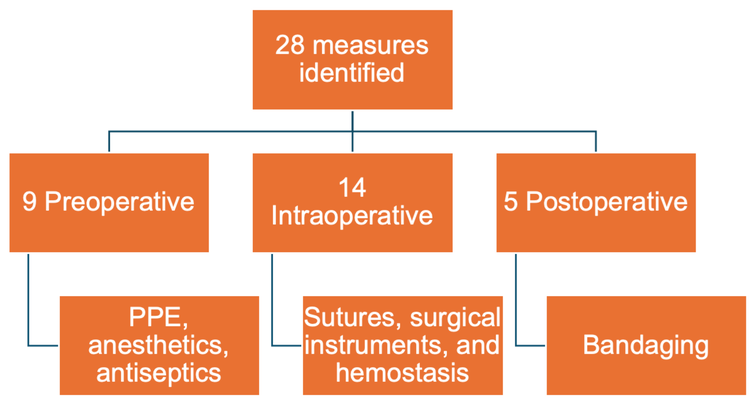

Figure 1: Surgical workflow classification of identified sustainability interventions.

Discussion

Table 1. Strength of Recommendation and Level of Evidence for Preoperative Waste Reduction Strategies in Dermatologic Surgery

Waste Reduction Strategy	Strength of Recommendation	Level of Evidence	References
Use non-sterile gloves from multi-glove boxes	A	1a	5,6
Use longer-acting anesthetics with epinephrine	A	1b	11
Use colored antiseptics like povidone-iodine	B	1b	8
Use spray or foam-based chlorhexidine	B	2b	7
Use reusable cloth drapes	B	2b	12, 13
Use clean technique in select low-risk cases	B	2b	13
Reuse gentian violet surgical markers and fix with povidone-iodine or isopropyl alcohol	D	5	9
Use low dead space syringes	D	5	10
Use bulk-pour antiseptics in sterilizable containers	D	5	Expert opinion

Table 2. Strength of Recommendation and Level of Evidence for Intraoperative Waste Reduction Strategies in Dermatologic Surgery

Waste Reduction Strategy	Strength of Recommendation	Level of Evidence	References
Use absorbable sutures to reduce material and follow-up visits	A	1a	21, 22
Use of continuous suturing techniques	A	1b	23-25
Allow 25 minutes after lidocaine with epinephrine injection for peak vasoconstriction	A	1b	28
Use tranexamic acid as an adjunct to lidocaine	A	1b	29
Reuse the same sterile instrument set for tumor removal and reconstruction in Mohs surgery	B	2b	19
Use reusable instruments for surgery and suture removal	B	2b	15, 16
Consider the double-loop dermal for suture knot technique	B	2b	26
Assemble procedure-specific packs	B	3b	17, 18
Use reusable cotton surgical towels for hemostasis	C	4	12, 13, 27
Use sterilizable metal rulers, blade handles or caliper to measure	D	5	Expert opinion
Repurpose graduated syringe barrels as measuring tools	D	5	14
Maintain instruments through routine sharpening and sterilization	D	5	Expert opinion
Delay opening suture packets until wound closure begins	D	5	Expert opinion
Use electrosurgical units with reusable tips and accessories that can be sterilized	D	5	Expert opinion

Discussion

Table 3: Strength of Recommendation and Level of Evidence for Postoperative Waste Reduction Strategies in Dermatologic Surgery

Waste Reduction Strategy	Strength of Recommendation	Level of Evidence	References
Maintain dressings for at least 48 hours postoperatively	C	1b	33
Use occlusive dressings like films, hydrocolloids, and alginates	B	2b	30, 31
Reduce frequency of dressing changes and consider the 24-7 bandage technique	C	5	32
Simplify dressing layers	D	5	Expert opinion
Use biodegradable dressings and skin substitutes	D	5	Expert opinion

Conclusion

Dermatologic surgery contributes significantly to healthcare waste, yet numerous evidence-based strategies can reduce environmental impact without compromising patient safety. This review identified 28 sustainability interventions across the surgical workflow. Adoption of practical measures such as nonsterile gloves, absorbable sutures, reusable instruments, and simplified dressings may substantially decrease waste generation. Integrating these practices into routine dermatologic surgery represents a feasible pathway toward more sustainable care.

References

1. Health Care Without Harm; Arup. Health care's climate footprint: How the health sector contributes to the global climate crisis and opportunities for action. Published September 2019. Accessed July 2025. https://noharm-global.org/documents/health-cares-climate-footprint
2. Zurl H, Qian Z, Stelzl DR, Dagnino F, Korn SM, Labban M, Lipsitz SR, Leitsmann M, Ahyai S, Ellimoottil C, Loeb S, Iyer HS, Trinh QD, Cole AP. Carbon Emissions From Patient Travel for Health Care. JAMA Netw Open. 2025 Mar 3;8(3):e252513. doi: 10.1001/jamanetworkopen.2025.2513. PMID: 40163116; PMCID: PMC11959441.
3. Shearman H, Yap SM, Zhao A, Passby L, Barrett A, Nkocokam Y, Stoneham S, Myint NA, Phillips D, Dalal F, Wylie G, Costley M, Odedra S, Phillips M, Abbott RA, Wernham A, Tso S; Dermatology Sustainability UK Group. A UK-wide study to describe resource consumption and waste management practices in skin surgery including Mohs micrographic surgery. Clin Exp Dermatol. 2023 Aug 25;48(9):1024-1029. doi: 10.1093/ced/llad184. PMID: 37192414.
4. Singh P, Smith FL, Brown MD. Practice Patterns for Mohs Surgeons of Varying Clinical Experience: A Cross-Sectional Analysis of a Medicare Claims Database. Dermatol Surg. 2022 Oct 1;48(10):1029-1032. doi: 10.1097/DSS.0000000000003562. Epub 2022 Sep 8. PMID: 36095278.
5. Jamal H, Lyne A, Ashley P, Duane B. Non-sterile examination gloves and sterile surgical gloves: which are more sustainable? J Hosp Infect. 2021 Dec;118:87-95. doi: 10.1016/j.jhin.2021.10.001. Epub 2021 Oct 14. PMID: 34655693.
6. Brewer JD, Gonzalez AB, Baum CL, et al. Comparison of Sterile vs Nonsterile Gloves in Cutaneous Surgery and Common Outpatient Dental Procedures: A Systematic Review and Meta-analysis. JAMA Dermatol. 2016;152(9):1008–1014. doi:10.1001/jamadermatol.2016.1965
7. Robins K, Wilson R, Watkins EJ, et al. Chlorhexidine spray versus single use sachets for skin preparation before regional nerve blockade for elective caesarean section: an effectiveness, time and cost study. Int J Obstet Anesth. 2005;14(3):189–192. doi:10.1016/j.ijoa.2005.02.006
8. Burchard R, Sayn L, Schmidt R, Graw JA, Scheicher T, Soost C, Gruenewald A. The Level of Surface Coverage of Surgical Site Disinfection Depends on the Visibility of the Antiseptic Agent-A Virtual Reality Randomized Controlled Trial. J Clin Med. 2023 Feb 12;12(4):1472. doi: 10.3390/jcm12041472. PMID: 36836006; PMCID: PMC9961233.
9. Neckman JP, MacKelfresh J, Adams BB. Skin markings fixed with iodine: the surgical marking Gram stain. J Am Acad Dermatol. 2015;72(6):e165. doi:10.1016/j.jaad.2015.02.111
10. Oramasionwu CU, Cole AL, Dixon MS, et al. Estimated cost of injectable medication waste attributable to syringe dead space. JAMA Intern Med. 2016;176(7):1025-1027. doi:10.1001/jamainternmed.2016.2301
11. Chen P, Smith H, Vinciullo C. Bupivacaine as an Adjunct to Lidocaine in Mohs Micrographic Surgery: A Prospective Randomized Controlled Trial. Dermatol Surg. 2018 May;44(5):607-610. doi: 10.1097/DSS.0000000000001385. PMID: 29140864.
12. Bellchambers J, Harris JM, Cullinan P, Gaya H, Pepper JR. A prospective study of wound infection in coronary artery surgery. Eur J Cardiothorac Surg. 1999 Jan;15(1):45-50. doi: 10.1016/s1010-7940(98)00255-3. PMID: 10077372.
13. Rogers HD, Desciak EB, Marcus RP. et al. Prospective study of wound infections in Mohs micrographic surgery using clean surgical technique in the absence of prophylactic antibiotics. J Am Acad Dermatol 2010; 63:842–51
14. Mehta, Nikhil MD*; Kaur, Japnoor MBBS*; Gupta, Somesh MD*. Intraoperative Use of Syringes as Scales of Measurement. Dermatologic Surgery 50(1):p 117-118, January 2024. | DOI: 10.1097/DSS.0000000000003958
15. Silva de Souza Lima Cano N, et al. Measuring and reducing the environmental impact of surgery. Clin Orthop Relat Res. 2025;483(1):7–19. doi:10.1097/CORR.0000000000003242
16. Jeha GM, Tolkachjov SN. Reducing medical waste. Int J Dermatol. 2025. doi:10.1111/ijd.17058
17. Van Demark RE, Jr., Smith VJS, Fiegen A. Lean and green hand surgery. J Hand Surg Am. 2018;43(2):179-181. doi: 10.1016/j.jhsa.2017.11.007. [DOI] [PubMed] [Google Scholar]
18. Bravo D, Townsend CB, Tulipan J, Ilyas AM. Economic and environmental impacts of the Wide-Awake, Local Anesthesia, No Tourniquet (WALANT) technique in hand surgery: a review of the literature. J Hand Surg Glob Online. 2022;4(6):456–463. doi:10.1016/j.jhsg.2022.05.009
19. Nasseri E. Prospective Study of Wound Infections in Mohs Micrographic Surgery Using a Single Set of Instruments. Dermatol Surg [Internet]. 2015 Sep 8;41(9):1008–12. Available from: https://pubmed.ncbi.nlm.nih.gov/26230327/
20. Xu B, Xu B, Wang L, Chen C, Yilmaz TU, Zheng W, He B. Absorbable Versus Nonabsorbable Sutures for Skin Closure: A Meta-analysis of Randomized Controlled Trials. Ann Plast Surg. 2016 May;76(5):598-606. doi: 10.1097/SAP.0000000000000418. PMID: 25643187.
21. Aboul-Fettouh N, Marzouf S, Smith JM, Srivastava D, Nijhawan RI. Patient satisfaction and preference for absorbable versus nonabsorbable sutures for linear repairs. J Am Acad Dermatol. 2018 Sep;79(3):561-562. doi: 10.1016/j.jaad.2018.02.020. Epub 2018 Feb 10. PMID: 29438769.)
22. Silva GS, Waegel A, Kepner J, Evans G, Braham W, Rosenbach M. Carbon Footprint Analysis of an Outpatient Dermatology Practice at an Academic Medical Center. JAMA Dermatol. 2025;161(2):191–197. doi:10.1001/jamadermatol.2024.5689
23. Faal Siahkal S, Abedi P, Iravani M, Esfandiarinezhad P, Dastoorpoor M, Bakhtiari S, Najafian M, Sharifipour F, Mohaghegh Z. Continuous non-locking vs. interrupted suturing techniques for the repair of episiotomy or second-degree perineal tears: A single-blind randomized controlled trial. Front Surg. 2023 Apr 5;10:1114477. doi: 10.3389/fsurg.2023.1114477. PMID: 37091272; PMCID: PMC10113503.
24. Fayyaz GQ, Gill NA, Alam I, Chaudary A, Aslam M, Ishaaq I, Hameed A, Ganatra A, Sheikh T, Bilal M. Continuous Versus Interrupted Sutures for Primary Cleft Palate Repair. Plast Reconstr Surg Glob Open. 2018 Nov 13;6(11):e2001. doi: 10.1097/GOX.0000000000002001. PMID: 30881799; PMCID: PMC6414111.
25. Boutros S, Weinfeld AB, Friedman JD. Continuous versus interrupted suturing of traumatic lacerations: a time, cost, and complication rate comparison. J Trauma. 2000 Mar;48(3):495-7. doi: 10.1097/00005373-200003000-00021. PMID: 10744291.
26. Pollhammer MS, Duscher D, Schmidt M, et al. Double-loop dermal suture: a technique for high-tension wound closure. Aesthetic Surg J. 2015;36(4):NP165-NP167. doi:10.1093/asj/sjv230
27. Bakhshi M, Mollazadeh S, Alkhan M, Salehinia R, Parvizi M, Ebrahimi Z. Investigating the sterile surgical supply waste in laparotomy surgery. BMC Health Serv Res. 2024 Sep 11;24(1):1048. doi: 10.1186/s12913-024-11497-9. PMID: 39261886; PMCID: PMC11389253.
28. McKee DE, Lalonde DH, Thoma A, Glennie DL. Optimal time delay between epinephrine injection and incision to minimize bleeding: a randomized controlled trial. Plast Reconstr Surg. 2013 Jan;131(1):165-73. doi: 10.1097/PRS.0b013e3182729c4c.
29. Gordon K, Schwalje AT, Teng JM, et al. Use of tranexamic acid in dermatologic surgery: A randomized controlled trial. Dermatol Surg. 2022;48(2):147-153. doi:10.1097/DSS.0000000000003246
30. Holmes SP, Rivera S, Hooper PB, Slaven JE, Que SKT. Hydrocolloid dressing versus conventional wound care after dermatologic surgery. JAAD Int. 2021;6:37–42. doi:10.1016/j.jdin.2021.11.002
31. Aderibigbe BA, Buyana B. Alginate in wound dressings. Pharmaceutics. 2018;10(2):42. doi:10.3390/pharmaceutics10020042. Available from: https://pubmed.ncbi.nlm.nih.gov/29772682
32. Edelman A, Foley M, McCall M Jr. 24-7 Dressing Technique to Optimize Wound Healing After Mohs Micrographic Surgery. Cutis. 2021;107(3):149-150. doi:10.12788/cutis.0201
33. Toon CD, Lusuku C, Ramamoorthy R, Davidson BR, Gurusamy KS. Early versus delayed dressing removal after primary closure of clean and clean-contaminated surgical wounds. Cochrane Database Syst Rev. 2015 Sep 3;2015(9):CD010259. doi: 10.1002/14651858.CD010259.pub3. PMID: 26331392; PMCID: PMC7087443.

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