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Assessing the Environmental Impact Associated With Disruptive Surgical Bleeding

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Introduction

- Disruptive bleeding remains a common complication of surgical procedures.[1] Although hemostatic agents are an effective treatment option to control bleeding, some patients experience disruptive bleeding despite using hemostats.[2]
- Whilst the clinical and economic burden of disruptive bleeding has been well studied, its environmental impact is less understood.

Objective

- To analyse the environmental impact associated with disruptive bleeding due to the subsequent increase in healthcare resource use (HRU).

Methods

- An environmental impact model was developed.
- Clinical and HRU data to compare outcomes between patients receiving hemostats with vs. without disruptive bleeding were sourced from the retrospective analysis of the Premier Healthcare Database[3] for the selected surgical procedures of interest: cholecystectomy, coronary artery bypass grafting (CABG), cystectomy, hepatectomy, hysterectomy, lung resection, pancreatectomy, peripheral vascular (PVP) and valve procedures.
- Sustainability data were obtained from the Sustainable Healthcare Coalition's Care Pathways Guidance and the relevant literature (Table 1).[4–5] Outcomes assessed were greenhouse gas emissions, water use, and waste generated.

Table 1: Sustainability Inputs[4–5]

Activity	Unit	GHG Emissions (kg CO_2e)	Fresh water use (m^3)	Waste generation (kg)
ICU	per day	90.0	137.0	13.0
LOS	per day	38.0	61.0	3.3
Surgical procedure	per 66 mins	35.0	66.0	7.6
Patient travel* (provided emergency)	per patient journeys to and from hospital	36.0	91.0	0.5
Patient travel (self)	per patient journeys to and from hospital	2.9	0.5	0.0
Emergency department**	per visit	14.0	21.0	0.3
Outpatient clinic	per visit	1.1	2.3	0.2

*46.8% of patients required ambulance transport for 30-day readmissions.[6]

** 78.0% of patients readmitted via emergency department for 30-day readmissions.[7]

Results

- Patients with disruptive bleeding were associated with more ICU days (up to 1.6) and LOS days (up to 6.3), longer operative time (up to 35%), and higher readmission rates at 30 days (up to 13%) for the selected procedures of interest.

Results contd.

- The environmental impact of disruptive bleeding was estimated to incur up to 309.8 kg CO_2e, 484.5 m^3 water use, and 36.1 kg waste for the selected procedures of interest (Table 2).

Table 2: Environmental Impact of Disruptive Bleeding in Selected Procedures

Procedure	GHG Emissions per disruptive bleeding (kg CO_2e)	Water use per disruptive bleeding (m^3)	Waste generation per disruptive bleeding (kg)
Cholecystectomy	261.7	426.6	25.4
CABG	146.8	232.6	18.9
Cystectomy	309.8	484.5	36.1
Hepatectomy	244.6	394.9	29.9
Hysterectomy	117.1	193.0	14.9
Lung Resection	154.7	238.2	21.2
Pancreatectomy	213.6	337.4	23.4
PVP	245.1	396.3	30.1
Valve	218.5	347.4	28.3

- Achieving effective and timely control for surgical bleeding events could save up to 96 tonnes of CO_2e (equivalent to 340 return flights from London to Rome[8]), 152,840 m^3 of water use, and 12 tonnes of waste per 1,000 surgical procedures (Table 3).

Table 3: Overall Environmental Impact due to Disruptive Bleeding per 1,000 Surgical Procedures

Procedure	% of Patients with Disruptive Bleeding	Number of Patients with Disruptive Bleeding per 1,000 procedures	GHG Emissions (tCO_2e)	Water use (m^3)	Waste generation (t)
Cholecystectomy	2%	20	5.2	8531.2	0.5
CABG	34%	340	49.9	79096.5	6.4
Cystectomy	24%	240	74.3	116288.9	8.7
Hepatectomy	18%	180	44.0	71088.0	5.4
Hysterectomy	3%	30	3.5	5791.2	0.4
Lung Resection	21%	210	32.5	50028.7	4.5
Pancreatectomy	24%	240	51.3	80966.5	5.6
PVP	19%	190	46.6	75296.4	5.7
Valve	44%	440	96.1	152839.7	12.5

Conclusion

- Disruptive bleeding is associated with a substantial environmental impact. By timely and effective control of disruptive bleeding, healthcare facilities may improve their environmental sustainability in addition to reducing the clinical and economic burden of this complication.

References

1. Thomas AB, Shammas RL, Orr J, et al. An assessment of bleeding complications necessitating blood transfusion across inpatient plastic surgery procedures: a nationwide analysis using the national surgical quality improvement program database. Plast Reconstr Surg. 2019;143:1109e–17e.
2. Corral M, Ferko N, Hollmann S, Broder MS, Chang E. Health and economic outcomes associated with uncontrolled surgical bleeding: a retrospective analysis of the premier perspectives database. Clinicoecon Outcomes Res. 2015;7:409–421.
3. Johnston SS, Afolabi M, Tewari P, Danker W. Clinical and Economic Burden Associated with Disruptive Surgical Bleeding: A Retrospective Database Analysis. Clinicoecon Outcomes Res. 2023 Jul 3;15:535-547.
4. Sustainable Healthcare Coalition (2015). Sustainable Care Pathways Gudaince. Available at https://shcoalition.org/sustainable-care-pathways-guidance/. Accessed October 2023.
5. MacNeill AJ, Lillywhite R, Brown CJ. The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems. Lancet Planet Health 2017;1:e381-e388
6. Turbow SD, Culler SD, Vaughan CP, Rask KJ, Perkins MM, Clevenger CK, Ali MK. Ambulance use and subsequent fragmented hospital readmission among older adults. J Am Geriatr Soc. 2023 May;71(5):1416-1428.
7. Knighton A, Martin G, Sounderajah V, Warren L, Markiewicz O, Riga C, Bicknell C. Avoidable 30-day readmissions in patients undergoing vascular surgery. BJS Open. 2019 Aug 2;3(6):759-766. doi: 10.
8. International Civil Organization Carbon Emissions Calculator Available at https ://www icao int/environmental protection/Carbonoffset/Pages/default aspx Accessed October 2023.