

Reducing Waste in Hospitals: The Costs of Disposable Medical Equipment

Laidlaw Undergraduate Research
and Leadership Program

Chia Khoshnaw
Supervisor: Dr. Pelin Demirel
Imperial College London

Introduction

Currently, the NHS in England alone discards around 156,000 tonnes of clinical waste every year, with a substantial portion generated by disposable items used in surgery, such as tourniquets, scissors, and surgical tools wrapped in plastic packaging.[1] Individually wrapped implants are purported to be useful for maintaining sterility and safety in operating rooms but significantly increase costs due to reduced time efficiency and contribute significantly to plastic waste, which degrade into microplastics that spread to a wide range of environments and currently have unknown effects on ecosystems and human health.[2] The government's recently launched "Design for Life Roadmap" initiative aims to phase out avoidable single-use medical technologies by 2045, prioritizing sustainable alternatives, and successful trials and case studies demonstrate that a shift towards reusable equipment can mitigate environmental impacts and generate cost savings.[3] This paper explores the scope of the problem, evaluates current practices, and highlights potential solutions for reducing plastic waste in the NHS.

Methodology

An extensive review of academic research, case studies, and healthcare reports provided insights into the scale and types of packaging waste generated in hospitals, current waste management procedures and their limitations, and successful interventions.

Primary sources included peer-reviewed articles, hospital sustainability reports, and data from NHS initiatives. Examples like reusable medical equipment and material substitutions were critically evaluated.

Quantitative and qualitative data on packaging waste generation and disposal costs were analysed. Metrics included reductions in carbon footprint, cost savings, and changes in clinical efficiency following the implementation of sustainable practices.

Analysis

The NHS, similar to other sectors, relies heavily on plastic. NHS Supply Chain reports that plastic accounts for a larger proportion of NHS waste than in most other industries, comprising about 22.7% of all waste produced. Of this plastic waste, 13.7% is from plastic film, while 9% is from hard plastics. The NHS discards approximately 133,000 tonnes of plastic annually, but only around 5% of this is recycled. [4] The use of individually wrapped implants is particularly concerning, especially due to the lack of clinical evidence with regard to reducing harm to the patient and increase in operating costs. A 2013 study in an NHS district general hospital found that when compared to screw rack stored screws, the use of individually packed screws (IPS) could potentially increase department spending by approximately £76,680 per year due to an increased

screw acquisition time of 72 seconds, despite the closer proximity of an IPS. As an example, a typical ankle ORIF (open reduction and internal fixation) surgery can cost £256 more and take 14.4 minutes longer IPS were used. [5]

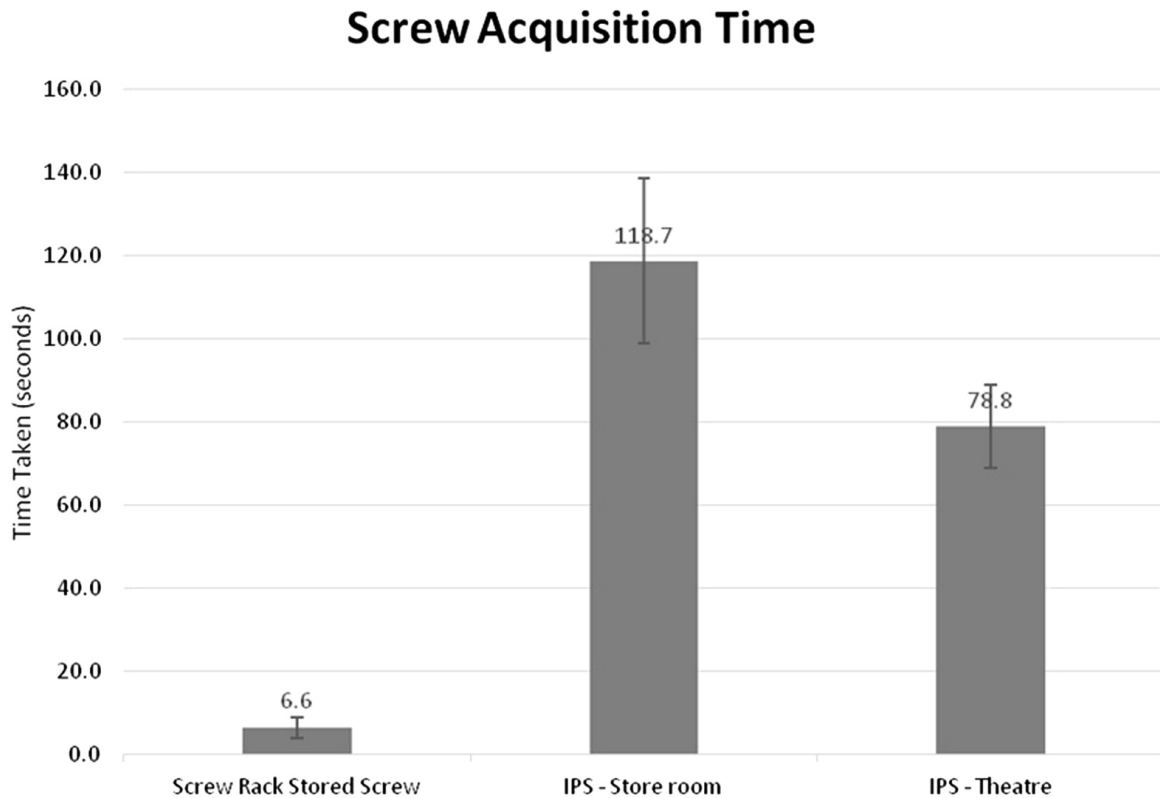


Fig. 1. Screw acquisition times for screw rack stored screws compared to individually packaged screws (IPS) kept in theatre and IPS kept in the storeroom. There was significance difference between all 3 groups ($p < 0.001$). [5]

Recent research has further validated these concerns, such as study by Suchowersky et al. (2020) that analysed the comparative safety, effectiveness, and cost-efficiency of individually wrapped screws (IWS) versus traditional screw caddies in orthopaedic operations. They found that screw caddies were at least as safe and effective as IWS, with a lower contamination risk during packaging removal. The economic analysis highlighted the significant cost burden of IWS, adding approximately AUD

50,112 annually for a single procedure type. The researchers concluded that screw caddies remain a superior choice for cost-effectiveness and operational efficiency. [6]



Figure 2. An example of an individually wrapped screw and the inner packaging that risks becoming contaminated when removal from the outer element is undertaken. [6]



Figure 3. An example of screws as presented in a caddy. Once opened at the beginning of the case, the entire apparatus remains in the sterile operative environment. [6]

Khan et al. (2013) conducted a controlled experiment to measure the impact of IWS on surgical times. They reported that using pre-sterilised, individually wrapped implants added an average of 2 minutes and 56 seconds to surgical procedures, increasing to nearly 4 minutes when self-tapping screws were used. These delays were attributed to the time needed for unpacking and verification, particularly under sterile conditions. While proponents argue that IWS enhances sterility, the study raised concerns about the practical implications, including the potential for contamination during packet handling and increased operative costs. [7] Philips et al. (2024) explored the time-efficiency of IWS compared to screw caddies in distal radius fracture treatments. They observed a significant increase in handling time with IWS, averaging 22 seconds per screw compared to 9 seconds with caddies. This cumulative delay added approximately 1 minute and 44 seconds per surgery, a critical factor in procedures constrained by tourniquet time. The study called for rigorous evaluation before widespread adoption of IWS due to their inefficiency and contribution to packaging waste. [8]

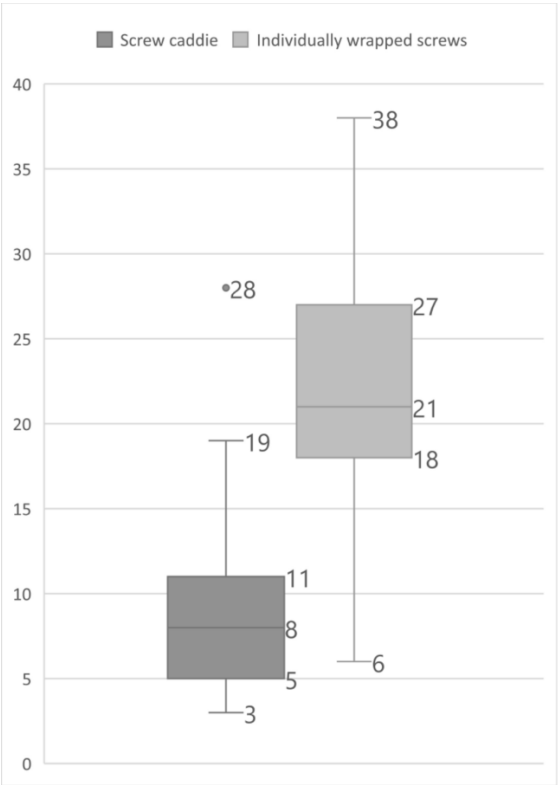


Figure 4. Boxplot comparison of screw handling time (in seconds) between screws taken from a screw caddie and individually wrapped screws: 25th percentile, 50th percentile, 75th percentile, minimum, maximum and outlier values are represented. [8]

Other disposable items like tourniquet, and scissors are commonly used only once, and NHS procurement data shows that several million pairs of disposable scissors were purchased across the NHS from 2022 to 2023, amounting to hundreds of pairs discarded every hour. [3]

Successful Case Studies

1. The trial of reusable tourniquets at Mid Yorkshire NHS Trust demonstrated significant benefits in sustainability and cost reduction. Each reusable tourniquet, designed for a lifespan of 10,000 uses over two years, led to a reduction of three-quarters of a metric tonne of plastic waste annually, equivalent to 2.3 tonnes of CO2 emissions avoided. The trust also achieved procurement savings of £20,000, realized after the reusable devices had been used approximately 250 times. Additionally, the adoption of these tourniquets in the phlebotomy department alone reduced the use of 6,375 single-use tourniquets within six months, eliminating 127 kilograms of plastic waste. [9]
2. An ophthalmology department in Northampton Hospitals NHS Trust saved 1,000 pairs of scissors and reduced expenses by £12,000 and 1,065 kgCO2e in just one year by switching from disposable to reusable scissors. The department also piloted multi-dose eye drop bottles, projected to save an additional £8,370 annually while minimizing packaging waste. [3] [10]
3. The purchase of 604 remanufactured electrophysiology (EP) catheters by Leeds Teaching Hospitals Trust saved £76,610 and generated an additional £22,923 by selling used devices for collection. Expanding this approach

across the UK could potentially save the NHS millions each year on EP catheters alone [3]

4. Leeds Teaching Hospitals Trust has shown that harmonic shears used in surgery, which cost over £500 each and are discarded after one use 90% of the time, can be safely remanufactured, achieving up to 50% in cost savings. [3]
5. The transition from single-use LDPE plastic bags to 100% recycled paper bags in Ysbyty Glan Clwyd's pharmacy demonstrated substantial environmental benefits. Each year, approximately 300,000 plastic bags were used across the health board's three hospitals, many ending as litter. A trial at Ysbyty Glan Clwyd Hospital replaced single-use plastic bags with recyclable paper bags for outpatient and discharge prescriptions. Over a six-month period, plastic bag usage decreased by 19% across the hospital, while recycled paper bag purchases accounted for 42% of outpatient prescriptions. The project anticipates reducing CO₂ emissions by 50% for outpatient bags. Challenges included label adherence issues and storage concerns, but these were mitigated through process adjustments and stakeholder engagement. [11]
6. Great Ormond Street Hospital's Koala Ward implemented a reuse policy for LDPE feed hanging bags, previously single-use. By reusing bags for up to seven days, the ward achieved a 75% reduction in bag use, saving approximately 16,000 bags annually. This change cut annual costs by £967 and reduced carbon emissions by 193 kgCO₂e, equivalent to driving 570 miles. The project, supported by infection control guidelines, required minor adjustments like staff training and ensuring bag safety for MRSA patients. Expanding this initiative trust-wide could save £7,200 and eliminate 48,000 plastic bags yearly. [12]

7. The “be PPE Free” initiative at Northampton General Hospital targeted unnecessary personal protective equipment (PPE) use, achieving a 4.3% reduction in glove use and a 22.1% reduction in aprons over two months, equating to a carbon saving of 4,329 kgCO₂e. Educational campaigns, including videos, posters, and intranet content, informed staff about proper PPE use, leading to an 86% improvement in knowledge. The initiative also generated £3,781 in procurement savings and reduced clinical waste costs by £169. Observational audits revealed an 80% decrease in unnecessary glove use and 95% in apron use. Annual projections estimate savings of 25,974 kgCO₂e and £23,704, which shows that targeted education can have a significant impact. [13]

Conclusion

Much has already been achieved through local initiatives to reduce waste and embrace more sustainable practices without negatively impacting patient safety, however substantial progress can only be made through a wider national commitment to reduce the environmental impact of health services. The findings from this report underscore the urgent need for the NHS to address its reliance on disposable medical tools and packaging, and despite the perceived benefits of single-use items, such as sterility and convenience, evidence demonstrates that these practices often lead to inefficiencies, increased costs, and substantial environmental harm. The case studies covered have shown that transitioning to reusable medical equipment can yield significant environmental and economic benefits without compromising clinical outcomes and initiatives like reusable tourniquets, multi-dose eye drop bottles, and remanufactured surgical tools have demonstrated the feasibility of reducing carbon emissions, minimizing waste, and generating substantial cost savings. These successes show that

the NHS's "Design for Life Roadmap" initiative could potentially lead to a drastic shift in the ecological impact of healthcare in the UK.

References

1. England, N. (2023). NHS England » NHS clinical waste strategy. NHS England. <https://www.england.nhs.uk/estates/nhs-clinical-waste-strategy/>
2. Khan, Y., Tokarczyk, S., Khan, I., Eleftheriou, K., & Pearce, C. (2013). The use of individually wrapped presterilized small orthopaedic implants increase operating time: A prospective experimental study. *JRSM Short Reports*, 4(6). <https://doi.org/10.1177/2042533313476413>
3. Department of Health, & Care, S. (2024, October 16). Design for Life roadmap. GOV.UK. <https://www.gov.uk/government/publications/design-for-life-roadmap/design-for-life-roadmap--4>
4. Percival, A. (2019). Not so fantastic plastic. NHS Providers. <https://nhsproviders.org/news-blogs/blogs/not-so-fantastic-plastic>
5. Man, W. Y., Mukherjee, A., & Feng Lee, P. Y. (2014). The economic impact of individually packaged screws. *The Surgeon: Journal of the Royal Colleges of Surgeons of Edinburgh and Ireland*, 12(1), 35–39. <https://doi.org/10.1016/j.surge.2013.08.001>
6. Suchowersky, A. M., Hua, M., Lorentzos, P., & Ashton, L. A. (2020). A comparison of risk profile for orthopaedic operations when utilizing individually wrapped screws (IWS) when compared with sterile screw caddies (screw racks). *Journal of Orthopaedic Surgery*, 28(3). <https://doi.org/10.1177/2309499020944086>
7. Khan, Y., Tokarczyk, S., Khan, I., Eleftheriou, K., & Pearce, C. (2013). The use of individually wrapped presterilized small orthopaedic implants increase operating time: A prospective experimental study. *JRSM Short Reports*, 4(6). <https://doi.org/10.1177/2042533313476413>

8. Philips, T., Molenaers, B., Caekebeke, P., Flies, M., Vanderhaeghen, O., & Duerinckx, J. (2024). Comparison of time-efficiency of individually wrapped screws and sterile screw racks in distal radius fracture treatment. *Archives of Orthopaedic and Trauma Surgery*, 144(5), 2127–2129. <https://doi.org/10.1007/s00402-024-05278-6>
9. NHS Supply Chain. (2023, July 6). Reusable tourniquet alternative provides significant waste reduction. NHS Supply Chain. <https://www.supplychain.nhs.uk/news-article/sustainable-reusable-tourniquet-alternative-provides-significant-waste-reduction-opportunities-for-mid-yorkshire-nhs-hospitals-trust/>
10. McMullan, T. (2024, March). A paradigm change: From disposable to reusable instruments usage in the Ophthalmology Department. Sustainable Healthcare Networks Hub. <https://networks.sustainablehealthcare.org.uk/resources/paradigm-change-disposable-reusable-instruments-usage-ophthalmology-department>
11. Firth, S. (2024, July). Project to reduce plastic bag use in hospital pharmacy. Sustainable Healthcare Networks Hub. <https://networks.sustainablehealthcare.org.uk/resources/project-reduce-plastic-bag-use-hospital-pharmacy>
12. Gately, V. (2024, May). Reducing hospital plastic use through re-use of LPDE plastic feed hanging bags for up to 7 days. Sustainable Healthcare Networks Hub. <https://networks.sustainablehealthcare.org.uk/resources/reducing-hospital-plastic-use-through-re-use-lpde-plastic-feed-hanging-bags-7-days>

13. Slyne, H., & Lowdon, J. (2022, October). Targeted education to reduce PPE use. Sustainable Healthcare Networks Hub. <https://networks.sustainablehealthcare.org.uk/resources/targeted-education-reduce-ppe-use>