Early Economic Evaluation of Nasal Photodisinfection Therapy for the Prevention of Surgical Site Infections

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BACKGROUND

Surgical site infections (SSIs) are a leading cause of morbidity, mortality, and healthcare costs worldwide. They are closely linked to increased antibiotic use, which in turn drives antimicrobial resistance (AMR).

Nasal Photodisinfection Therapy (nPDT; Steriwave®) offers a novel, non-antibiotic approach to infection prevention. The treatment rapidly eliminates microbes in the nasal passages—the primary reservoir for many pathogens that cause surgical infections—through a light-activated photosensitizer that kills microbes within minutes, without promoting resistance.

OBJECTIVES

To evaluate the clinical and economic impact of nPDT on the Incidence of surgical site infections (SSIs) and healthcare costs.

METHODS

Model Overview

A decision-tree cost comparison model was developed from the perspective of the UK NHS over a 1-year horizon. The model assessed five surgical categories (hip, knee, spinal, cardiac, vascular) and a composite "all surgeries" group.

Data sources:

- Mid Yorkshire Hospitals NHS Trust (MYHT) dataset;
- Published literature.[1-3]

The model simulates surgical patients receiving either standard of care (SoC) or nPDT. Post-surgery, patients may or may not develop an SSI. Infections can occur pre- or post-discharge, range from superficial to organ/space, and may lead to reoperation, readmission, or death.In the MYHT series, the SoC comparator is Octenidine nasal decolonisation, while in the model-based analyses it is mupirocin —both administered for five days prior to surgery.

nPDT is assumed to affect the probability of developing an SSI, without influencing timing or severity. All other care pathways are identical between arms. Comparator SoC strategies include eight nasal decolonisation options reflecting UK practice variation. SSI risks and nPDT effectiveness were derived from multiple evidence sources to capture heterogeneity across settings and surgical categories.

Data & Analyses

The analysis was based on 764 surgical patients at MYHT, of whom 479 received nPDT. Clinical effectiveness estimates combined MYHT data with published studies.[1-3] Two costing methods were applied to estimate the economic burden of SSIs in the English NHS:

- **Micro-costing:** resource-by-resource estimation of SSI treatment costs;
- **Aggregate costing:** hospital-based SSI costs from Jenks et al. (2014), inflated to 2023 values using the PSSRU index.

Sensitivity analyses tested the robustness of results. Deterministic analysis identified key cost drivers, while probabilistic analysis varied inputs simultaneously to assess overall uncertainty. This approach ensured that both clinical and economic outcomes were comprehensively assessed under real-world and literature-based assumptions

Figure 1. nPDT process

1. Application

Apply photosensitizer to target area. It binds to microbes.

2. Illumination

Activate photsensitizer, generating reactive oxygen species.

3. Results

Rapid physical destruction of microbes.

RESULTS

Use of nPDT reduced surgical site infections (SSIs) and generated cost savings compared to standard of care. Both micro-costing and aggregate costing methods showed that nPDT lowered per-patient costs, with the greatest financial impact seen in higher-risk procedures. Sensitivity analyses confirmed the robustness of these findings, with nPDT remaining cost-saving under most modeled assumptions.

Table 1. SSI Reduction per 1000 Patients

Source	Surgical Category	nPDT	Comparator	Difference
MYHT	Hip and knee	4.2	14.0 [a]	**-9.8**
Model-derived	All surgeries	22.2	46.7 [b]	**-24.5**

Comparator: [a] Octenisan nasal gel with chlorhexidine body wash. [b] Mupirocin nasal gel with chlorhexidine body wash.

Figure 2. Per-Patient Cost Reduction

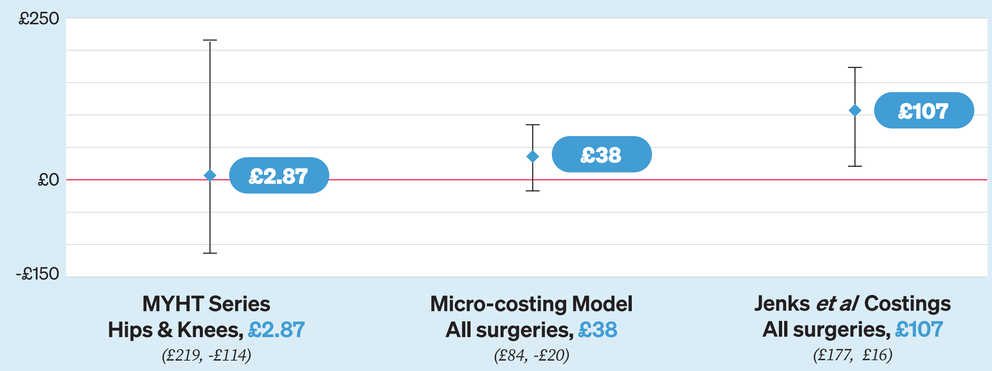
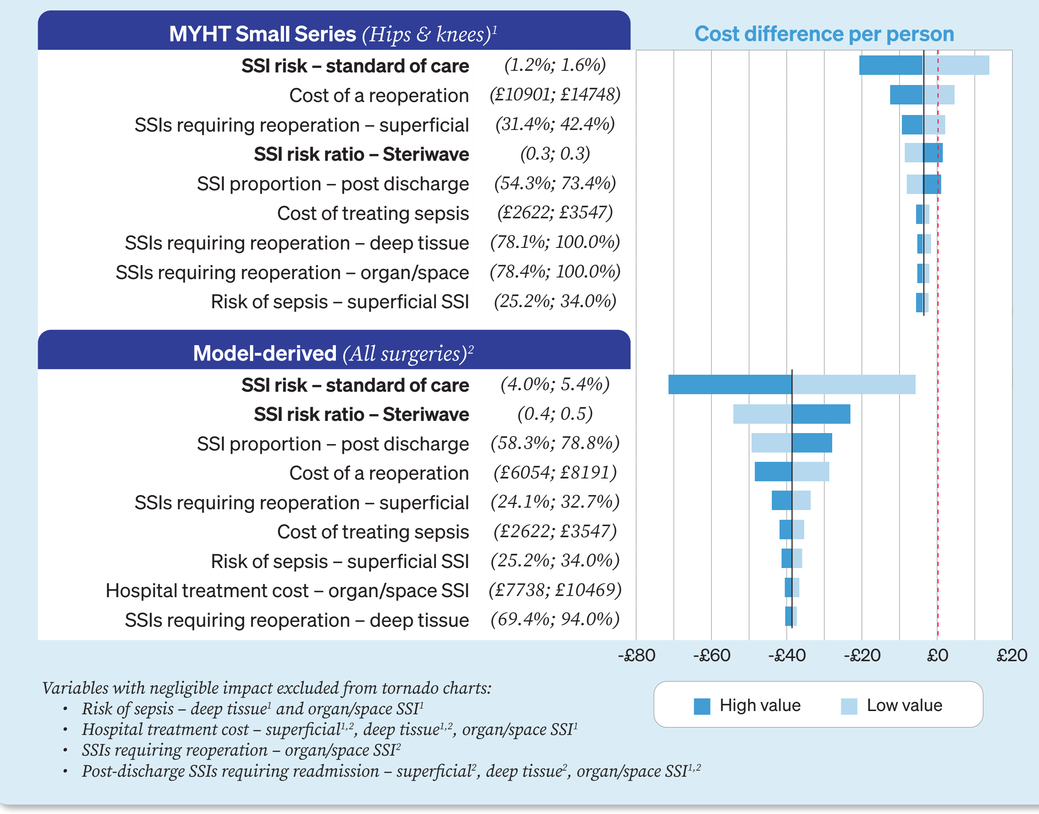


Figure 3. Sensitivity Analyses



Variables with negligible impact excluded from tornado charts:

- *Risk of sepsis – deep tissue[1] and organ/space SSI[1]*
- *Hospital treatment cost – superficial[1,2], deep tissue[1,2], organ/space SSI[1]*
- *SSIs requiring reoperation – organ/space SSI[2]*
- *Post-discharge SSIs requiring readmission – superficial[2], deep tissue[2], organ/space SSI[1,2]*

CONCLUSION

nPDT is an effective, antibiotic-free intervention that reduces SSIs and generates healthcare savings across a wide range of surgical procedures. Scaled to the national level, these results translate into substantial impact for the NHS: widespread adoption of nPDT could prevent thousands of infections and save hundreds of millions of pounds annually. With its alignment to antimicrobial stewardship, neutrality to surgical workflow, and strong economic case, nPDT represents a scalable innovation with the potential to transform SSI prevention across the UK.

REFERENCES

1. Hickok J et al. Surgical Site Infection Reduction With a Pre-Surgical Bundle Including Nasal Photodisinfection. *Infection Prevention Society Conference 2022*.
2. Bryce E et al. Nasal photodisinfection and chlorhexidine wipes decrease surgical site infections... *J Hosp Infect*. 2014.88(2):89-95.
3. Moskven E et al. Effectiveness of prophylactic intranasal photodynamic disinfection therapy...in adult spine surgery. *Can J Surg*. 2023.66(6):E550-E60.
4. Jenks PJ, et al. Clinical and economic burden of surgical site infection... *J Hosp Infect*. 2014.86(1):24-33.