

MEASURING AND REDUCING PLASTICS

IN THE HEALTHCARE SECTOR



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ABBREVIATIONS USED IN THIS PUBLICATION

ANTT	Aseptic non-touch technique
BPA	Bisphenol A
CMR	Carcinogenic, mutagenic, and toxic to reproduction
DEHP	di-2-ethylhexyl phthalate
ED/EDCs	Endocrine disruptor/Endocrine-disrupting chemicals
EUDAMED	European Database on Medical Devices
HDPE	High-density polyethylene
ICU	Intensive care unit
IV	Intravenous
LCA	Life Cycle Assessment
LDPE	Low-density polyethylene
MDR	Medical Devices Regulation
NHS	National Health Service
NICU	Neonatal Intensive Care Unit
OR	Operation Room
PA	Polyamide
PE	Polyethylene
PET	Polyethylene terephthalate
PFAS	Per- and polyfluoroalkyl substances
PP	Polypropylene
PPE	Personal protective equipment
PS	Polystyrene/Styrofoam
PUR	Polyurethane
PVC	Polyvinyl chloride

WASTE TERMINOLOGY USED IN THIS TOOLKIT

CLINICAL WASTE: Waste that may pose a risk of infection e.g. used or contaminated swabs, bandages, and dressings or is considered hazardous because it contains pharmaceutical or chemical substances.¹

OFFENSIVE/SANITARY WASTE: Non-clinical waste that is non-infectious and does not contain pharmaceutical or chemical substances, but is recognisable as healthcare waste and may be unpleasant to those that come into contact with it e.g. outer dressings, personal protective clothing, nappies, incontinence pads.²

GENERAL WASTE: Waste that does not pose a biological, chemical, radioactive, or physical hazard; most healthcare waste is in this category.³

RECYCLING STREAMS: Segregated waste meant for recycling e.g. paper, plastics, glass. Note that plastic recycling streams are not necessarily always recycled.





INTRODUCTION

Plastic has become ubiquitous in healthcare, with a dramatic shift towards single-use items in recent decades. Though essential for healthcare delivery in some cases, plastic can negatively affect both human health and the environment at each stage of its life cycle - resource extraction, manufacturing, use, and disposal. Over-reliance on disposable plastics not only has significant consequences for our planet, but threatens the resilience of our healthcare systems, as evidenced by shortages of medical protective clothing at the peak of the COVID-19 pandemic. Disposables also often represent higher operational costs. Reusable systems for isolation gowns, for example, have achieved in some cases a 30% reduction in costs when compared to disposable counterparts.⁴

Based on current consumption, plastic production is projected to double in the next 20 years and triple by 2060.⁵ Increased plastic production will only lead to greater negative impacts on our environment and our health and will further complicate plastic waste management. Not only can healthcare providers and healthcare professionals play a critical role in tackling plastic consumption and waste within their own institutions, they can also inspire action in their communities and other sectors, limiting use of plastic items, especially single-use items, to when absolutely necessary and alternatives are unavailable.

This publication has been produced as part of HCWH Europe's project *Towards Plastic-free Healthcare in Europe*, which aims to reduce the negative impact of plastics by transforming current practices so that plastic use is reduced within the sector, facilitating the transition to a circular economy model. It contains empirical data and learning and experience gained through this project.

The publication is divided into two sections; firstly, we present an overview of plastics used in healthcare and the associated health and environmental risks. The second part serves as a toolkit, providing healthcare professionals and sustainability managers with practical guidance to reduce plastic use and waste in their facilities, building on inspirational and informative case studies and pilot projects.



THE IMPACT OF PLASTIC

WHAT IS PLASTIC?

Plastics comprise many small molecules (monomers) linked together in long chains (polymers). Different polymers are created through different production methods; they have different chemical structures and varying properties, which makes recycling them together unfeasible. Fossil fuels (oil, gas, and coal) are the primary materials for the majority of plastics.⁶

Plastics also contain additives to aid production such as lubricants, catalysts, and stabilisers, or additives to improve performance e.g. flexibility, softness, resistance to ultraviolet light.⁷



ENVIRONMENTAL IMPACTS

Public awareness of the environmental impact of plastic waste may be growing, but plastics' role in fuelling the climate crisis is currently less visible. There are many hidden impacts from all stages of the plastic life cycle, and plastic production relies heavily on fossil fuels.^{8,9}

The plastic life cycle

- **Oil and gas extraction** - direct emissions from fuel combustion as well as methane leakage and flaming. There are also impacts from the clearing of forests, fields, and natural environments for wells and pipelines.⁸ Natural gas, which is often obtained through hydraulic fracturing (fracking), is commonly used to create plastics.¹⁰ Fracking releases significant methane emissions and toxic chemicals into the environment.¹¹
- **Refining and manufacturing** - energy-intensive procedures that produce large amounts of emissions and toxic chemicals.⁸
- **Product use** - microplastics, microfibers, and additives can be released in the environment.¹² Microplastics negatively affect both soil and marine ecosystems.^{13,14}
- **Product disposal** – plastics, especially those used in healthcare, are not commonly recycled, so most plastic waste ends up in one of the following disposal streams:
 - **Incineration** (including waste-to-energy) - produces carbon emissions and toxic gases such as dioxins or furans and toxic ashes.¹⁵ Incineration is the most harmful plastic disposal method and generates the most CO₂ emissions.¹⁶
 - **Landfill** – products can persist for hundreds of years, potentially leaching toxic chemicals and microplastics to soil and water and taking up important land surface.^{17,18}

In Europe, landfill bans are leading to more waste being incinerated, and waste-to-energy is projected to become one of the largest sources of fossil fuel emissions in Europe's energy sector.^{19,8}

Plastic production is growing, proliferating the use of fossil fuels and undermining climate and health goals. In 2019, plastic production and incineration emissions were equal to the emissions of 189 coal power plants, of 500 megawatts each.⁸ By 2040, 44% of the increase in crude oil consumption will be attributed to petrochemical production, with plastics being a key driver.²⁰



HEALTH IMPACTS

The health impacts of growing human exposure to plastic particles and the harmful chemicals within them are a major health concern. In April 2021, Canada recognised plastic manufactured items as toxic under Schedule 1 of the Canadian Environmental Protection Act.²¹ In addition, The United Nations Office of the High Commissioner on Human Rights is currently working on a report on plastic's impact on human rights, identifying plastic as a global threat to human rights.²²

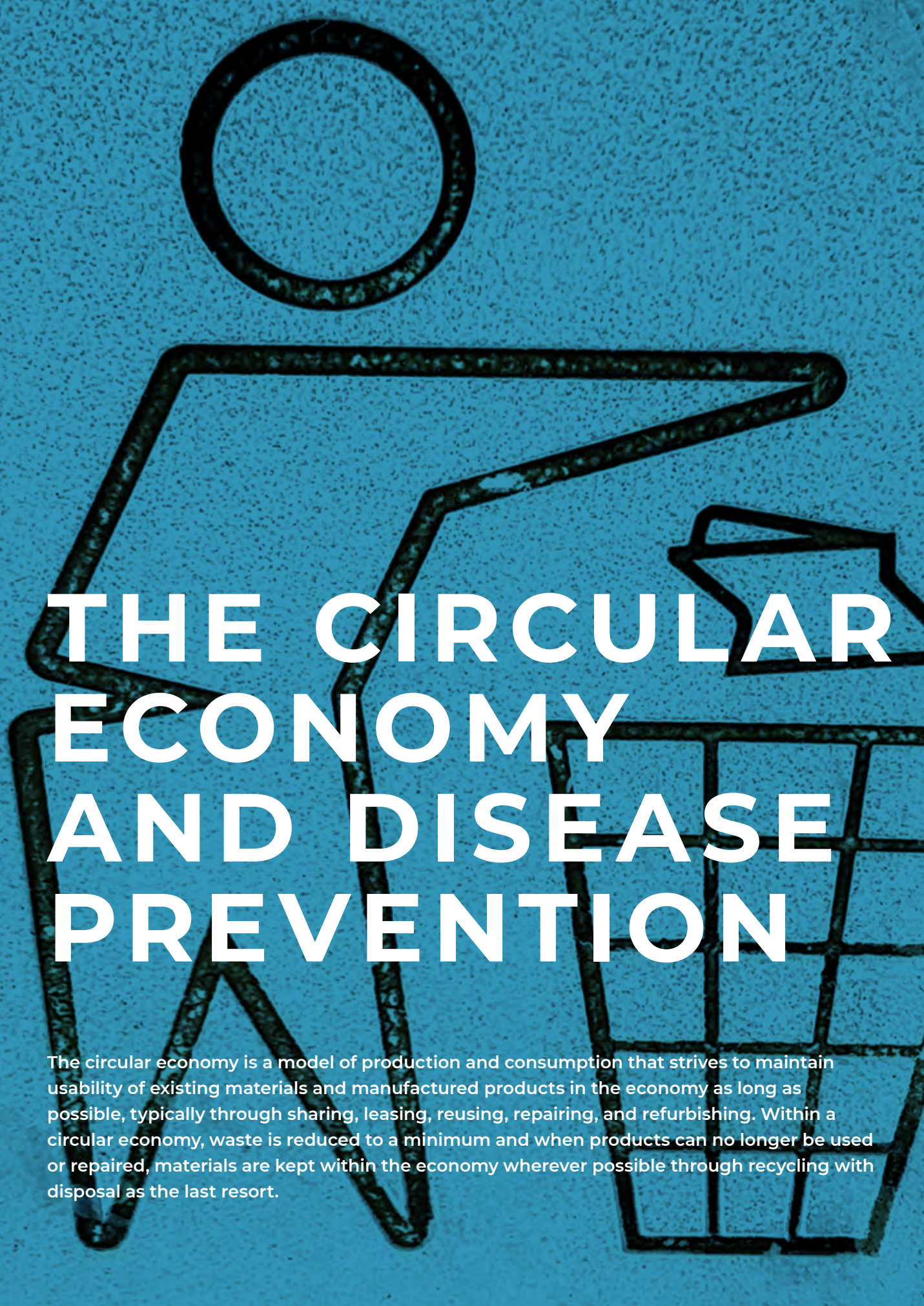
As with their environmental impact, each stage of the plastics life cycle poses a threat to human health. Toxic chemicals are used and released during raw resource extraction, refining, and manufacturing. These substances can severely affect human health, negatively impacting the neurological, reproductive, and immune systems, and causing certain cancers. Communities situated next to manufacturing and processing sites, usually deprived, are particularly exposed to the health risks.^{8,23}

During use, humans can be exposed to any of the hazardous chemicals that are used as plastic additives.²⁴ The chapter *Problematic chemicals in medical plastics* (page 25) of this report addresses some of the harmful chemicals present in medical items and their impact on human health.

If plastic is incinerated at the end of its life, toxic substances such as lead, mercury, dioxins, furans, and ash are released into the air, water, and soil.¹⁵ If plastic remains in the environment (landfill, soil, waterways) it breaks down into microplastic (<5mm) and nanoplastic (<100nm). The smaller these particles become, the higher the risk of negative health effects once inside the human body.²⁵ We are exposed to these plastic particles daily in the air we breathe, the water we drink, and the food we eat.²⁴ Microplastics have even been found in the human placenta and in lung tissue.^{26,27} Research has shown that polystyrene beads can cross the placental barrier and plastic particles pass from mother to foetus.^{28,29} While the exact human health effects of micro- and nanoplastics are still not fully understood, the fact that nanoplastics can pass the blood-brain barrier is cause for alarm.³⁰

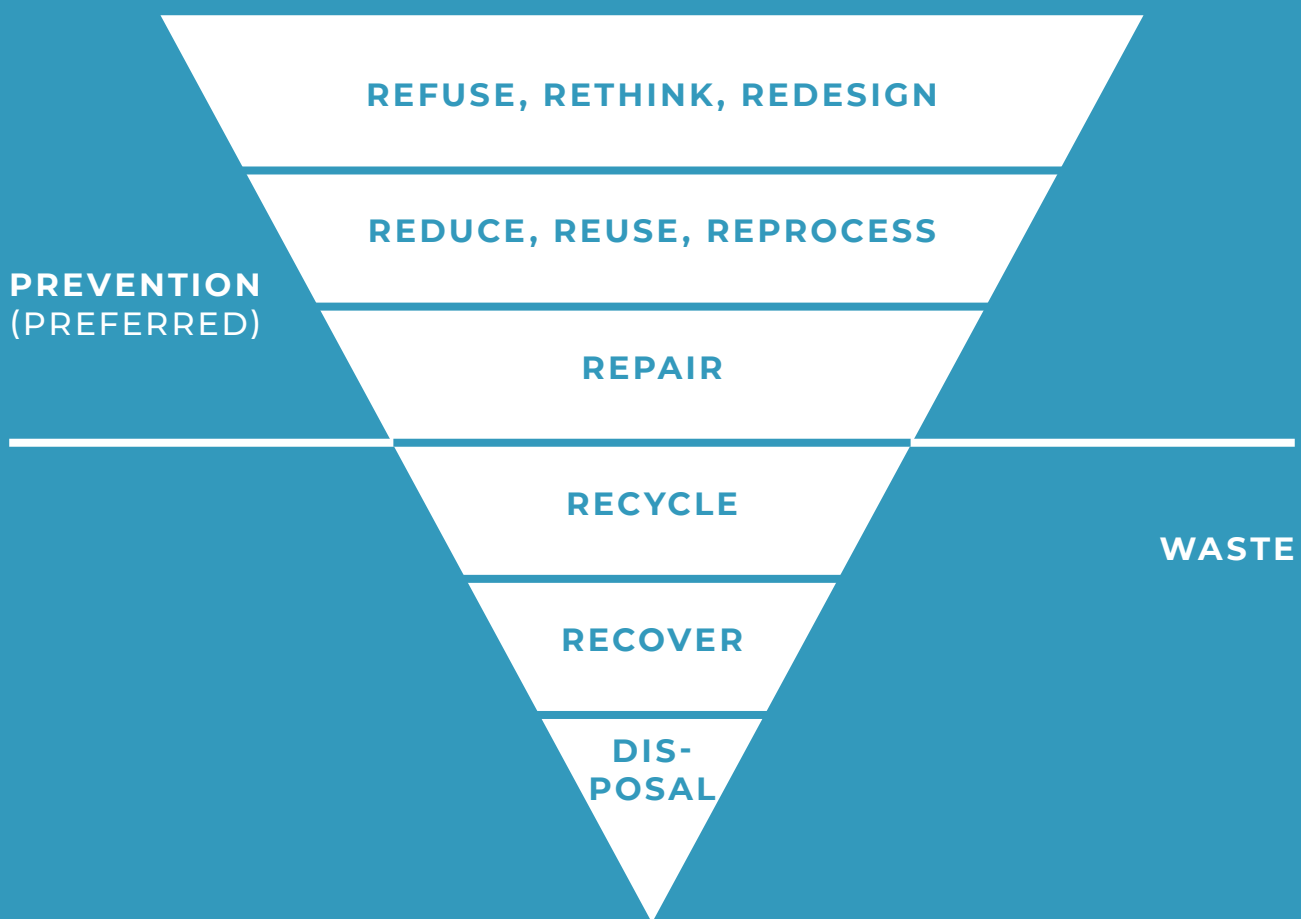
The human health impact of plastics is especially relevant to the healthcare sector. Exposure to hazardous chemicals from plastic is a particular concern for vulnerable patients including unborn children, neonates, and young children. Further information can be found in the chapter *Problematic chemicals in medical plastics* (page 25).

Healthcare providers can help reduce this public health threat by addressing plastic use in their own activities, seeking safer alternatives. Human exposure to plastics and its negative effects will continue to grow if no action is taken.



THE CIRCULAR ECONOMY AND DISEASE PREVENTION

The circular economy is a model of production and consumption that strives to maintain usability of existing materials and manufactured products in the economy as long as possible, typically through sharing, leasing, reusing, repairing, and refurbishing. Within a circular economy, waste is reduced to a minimum and when products can no longer be used or repaired, materials are kept within the economy wherever possible through recycling with disposal as the last resort.



The waste hierarchy [Adapted from Zero Waste Europe's Zero waste hierarchy]

To support the transition towards a circular economy, it is crucial to respect the waste hierarchy: refuse, reduce, reuse, repair, recycle. For the healthcare sector, this means analysing working practices and identifying opportunities to reduce the use of plastic products through existing solutions and encouraging innovation to design products and services that are reusable wherever feasible. In many cases, reusable solutions already exist and have been safely used in healthcare for decades. Expanding the circularity of products and materials in the healthcare sector also requires a green chemistry approach, free of toxic chemicals i.e. replacing plastic items that contain harmful chemicals with safer materials, for example by substituting PVC items. To further minimise health risks, reusable products should also be toxic-free.

Adopting a circular model in healthcare helps to reduce the negative environmental impacts of waste and can create a virtuous circle that improves public health and reduces the number of healthcare interventions needed. Preventing human exposure to environmental pollutants and disease prevention are primary goals of a circular healthcare approach.

THE FALSE PROMISE OF RECYCLING

Plastic recycling has been promoted as the main solution to addressing plastic waste since the 1990s.³¹ Yet, thirty years later, estimates show that less than 10% of all plastic ever produced has been recycled.³² Considering the complexity of healthcare waste management and that many plastic recyclers do not even accept plastic waste from healthcare facilities, plastic recycling rates in healthcare are potentially lower still.

The low cost of virgin materials to produce plastics often makes recycling an unattractive, uneconomical option. Even when recycled, plastics cannot be recycled infinitely and they are often 'downcycled' into products of lower quality. Virgin materials are also still needed in recycling to preserve quality as the recycled material loses value with each pass through the recycling stream.

There is insufficient capacity within the EU to ensure the recycling of all plastic consumed within the bloc and plastic waste is commonly shipped to other countries, which often lack robust waste management systems, raising serious concerns about the safety and efficacy of their recycling practices.³³ It is estimated that 7.3% of the European polyethylene being exported for recycling ends up in the ocean and that significant amounts end up in landfill across the world.³⁴ NGOs are advocating for a total ban of waste exports from the EU, even for sorted waste. There is, nonetheless, a serious risk of illegal waste shipments, especially since the EU framework against these is weak.³⁵

With plastic production expected to triple by 2060,⁵ and considering the issues listed above, recycling does not present a viable long-term solution to this growing problem. Instead it is necessary to rethink how products are designed and consumed, and to focus on safe, reusable alternatives and preventing waste in the first place.

Some healthcare providers might be attracted by bio-based or 'biodegradable' plastic options; however, these do not offer a systematic solution. Such products are not necessarily better for human health and the environment, and they can still contain the chemical additives found in conventional plastics, which have endocrine-disrupting effects.^{36,37}

THE SCALE OF PLASTICS USED IN HEALTHCARE

Whilst it is difficult to quantify the amount of plastics currently being used in healthcare, by combining procurement data and waste audit results it is possible to produce a high-level estimate of the volume and types of plastic consumed, where it is being used, and how it is disposed of. This information can support healthcare providers to better understand the scale of plastic consumption in their facilities and establish plastic reduction and waste prevention strategies that prioritise key product categories. This chapter aims to highlight some commonly used plastics in healthcare by presenting procurement and waste data collected through desk research and empirical experience.ⁱ

ⁱ Many examples used in this toolkit are from the UK – this is partially due to language barriers and availability of data.

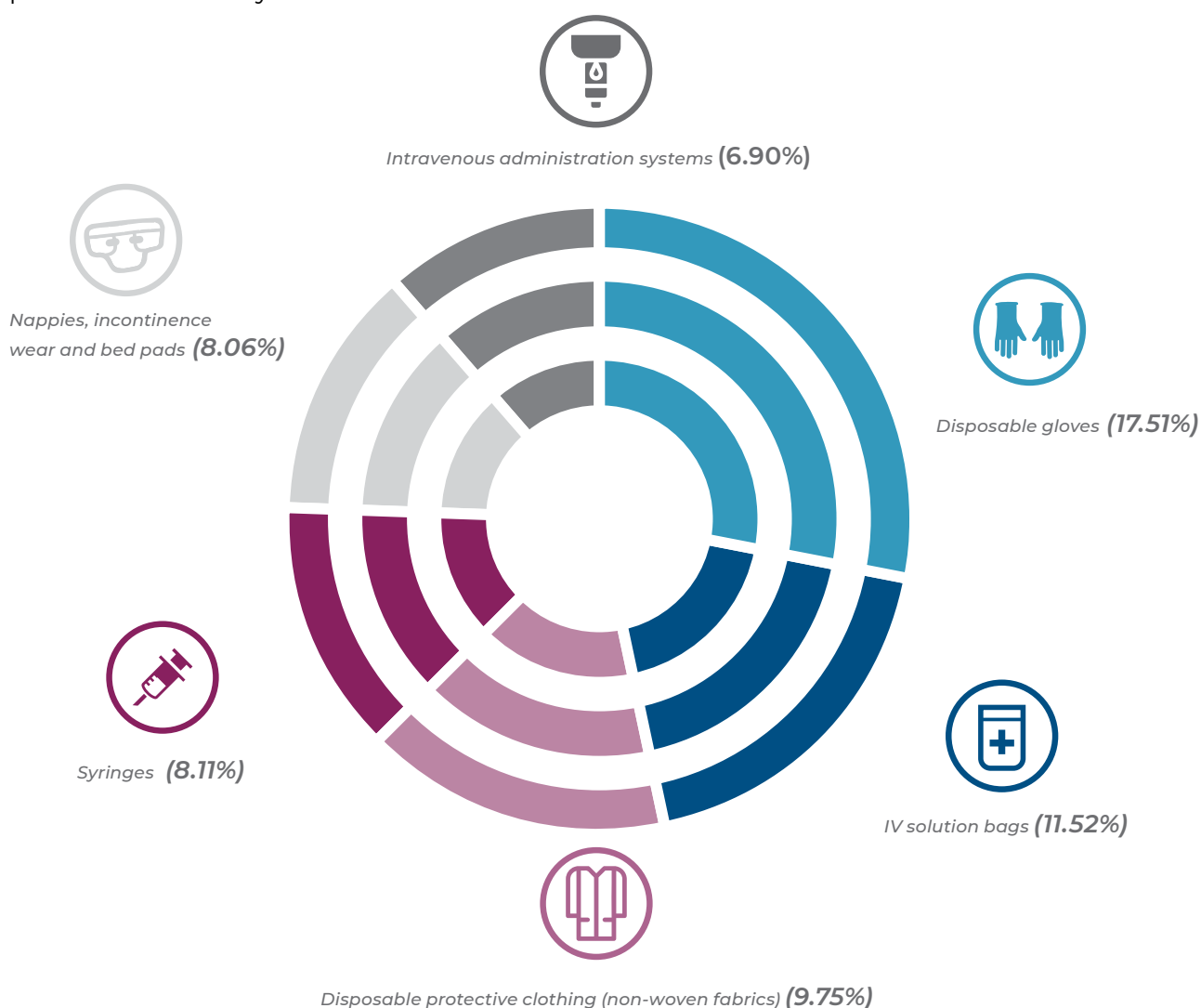
PROCUREMENT DATA

As part of the project *Towards Plastic-free Healthcare in Europe*, HCWH Europe conducted procurement surveys in five European hospitals to identify plastic items commonly purchased in healthcare facilities, dividing plastic products into three categories:

- Medical items
- Critical medical devices (that come into contact with vascular system/other sterile tissue)
- Non-medical items

The survey results showed that the medical items purchased in the greatest volume were common across all project participants, with gloves being the largest single item by volume in all five hospitals.ⁱⁱ Prioritising reduction and replacement efforts in the categories of products common to most hospitals can help achieve the biggest impact.

One participating hospital conducted a more detailed analysis that reflected the overall trend amongst all project participants. Six product categories accounted for over 60% of the total plastic used annually:



ⁱⁱ The data gathered in this project only covers purchases made in 2019 and therefore does not reflect increased consumption caused by the COVID-19 pandemic.

NHS Supply Chain data from 2014-2015 show that 15 product categories represent 69% of total weight of plastic used, with single-use disposable items including gloves, protective clothing, wipes, bags, continence care products, and suction consumables accounting for more than 50%.³⁸

Whilst safe and reusable alternatives are not currently available or feasible for some items, such as wound dressings or IV tubing, others could be made reusable and unnecessary use can be reduced. Single-use items should be replaced by safer alternatives (e.g. PVC-free IV bags, DEHP-free IV lines).³⁹ Many of the items listed have also been prioritised for their high carbon footprint. By prioritising the reduction and replacement of a few key product categories, healthcare providers can make considerable progress in reducing plastic consumption in the healthcare sector.

Procurement data can sometimes identify what plastic types are used and can also indicate whether items are disposable or not. Procurement data from one healthcare provider in the UK, for example, illustrate the plastic types used for the following products:

- PE – Nearly all aprons and some gowns, plastic bags
- PP – Patient wipes, sharps containers, and disposable bowls, kidney dishes, and gallipots
- PVC – Shoe covers, tubing sets, catheters
- HDPE – Tubing connectors

Syringes found during waste audits by one of the project participants





Gloves found during the waste audit by one of the project participants

GLOVES

Though essential in healthcare, non-sterile gloves are often used unnecessarily and hand hygiene is neglected, increasing the risk of cross-contamination. Addressing the overuse of gloves is a great opportunity for reducing plastic consumption and waste.

Non-sterile (examination) gloves were the product purchased in the largest quantities amongst project participants. Evidence suggests that this is not a unique trend - the National Health Service (NHS) in England used 1.4 billion gloves annually before COVID-19, (this number increased by 200% during the pandemic).⁴²

Gathering data on glove use from 21 healthcare institutions across Europe, including project participants, HCWH Europe found that nitrile was the most popular material for gloves used in almost all survey participants – only one hospital primarily used PVC gloves. While it is positive that most hospitals are using nitrile gloves, it is concerning that PVC gloves continue to be used in European hospitals, as PVC is not a sustainable material. Glove consumption patterns differed greatly across facilities, including those of a similar size; annual use per employee ranged from 456 - 4,411 gloves. The number of gloves used per patient also varied widely between facilities, ranging from 1.4 - 30.2, and whilst differences in healthcare services might explain part of this discrepancy, it is clear that gloves are often overused.

Gloves of the same size, material, and quality also showed significant differences in weight. One project participant calculated that choosing lighter gloves could save 10,000kg or 5% of total annual plastic waste, while maintaining the same quality and compliance with regulatory standards.

Currently, examination gloves cannot be reused, but their negative environmental, social, and health impacts can still be reduced by addressing overconsumption and how they are manufactured. Working with suppliers, healthcare providers can stipulate the elimination of harmful chemicals or the use of renewable energy in manufacturing, for example.

NON-MEDICAL ITEMS IN HEALTHCARE

Non-medical, single-use items are also a large source of plastics used in healthcare, despite reusable alternatives being readily available. HCWH Europe's procurement survey highlighted the most common non-medical items purchased by respondents:

- Items that come into contact with food (known as food contact materials)
 - Cups
 - Cutlery
 - Plates
 - Trays
 - Single-serving snacks packaging
 - Small drink containers (e.g. 85ml bottles)
 - Condiment sachets
 - Bottled water
- Patient care:
 - Disposable medicine pots
 - Wipes sachets (non-disinfectant)
 - Wipes and cleaning cloths
 - Continence care products (e.g. nappies)
- Others:
 - Plastic bags
 - Sponges
 - Small plastic toys

Replacing these items with reusable alternatives is an easy first step in reducing plastic consumption and waste in healthcare. Items such as food contact materials and single-use diapers and sanitary pads are also a source of concern, as they can impact health by leaching harmful chemicals.⁴³ Toxic-free, reusable solutions already exist for many of these items and offer a safer alternative for both health and the environment.

FOOD CONTACT MATERIALS

Replacing plastic food contact materials can also deliver health benefits as studies show that harmful chemicals migrate from plastic to food.⁴⁴ Learn more about the risks of food contact materials in healthcare in HCWH Europe's publication *Sustainable food contact materials in the European healthcare sector*,⁴⁵ which also presents successful case studies of healthcare facilities reducing plastic use in their food services.

Non-medical items found during HCWH Europe's waste audits



WASTE AUDIT FINDINGS

Conducting waste audits is an established method of quantifying waste and identifying consumption patterns and opportunities for waste reduction that might be less evident when analysing procurement data. Engaging staff in the audits can also help raise awareness about plastic consumption in the facility.

Estimates suggest that in the US, for example, 25% of healthcare waste is plastic.⁴⁶ Similarly, prior to the pandemic 22.7% of the waste produced by the NHS each day (11,300 tonnes) was plastic.³⁸ Though more recent data are not yet available, it is very likely that this figure has grown since the start of the COVID-19 pandemic, considering the increase in single-use plastic items.⁴⁷

The percentage of plastic waste, however, can vary greatly between facilities and the department being audited. The majority of operating theatre waste, for example, is plastic, comprising disposable surgical supplies, medical protective clothing, drapes, and plastic packaging.⁴⁸ It is estimated that blue wrap alone, usually made of non-woven polypropylene, makes up to 19% of operating room waste, and with operating theatres representing 30% of total hospital waste and approximately 67% of clinical waste, they are a significant source of plastic waste in healthcare.^{49,50}

One waste audit from the US showed that a single hysterectomy surgery generates more than 9kg of waste. Most of this waste is plastic gowns, blue wrap, and drapes (usually polypropylene), representing between 22%-35% of the total waste, while gloves account for 5%. Between 36%-46% of the waste comprises other plastic items, such as film and trays.⁵¹

An emergency department waste audit in the US, covering a 24h period with 300 patients, showed that 671.79kg of waste was generated and 64.6% of the total audited waste was plastic, with hard and soft plastics representing 19.5% and 45.1% respectively.⁵² A further 2.1% of the waste comprised unused items (including plastics).

To gain further insight into plastic in European healthcare, HCWH Europe audited waste gathered over a 48-hour period within hospitals participating in *Towards Plastic-free Healthcare in Europe*. Project participants were encouraged to prioritise auditing waste generated in the neonatal wards because of the patients' vulnerability to the health impacts of plastic.

Of the 1,330kg of waste audited, 634.41kg, or 47.67%, was plastic. The waste analysed included general, sanitary/offensive, and plastic recycling waste streams.ⁱⁱⁱ

ⁱⁱⁱ Clinical waste and other recycling streams (e.g. paper, metal) were not analysed, as the focus of the project was on plastic

Waste audits conducted at the facilities of project participants



PLASTIC WASTE IDENTIFIED IN WASTE AUDITS (HCWH EUROPE, 2021)

HOSPITAL	AUDITED WARDS	WASTE STREAM	TOTAL WASTE (KG)	PLASTIC WASTE (%)
Hospital 1	Orthopaedic, Neurosurgery, neurology, spine and video telemetry	General waste	148.4	34.3%
		Sanitary/offensive waste	96.9	68.9%
		Recycling waste	21.8	47.0%
Hospital 2	General, maternity, Neonatal, Neonatal ICU	General waste	66.3	9.8%
		Sanitary/offensive waste	341.2	49.4%
		Recycling waste	10	65.6%
Hospital 3	Neonatal, Gastroenterology	General waste	68.9	60.0%
		Recycling waste	7.4	83.0%
Hospital 4	Intermediate care wards	General waste	155.6	14.0%
		Sanitary/offensive waste	237	83.0%
		Recycling waste	14.6	19.0%
Hospital 5	Neonatal ICU, Ophthalmology	General waste	57.38	18.5%
		Sanitary/offensive waste	87.43	48.0%
		Recycling waste	17.34	26.3%

Across all wards audited in Hospital 1, 68.9% of sanitary waste and 34.3% of general waste was plastic. Hospital 3 saw similar levels of plastic (60%) in the general waste of the selected wards, whereas in Hospital 2 general waste comprised only 9.8% plastic. Across all the pilot hospitals, the plastic recycling waste stream itself represented a relatively low proportion of the total waste, suggesting that very little of the total healthcare plastics is sent for recycling.

A key challenge of the audits was identifying plastic types, as labelling is often not available on products. This lack of information meant many items were classified as 'mixed materials' or 'unknown'. In three of the five audits, 37% of all the plastic items analysed were mixed materials (including paper/plastic mixes), with the specific plastic types mostly unknown or unlabelled. An additional 18.27% were non-mixed materials of unknown plastic types.

In some instances, when labelling was unclear or unavailable, the auditing team could use their familiarity with plastic characteristics to make an educated guess. Based on labelling and guessing, PP represented approximately 12% of the items, and nitrile was approximately 10% of the waste audited, primarily gloves. LDPE was identified in 8.52% of the items assessed, 3.66% were made from HDPE, and 3.38% from PET. Based on labelling alone, 1.52% of the plastic items were made of PVC.

Packaging, wipes, diapers, syringes and accessories, surgical gowns/aprons, and surgical gloves were the most abundant items found in all the audits. At two hospitals, tubing and accessories were also in the top ten items found. Plastic water/drinking bottles and plastic bags were the most abundant non-medical items counted in the audits. The impact of the COVID-19 pandemic was evident in the amount of medical protective clothing found in the audits; it would be important to repeat the audits once consumption reaches pre-pandemic levels.

Items found during the waste audits conducted by project participants



PACKAGING

Though audit results were varied, plastic packaging was ubiquitous across all participating hospitals. Plastic packaging cannot be easily quantified through procurement data alone, but the waste audits show that this is another category to prioritise in reduction efforts.

Other plastic waste audits undertaken outside of our project, such as the OLVG hospital in the Netherlands, have shown that approximately 50% of total plastic waste by weight was disposable packaging, composed of at least 15 different types of plastic.⁵³ According to their findings, 45% of the plastic items analysed did not have the polymer type labelled. They estimated that the plastic types used the most in packaging were PP, PET, HDPE with coated medical grade paper, and PVC. Bubble wrap from shipments also represented a significant fraction of the plastic waste found – up to 25% of the total plastic waste by weight.



Mixed plastic-paper packaging waste found during HCWH Europe's waste audits

Plastic packaging waste found during HCWH Europe's waste audits





Packaging sachets and single-use tourniquets found by project participants during waste audits

As part of waste audits conducted at Aarhus University Hospital (AUH) in Denmark, 500kg of municipal waste was collected from nine departments over a 48-hour period. Clean plastic packaging accounted for 18% weight, or 90 kg, of the total waste measured and approximately 50% of the volume of all waste from operational departments. In their audit, AUH found that at least 15 polymer types are used in healthcare plastic packaging including mixes. LDPE was the most common, representing 27kg of the total packaging. Almost half of the packaging waste analysed, however, comprised unknown plastics. Most of the plastic packaging was soft packaging such as peel packs, blue wrap or shrink wrap, with peel packs representing most of the packaging found – 19kg out of the 90kg analysed.⁵⁴

WIPES

Most disposable wipes are made of plastic, generally polyester or polypropylene. Procurement data show that disposable wipes were purchased in large quantities in hospitals across Europe, while the waste audits revealed that unused disposable disinfecting wipes were being thrown away. This can be put down to the fact that wipes are prone to drying out, and also multiple wipes may be removed when only one is needed.

The COVID-19 pandemic has increased the use of disinfecting products, including wipes, which can explain the quantities found in recent waste audits. Considering the increased need for cleaning and disinfection in healthcare settings to prevent the spread of pathogens and infections, it is important that healthcare providers adopt more sustainable cleaning and disinfection practices and consider alternatives to disposable wipes.

Wipes found by one of the project participants during their waste audits



THE ELEPHANT IN THE ROOM: THE SHIFT TOWARDS DISPOSABLES

In recent decades, there has been a shift to replace reusable items with disposables in healthcare. Though necessary when no alternatives are available, disposables are not always essential for the safer delivery of healthcare, as safe and cost-effective reusable alternatives are already available and offer the same levels of hygiene and safety. The unnecessary use of disposables increases healthcare waste and associated costs.⁵⁵

The shift towards disposal products was partly motivated by the misleading oversimplification that disposables reduce contamination risks. However, infection risk is dependent on multiple factors, including the product itself and the procedure. A case-by-case analysis is needed for a true comparison, but it is difficult to associate a reduction in infection rate with a specific product. The infection risk associated with reusable items is often either not demonstrated or extremely small.^{56,57} Furthermore, the majority of progress made in reducing surgical site infection rates is not associated with disposables, but care standardisation and improvements in host defence mechanisms.⁵⁶ A recent study even shows that reusable gowns might actually provide better protection for staff.⁵⁸

There can also be economic incentives for manufacturers and suppliers in providing single-use items. Furthermore, from a regulatory perspective, labelling an item as 'single-use only' requires less effort, and items that can be safely reused are often labelled as 'disposable' to speed up market access.⁵⁷

Another common problem is that many hospitals have closed on-site cleaning and sterilisation facilities in the transition to disposables, meaning they no longer have the capacity to support reusable items in-house. If re-opening those facilities is no longer feasible, external providers can be a viable alternative. Other logistical aspects also need to be considered, such as storage space, tracking number of uses, and changes in staff behaviour.



Disposable pants and shirt found during HCWH Europe's waste audits

FROM REUSABLE MASKS TO DISPOSABLES AND BACK AGAIN

Many recent studies unfairly compare disposable, surgical medical-grade face masks with 'homemade', cotton, reusable ones.⁵⁹ Surgical masks were reusable until the 1960s and evidence shows that this did not diminish the prevention and control of infections.⁶⁰ Studies at the time attest for the quality and even the superiority of fabric masks to disposable surgical ones.⁵⁹ More recently, large-scale production of medical-grade reusable masks has ceased, making it challenging to conduct contemporary studies and offer a fairer comparison.

Fortunately, the healthcare sector is now rethinking this model: the NHS initiated a pilot project to introduce reusable IIR certified face masks by collaborating with suppliers, demonstrating that the healthcare sector can successfully increase demand for reusable products in a market otherwise dominated by disposables.⁶¹ Regulatory challenges remain, but this pilot highlights great potential and could represent significant progress in the move away from disposable culture in healthcare.

THE COSTS OF DISPOSABLES IN HEALTHCARE

Another reason that hospitals have gradually switched to disposable items is the perception that logistically they are more straightforward since they are quicker to buy, use and throw away. Disposable items are often also seen as cheaper than reusable ones. However, when looking at the whole-life-cost, reusables are in many cases cheaper over the long term compared with single-use items. For an accurate cost comparison, cost of waste disposal, cleaning costs, and cost per use rather than per item need to be considered.

In one cost comparison study, the cost per intubation of reusable flexible optical scopes was €177.7, while disposables would have cost €204.4.⁶² Other cost comparison studies have been conducted on flexible ureterorenoscopes, scissors, blood pressure cuffs (in out-patient settings), or anaesthetic drug trays, all showing that reusable options for these items produce cost savings.^{63,54,65,66} For some items, the more they are used, the lower the cost-per-use becomes.⁶⁷ Sterilisation costs can vary, so an analysis of the local context is often needed.

PROBLEMATIC CHEMICALS IN MEDICAL PLASTICS

WHAT IS THE ISSUE?

It has been known for decades that certain hazardous chemicals leach out of plastics in medical devices, such as phthalates in plastic tubing.⁶⁸ HCWH Europe has long campaigned for the elimination of DEHP, the most commonly used phthalate, in intravenous (IV) drips. Our work in this area has also highlighted the high exposure risk of newborn babies to BPA when receiving medical treatment using multiple devices. The choice of materials used in medical devices is an important factor in determining exposure - one study demonstrated that BPA concentrations among infants between healthcare units using different materials differed by a factor of 17.⁶⁹

A major concern surrounding these substances is that they are known endocrine-disrupting chemicals (EDCs) that can mimic or otherwise interfere with hormone production or function. They can also affect brain development and function, growth, sexual maturation, stress response, and behaviour.⁷⁰ EDCs can impact the human body at very low concentrations and can combine with other endocrine disruptors to produce additive effects. Evidence shows that foetuses, children, and pregnant women are the most vulnerable groups and that effects may also be transmitted to future generations.⁷¹ Exposure to EDCs is harmful for human fertility and reproductive development and is linked to the 50% reduction in fertility worldwide over the past 50 years.⁷²

Phthalates and bisphenols (known EDCs) are produced in large quantities and used in many consumer products; exposure to these chemicals within the general population therefore happens on daily basis. Such exposure is particularly worrisome for sensitive populations, including pregnant women, infants, and paediatric groups. According to the European Chemicals Agency, the latest EU restrictions on four of the most widely used phthalates (DEHP, BBP, DBP, and DIBP) will annually prevent 2,000 boys from developing impaired fertility in later life.⁷³ There is also on-going debate about EDCs' role in increasing greater susceptibility to disease, including COVID-19.⁷⁴

Despite claims that exposure to hazardous chemicals via medical devices only represents a

small proportion of an individual's overall exposure, this exposure can be especially harmful for patients undergoing multiple medical interventions or who are exposed chronically over extended periods. Patients requiring such treatment are likely already from a vulnerable population and may be further susceptible to harm caused by exposure to toxic chemicals. Several clinical observations point to BPA/DEHP exposure for dialysis patients possibly contributing to increased cardiovascular mortality and sudden cardiac death.⁷⁵

Patients in a NICU are exposed to phthalate mixtures through the complex materials used in NICU care - respiratory circuits, intravenous equipment, enteral feeding supplies, and incubators are likely sources of phthalate exposure.⁷⁶ Premature babies and infants are particularly sensitive to phthalate effects, as their reproductive systems are still developing and they have much higher relative phthalates intake. Unborn and young children are not able to metabolise chemical substances in the same way as adults, due to the ongoing development of their organs and maturation of the different systems. Belgian clinicians have identified a link between significant attention-deficit observed in hospitalised children and their exposure to the phthalate DEHP during their stay in intensive care.⁷⁷

Hazardous chemicals present in medical plastics are not limited to phthalates and bisphenols; additives to improve product performance such as fillers, colourings, impact modifiers, stabilisers, parabens, flame-retardants, per- and polyfluoroalkyl substances (PFAS), biocidal active substances, and others can be found in medical plastics. In some cases, these harmful chemicals can represent up to 80% of the final product and they can be released into the environment during production, use, and disposal. DEHP and BPA are two common examples; they are both classified by the European Commission as toxic for reproduction and with endocrine-disrupting properties for human health and for the environment.⁷⁸

There is strong evidence that EDCs found in healthcare might not only increase the incidence of disease, but can also undermine the efficacy of medical treatments. Healthcare professionals have an ethical obligation to discuss these exposures and risks with their patients.⁷⁹

Certain plastics used in medical products, such as PVC, also create a waste management problem.⁸⁰ The primary disposal route for PVC medical waste is incineration, which releases dioxins and other persistent environmental pollutants that have a detrimental impact on both human health and the environment.

Current scientific evidence

Studies continue to show that vulnerable infants and children are exposed to high levels of harmful substances during medical procedures, through tubing and other medical devices. Exposure to phthalates and BPA has been associated with higher risk of cardiometabolic impairment in normal weight children.^{81,82} Academic and regulatory toxicology studies of BPA consistently state that the brain is one of the most sensitive organs disrupted by BPA, even at doses below 'safe' limits determined by regulatory agencies such as the European Food Safety Authority. Experimental and epidemiologic evidence also points to the same conclusion: BPA is a probable developmental neurotoxicant at low doses.⁸³

During hospitalisation, certain medical devices and interventions can increase BPA exposure in paediatric intensive care patients. High concentrations of parabens and BPA can be found in the urine of very low birth weight infants, indicating a high level of exposure.^{84,85} Exposure to non-invasive respiratory support in the NICU and phthalate mixtures have also been linked to neurobehavioral development in premature infants with birth weight <1500g.⁸⁶

Further studies have shown that standard medical procedures during cardiac surgery increased the amount of plasticiser substances within infants' bodies.⁸⁸ Despite the use of DEHP-free tubing in the study, the internal DEHP exposure after surgery still increased significantly.

The extent of patient exposure varies considerably and possible adverse effects have long been debated. SCENIHR^{iv} reviewed existing evidence and concluded that premature

babies in neonatal intensive care units, infants subjected to repeated medical treatment using medical devices, and patients undergoing haemodialysis are at risk of DEHP and BPA induced effects.^{89,90} Experts recommend, whenever possible, the use of medical devices that do not leach DEHP or BPA.

Whilst there are multiple, ubiquitous sources of exposure to harmful endocrine disruptors, the healthcare sector has both a moral and professional obligation to prevent harmful exposures to hazardous chemicals in medical devices. Exposure can be avoided by using existing alternative products and leveraging market influence to promote research into further, safer alternatives.⁹¹

HCWH Europe's report *Non-toxic healthcare* (2014) provides a more comprehensive overview of risks posed by chemicals contained in medical devices, the European legal framework on hazardous substances in medical devices, and information on existing alternatives.⁸⁷ The second edition of the report, published in 2019, also contains a dedicated chapter specifically examining the health impact of plastics in healthcare.³⁹

^{iv} Scientific Committee on Emerging and Newly Identified Health Risks

THE EU REGULATORY FRAMEWORK

As of 26 May 2021, hazardous substances present in certain medical devices are regulated by the Medical Devices Regulation (MDR 2017/745) in the EU.⁹² The presence of CMRs or EDCs in a concentration above 0.1 % weight by weight (w/w) will only be allowed in invasive medical devices with justifications. The European Commission prepared guidelines on how to perform a benefit-risk assessment of CMR/ED substances to justify their presence in medical devices.⁹³

The regulation also stipulates that hazardous substances used in medical devices (subject to approved justification), must be indicated on product labelling. In practice, this means that manufacturers should provide information on specific risks for vulnerable patient groups and appropriate precautionary measures.

Information labelled in accordance with the MDR is one of the mandatory Unique Device Identifiers (UDI) to be provided by the manufacturer to the UDI database. This and other relevant information on medical devices will be accessible for the healthcare professionals and patients via the European Database on Medical Devices (EUDAMED), which is expected to become fully operational by May 2022. The European Commission issued a factsheet that lists documents that will be accessible once the EUDAMED database is in place.⁹⁴

BARRIERS TO CHANGE

GAPS IN EXISTING REGULATIONS

EU regulation has developed significantly in recent years, benefitting health and environment, however, proper implementation of the law is still needed to see effective change. The risk-benefit assessment of hazardous chemicals in certain medical devices must be subject to the most stringent conformity assessment procedures.

The risk-benefit assessments currently only consider potential patient exposure to a specific CMR/EDC from an individual device at a given time. In reality, patients are often exposed to multiple sources from a variety of medical devices used simultaneously especially vulnerable patients receiving multiple treatments e.g. intensive care. These combined exposures are not considered by the current regulations and therefore do not offer an accurate overview of the significant potential health risks involved.⁹⁵

While hazard, exposure, and epidemiological data on a small number of prominent chemicals such as DEHP and BPA are abundant and growing, there are insufficient data for many other substances. It is challenging to comprehensively assess the chemical safety of all medical plastics, despite being potentially an important source of exposure to many hazardous, currently unrestricted chemicals.

LACK OF AWARENESS

Within the healthcare sector, awareness of actions to eliminate harmful plastics must be increased, emphasising that a high level of patient care and safety can be maintained. A recent survey showed that only 50% of senior neonatologists in Switzerland, Belgium, and France had previously received information about phthalates in neonatology.⁹⁶ Moreover, 63% were unaware of phthalate-containing medical devices in their NICUs. Another French study showed that perinatal health professionals (obstetricians, midwives, and general practitioners) lacked awareness about phthalates.⁹⁷ Involving healthcare professionals is crucial to eliminate harmful plastics in clinical settings - to take on a preventive role, healthcare professionals need to be better informed about phthalates and trained in environmental health.

CAPACITY BUILDING IN ENVIRONMENTAL HEALTH

New professional profiles and structures, e.g. an Environmental Health Unit or environmental health professionals can be created to facilitate work on the link between health and environment and enable structured knowledge exchange, capacity building, and a global multidisciplinary collaborative approach.

LABELLING

Due to a lack of full transparency in the supply chain, and a lack of publicly available information on both the use and amount of the numerous substances in medical plastics, knowledge and awareness is currently limited.

From a practical exercise focusing on labelling of IV bags and tubing used by six participants in the *Towards Plastic-free Healthcare in Europe* project we can conclude that information about materials and chemicals used in medical devices is often missing, incomplete, and not standardised between different manufacturers (see page 13). The majority of devices reviewed (31 out of 47) were missing information about their constituent polymers. Whilst we can deduce that items labelled with plasticisers indicate that they contain PVC, descriptions such as “DEHP-free” do not directly confirm the absence of presence of PVC or other plasticisers. Poor labelling is hampering a meaningful assessment of both the chemicals contained in medical devices and the materials they are made of, as well as limiting awareness of the issue amongst healthcare workers.

Analysis of labelling of IV bags and tubing:

- 47 devices were assessed based on labelling information
- 31 devices were missing information about polymers
- Only one device was labelled as made from PVC, five others were identified as PVC based on plasticiser information.
- Six devices were labelled as “PVC-free”
- 15 devices were labelled as “DEHP-free”
- One device indicated presence of phthalates without further specification
- One brand of IV bags provided detailed information about material used (FLEBOFLEX® / PP - Polypropylene)
- IV bags with trademark name as VIAFLO® of FreeFlex® are manufactured from non-PVC materials. VIAFLO is a flexible plastic container fabricated from a multilayer sheeting (PL-2442) composed of PP, PA, and PE
- Eight devices were labelled with resin code 7 (see *plastics commonly used in healthcare* on page 39), many plastics in this category contain BPA.

IV bags found by a project participant during waste audits



OPPORTUNITIES FOR THE HEALTHCARE SECTOR: SAFER MEDICAL DEVICES

Many alternatives for the most hazardous chemicals used in medical devices already exist, including for phthalates and BPA. There is a choice between using these safer alternatives or ignoring the dangerous exposures for patients. Within the EU, the Medical Devices Regulation (MDR) is a real opportunity to accelerate the phasing-out of hazardous substances (phthalates and BPA in particular) and minimise exposure for patients, especially vulnerable groups. As the EU is considered a front-runner in global efforts to reduce environmental harm, non-EU countries should be encouraged to adopt the MDR provisions as the basis for their own regulatory efforts.

Access to clear and complete product information is important not only for awareness raising but also for making informed purchases. The healthcare sector must make a clear demand to the market for correct and harmonised labelling.

Many alternative medical devices with safer toxicological profiles are already available and a number of European healthcare providers are moving to eliminate PVC, DEHP, and BPA from healthcare practice.^{39,87}

National health authorities can help raise awareness amongst healthcare professionals of these risks by communicating and adopting existing expert opinion and recommendations.^{89,90} Healthcare facilities and professionals play an important role in the substitution of hazardous chemicals – not only do they have an ethical responsibility to use less hazardous products but they also have significant purchasing power and market influence to drive manufacturers towards safer and lower impact products.

Importantly, substitution needs to be supported by strong national actions, such as in France, where tubing containing DEHP are already banned in paediatric, neonatal, and maternity departments.⁹⁸ Funding for research and development of alternative substances and products as well as clinical and epidemiological projects to compare their performance and safety should also be prioritised.

Further development of safer medical devices, along with greater market demand will support a transition away from DEHP, BPA, and other problematic chemicals in healthcare to safer alternatives.

TOOLKIT HOW TO REDUCE UNNECESSARY PLASTICS IN HEALTHCARE

This toolkit sets out a series of practical steps to support healthcare providers in reducing unnecessary plastics. It provides advice on how to conduct a facility or departmental waste audit, and how to collate and analyse procurement data, and makes recommendations for implementing changes in procurement processes and daily routines. Though different healthcare facilities may have different needs, there are several opportunities and challenges that are common to all healthcare providers. The toolkit also provides best practice examples of successful plastic reduction initiatives in healthcare, both to offer inspiration and to provide evidence and learning that can help demonstrate the benefits to colleagues and management teams.

STEP 1: IDENTIFY PLASTICS

Building an understanding of plastic items currently used in your facility is a crucial first step in reducing plastic. Observing daily operational practices can provide an initial insight of the plastic used, but a plastic waste audit and/or analysis of procurement data is needed for a more in-depth assessment. Below we summarise how to build a picture of plastics currently in use in your organisation via two complementary methods: plastic waste audits and procurement data analysis.

METHOD 1: CONDUCT A PLASTIC WASTE AUDIT

Waste audits are an established method for quantifying waste as well as identifying potential inefficiencies and opportunities for waste prevention and improvements in segregation practices. A waste audit entails collecting and sorting plastic waste from a defined area over a defined period of time. Audit data will help build an understanding of the types and quantities of plastic waste generated. Compared to other environmental impact assessment studies, waste audits are relatively easy to regularly repeat to monitor progress.

This toolkit offers a step-by-step methodology to conduct a hospital waste audit and a database (excel file) to collect and visualise waste audit data.^v The methodology builds on the exemplary work of Health Care Without Harm Asia's *Plastic toolkit for hospitals*.⁹⁹ This toolkit also includes practical examples of waste audits conducted by HCWH Europe as part of the *Towards Plastic-free Healthcare in Europe* project.

^v Plastic waste audit data entry sheet: <https://noharm-europe.org/documents/plastic-waste-audit-data-entry-sheet>



Waste audits conducted by
project participants

BEFORE THE AUDIT

1. Decide on the scope of the audit

- Get key staff on board – discuss waste audits with facility management, waste management, and infection prevention and control teams. Talk with other staff (e.g. clinical, food services) to assess interest in audit and recruit potential volunteers. It is important to explain why the audit is being carried out, what you are aiming to achieve and how it will be done. Part one of this publication can be used to highlight important drivers for plastic reduction in healthcare.
- Select the location and scope of your audit i.e. a particular ward/department, the entire facility, or possibly even multiple facilities.
 - HCWH Europe's project prioritised the neonatal ICU and maternity unit, due to the vulnerability of the patients there. Auditing an entire facility would provide a more comprehensive overview of all plastic waste, but will require more time and resources.
- Decide on the duration of the audit. Longer audits allow for day-to-day differences in waste generation, but again require more time and resources. HCWH Europe's waste audits were conducted over a 48-hour period during weekdays.
- Consider the number of personnel, storage space, equipment, and time available for your audit, as well as the approximate quantity of waste generated daily in the targeted ward and adapt your plan accordingly.
 - The number of staff needed is dependent on the amount of waste collected. One of HCWH Europe's audits, for example, required five volunteers for two days for approximately 250kg of waste.

2. Identify audit site and staff resources required

- Identify an area to collect and sort waste during the audit that is ideally located away from clinical areas and vehicles and has an easily washable floor. Depending on location and weather conditions, an indoor area might be preferred. The space needed will depend on the amount of waste being audited.
- Consider dedicated spaces for different phases of the audit: segregating plastic waste, sorting plastics, and measurement.
- Recruit volunteers through available communication channels and discuss the audit with sustainability champions or colleagues who have expressed concerns about or interest in plastics. Alternatively, discuss with senior managers the possibility of funding staff time to conduct the audits.
- Involve as many staff as possible in audits, even if you are bringing in expert assistance. Not only does this help to spread the workload, but by involving staff from different departments you can help raise awareness about the issue and create a sense of common purpose.

3. Gather necessary equipment

Many of these resources should already be available in your facility, but it is possible you will need to factor in additional purchases.

- Personal protective equipment (PPE) – this will vary according to the sorting site, hospital policy, and potential hazards:
 - Protective face masks
 - Nitrile gloves and needlestick resistant gloves for separating plastic waste
 - Safety glasses (optional)
 - Overalls/aprons (preferably reusable)
 - Closed shoes or boots
- Waste handling:
 - Sorting tables
 - Hand tools for separating healthcare wastes prior to hand sorting such as long handled tongs or litter pickers
 - Waste containers and corresponding coloured bin bags to adequately dispose of the waste after the audit
- Weighing:
 - Weighing scales with capacity up to 30Kg (min) and sensitivity in 0.5Kg intervals
 - Weighing scales able to measure in 0.1g intervals or less for lightweight materials. Weighing pad size should be suitable to weigh containers.
 - Containers for separating plastic material. If using hanging scales, small bulk bags would be suitable. For platform scales or benchtop scales, use rigid containers such as buckets, unused waste bins, or carton boxes.
- Record keeping:
 - Laptop for data collection or printable data forms to complete by hand
 - Camera for photo documentation
- Others:
 - Access to washrooms/sanitiser
 - Spill kits for hazardous and non-hazardous liquids
 - First aid kit
 - Try to avoid the use of plastic! However, if the floor is not easily washable, protective plastic sheeting might be necessary.

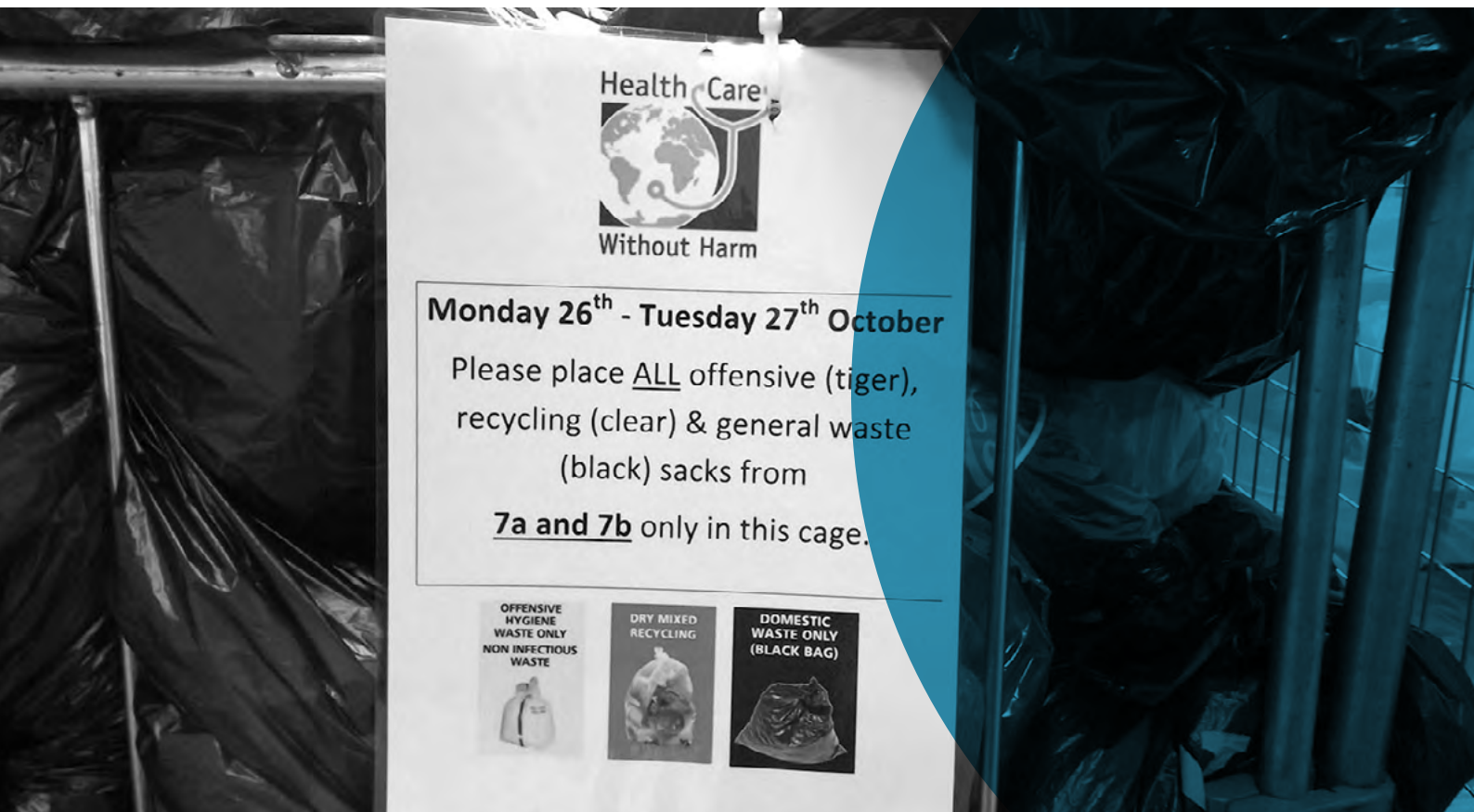
Weighing scale and waste bags at the audit site of a project participant



4. Collect waste for auditing

- Waste from the selected wards and waste streams should be collected and brought to the sorting location – different waste streams should be kept separated.
- Collected waste bags should be clearly labelled with the area where it was generated and the waste stream. Make sure the staff handling waste are thoroughly informed about the audit and know where to store the bags.
- Waste can either be all collected before starting the audit, or collected and audited in stages e.g. every 24 hours.

Project participant collecting waste for auditing



5. Prepare audit site

- If needed, lay protective floor covering where unsorted waste bags will be placed.
- Set up sorting tables and place containers for different plastic product categories within easy reach – measure the weight of these containers.
- Appropriate waste containers should be placed nearby for disposal of non-plastic items (e.g. paper, metal, general) and plastic items that have been successfully weighed and recorded.
- You will also need a container for any contents e.g. food or liquid waste included within plastic items.
- Weighing stations should be set up with access to power. If using a laptop for data collection, save and backup your files at regular intervals.
- Power cables and other trip hazards should be bundled together and taped to the floor or placed under matting.



Waste sorting areas at audits conducted by project participants

6. Brief audit team

- Brief your team on the audit steps presented below and how to enter data into the data collection spreadsheet. They will need to be familiar with the product categories and common plastic types beforehand.
- Conduct a health & safety briefing prior to starting work, following any existing protocols within the hospital - including COVID-19 measures, if applicable.
- Distribute PPE to your team.

DURING THE AUDIT

Bring collected waste to the sorting area. Sort one waste category from each department at a time. We recommend starting with the general waste and recycling streams, so that the team can familiarise themselves with the process, before moving on to the medical waste streams. Remember to take photos throughout the audit (they can later be used in awareness raising campaigns).

For each waste bag:

1. Record the ward or department where the waste was generated and the waste stream.
2. Weigh the unopened bag and record the weight.
3. Open the bag on the sorting table.
4. Remove any non-plastic items and discard in the appropriate waste container.
 - Empty any liquid/food content into the appropriate waste container. These can be weighed later, e.g. if you also want to measure food waste.
 - Include waste bags as part of the plastic waste stream.
5. Separate plastic items into categories. The main categories in the provided database are the following, each divided into subcategories:
 - Unknown
 - Drink bottles
 - Foodware
 - Medical items
 - Packaging
 - Toiletry
 - Other



Waste sorted by categories by one of the project participants



Food waste within plastic packaging found by project participants during waste audits

6. Weigh each item and record individual items in the data form
 - Group identical items together when weighing and recording e.g. group several drink bottles.
 - Photograph unknown items, including any visible labels for future reference.
7. Weigh discarded contents (e.g. food waste) and record it so that you can calculate percentage of plastic within the total waste generated.
8. Dispose of both plastic and non-plastic items in correct waste stream bins. Reuse the original waste bags if possible.
9. Input the data into the provided database.

The audit can follow two different methods:

- Sort, weigh, and record data one bag at a time - this method requires fewer containers for each plastic category.
- Sort all waste bags of one waste stream before weighing and recording data (repeating steps 1-5 before moving to step 6).

If you want to conduct your own plastic waste audit, you can access our data collection tool [here](#).

Items being weighted by one of the project participants



Plastic types commonly found in healthcare¹⁰⁰

RESIN CODE	PLASTIC TYPE	ABBREVIATION	COMMONLY USED IN
1	Polyethylene terephthalate (Polyester)	PET, PETE	Water/drinks bottles, textile fabrics.
2	High-density polyethylene	HDPE	Milk/yoghurt drink bottles, waste bags, IV fluid containers, syringe barrels.
3	Polyvinyl chloride	PVC	Blood bags, IV bags, tubing, catheters, respiratory masks, disposable gloves.
4	Low-density polyethylene	LDPE	Plastic bags, plastic films, other flexible packaging.
5	Polypropylene	PP	Syringes, sterilisation “blue” wrap, irrigation bottles, basins, cups and disposable items e.g. surgical masks, gowns, caps, shoe covers, drapes.
6	Polystyrene	PS	Plastic cutlery, yoghurt cups, fruit & vegetable trays, clear solid packaging, test tubes.
	Expanded polystyrene (Styrofoam)		Fast food packaging, packing “peanuts”, insulation.
7	OTHER All plastics that do not fit in any of the above categories, common examples include:		
Polycarbonate ^{vi}		PC	Medical tubing, catheters, incubators, syringes, blood oxygenators, baby bottles.
Polyurethane		PUR	Sponges
Polyamide		PA	Tea bags
Nitrile rubbers			Disposable gloves, catheters.
Polylactide		PLA	Coffee cup lids, yoghurt pots.

^{vi} Polycarbonates can contain BPA. In the EU, BPA is banned for use in baby bottles, but other bisphenols, which are just as harmful, are still used as replacements. Moon, M. K. (2019) Concern about the Safety of Bisphenol A Substitutes.

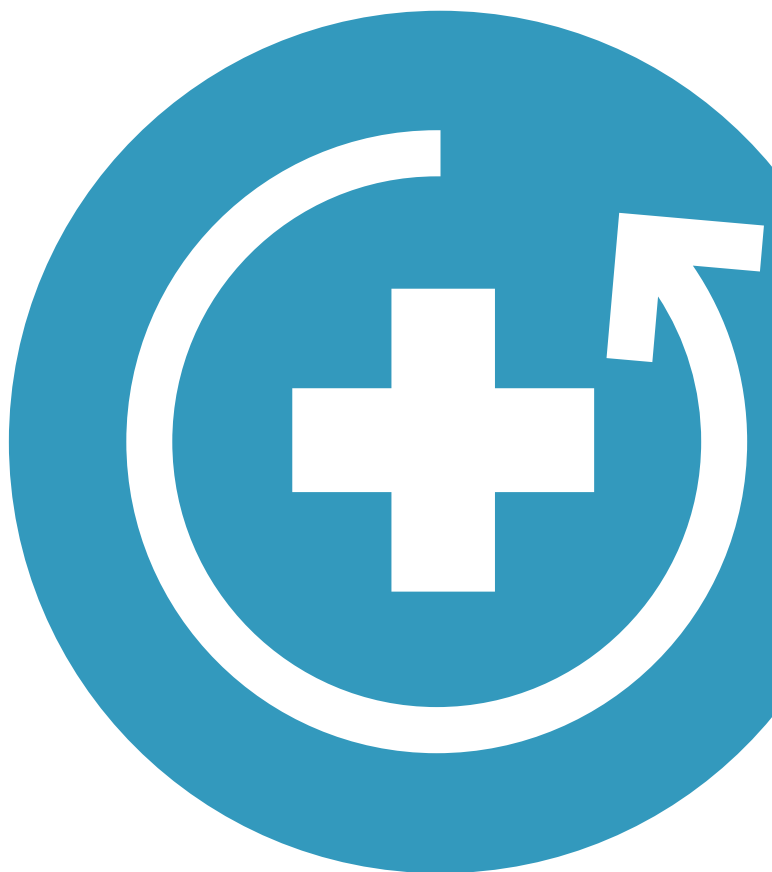
AFTER THE AUDIT

1. Clean up

- Clean and sanitise all surfaces and equipment used for handling waste.
- Store equipment in designated area or containers.
- Team members must remove PPE and wash their hands thoroughly.

2. Complete gathered data

- Take a look at the data summaries in the tool, which provides graphs of the weight of audited waste by product type, category, and plastic type.
- Conduct further data analysis if you want to find out more about specific products (e.g. look at procurement data or store rooms, talk with staff on the ground, etc.).
- Decide how the data can be used in your plastic reduction plans and actions.



METHOD 2: ANALYSE PROCUREMENT DATA

Analysing your organisation's procurement (purchasing) data is another valuable method of identifying the range of plastic items used by your organisation. As with the waste audit, begin by defining the scope/objective of your procurement analysis.

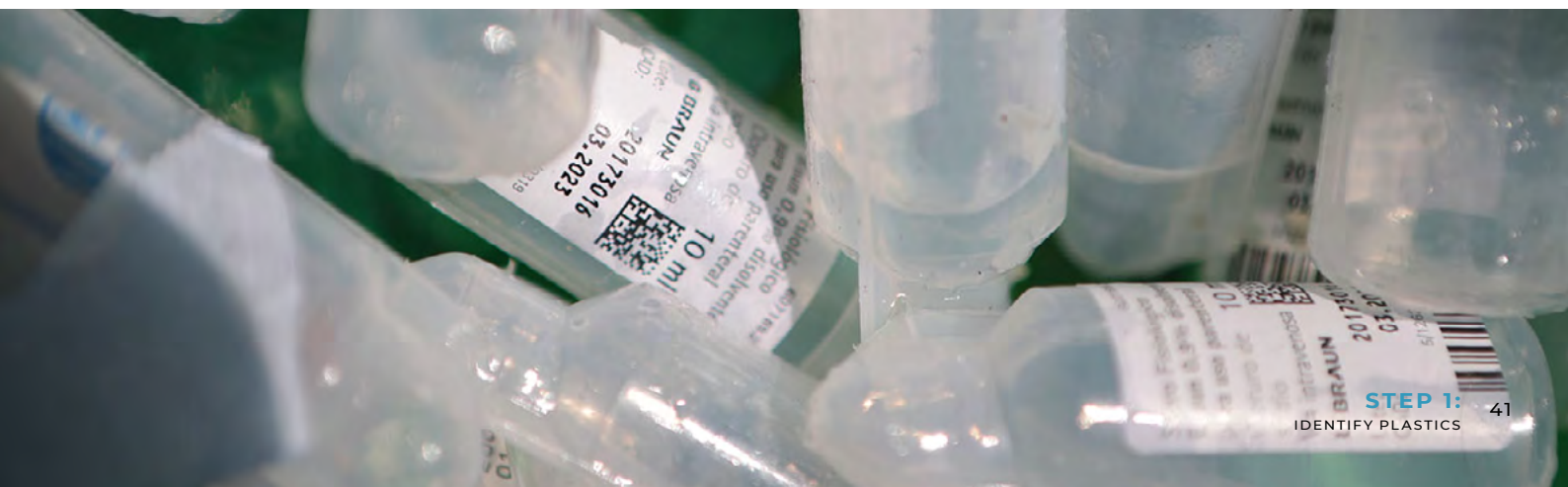
You can engage your procurement or finance teams and request a schedule of purchasing data for a given period of time (i.e. most recent 12 months' of available data). Be clear why you are requesting it and what you hope to learn from it – they may be able to assist in interpreting the information and even identifying priority items or categories.

If you are unable to access a complete data set, or only have the capacity to focus on a smaller group of items (analysing a full year of procurement data could be seen as a daunting task!), consider prioritising the most commonly used items within healthcare (see page 13). Procurement staff may be able to assist in this exercise, as well as staff that are familiar with the items in use, in particular frontline healthcare and facilities staff. It may also be helpful to look at storerooms to identify and record the most commonly used plastic items.

Relevant information that can be gathered from procurement data (and store room analysis) includes:

- Number of units purchased (e.g. per month)
- Price per unit
- Weight per unit (if primary packaging cannot be removed, the weight of the item can be calculated together with that of the packaging. This should be specified in the final results)
- Supplier or manufacturer of the product
- Whether the product is disposable or reusable
- Department where the purchase was made
- Product's material/plastic type
- Product's usual waste stream

Saline bottles found by project participant during waste audit



STEP 2: ANALYSE DATA, IDENTIFY PRIORITIES, AND CREATE AN ACTION PLAN

Use the information gathered through waste audits and/or procurement data analysis to create an action plan for reducing plastic and to raise awareness among staff.

Tips for creating your action plan:

- Discuss your findings with all relevant stakeholders and determine what actions can be taken to reduce the largest amount of plastic waste identified.
 - Make the discussion inclusive with representatives from as many departments as possible. This will help you gain meaningful and productive input from across the organisation and encourage ownership of potential solutions or actions.
- Engage with suppliers or manufacturers of high-volume items to explore potential solutions.
- Identify priority areas, establishing targets where appropriate, e.g. a reduction in specific items or plastic types, such as PVC.
 - Set realistic timeframes for action and identify individuals or teams that are responsible.
- Use the information and examples in the following sections (Sustainable procurement and Applying the waste hierarchy) to help define priorities and build your action plan.
- Repeat waste audits on an annual or bi-annual basis to help you track progress towards targets and goals. This should be considered when drawing up your action plan.

PLASTIC ACTION PLANS PROPOSED BY PROJECT PARTICIPANTS:

- Plastic consumption monitoring.
- Reduce plastic items' weight through collaboration with suppliers.
- Reduce consumption of disposable medical plastics through the use of reusable gowns.
- Replace plastic containers in IV administration systems with glass ones.
- Reduce the consumption of examination gloves through information and awareness campaigns.
- Reduce plastic in food services with reusable tableware, alternative materials, and increasing the use of tap water.
- Reduce use of non-hazardous waste collection bags through optimisation processes and introduction of alternative items.
- Introduce reusable containers for hazardous waste collection.
- Reduce plastic in laundry by replacing polyethylene packaging with smaller paper packaging.
- Reduce plastic waste destined for landfill through improved waste collection and segregation.
- Reduce direct exposure to micro and nano-plastics, by replacing plastic milk containers with glass in the neonatal and neonatal ICU units.

SUSTAINABLE PROCUREMENT

Healthcare organisations can significantly reduce their plastic consumption by transforming procurement policy so that it is more in line with the circular economy model.

The analysis of procurement and waste data can help build an understanding of which products and product groups should be prioritised for more sustainable practices. A better understanding of the supply chain helps you to identify opportunities to engage with key suppliers and explore more sustainable solutions. A sustainable procurement policy and full leadership support is essential to effectively implement plastic and waste reduction strategies.

ADAPT PROCUREMENT CRITERIA

EU regulations provide public procurers with a legal framework to demand circular, toxic-free products with minimised negative impacts on health and environment.

The Public Procurement Directive^{vii} allows public authorities in the EU to include environmental and social criteria in their procurement processes. The concept of “most economically advantageous tender” (art. 67.1), gives public authorities greater choice for awarding contracts.

The option of “lower cost” not only covers purchase price, but also costs of running, servicing, and disposing of the product as well as environmental externalities. A whole-life costing method is typically used when calculating this option, and if carried out correctly, can help assess products’ environmental impacts. The “best-price quality ratio” option also allows authorities to include environmental and social criteria (art. 67.2) as well as price/cost. The directive also allows procurers to request label and certifications or their equivalent as proof that certain environmental and social characteristics are fulfilled (art. 43).

The 2019 Single-Use Plastics (SUP) Directive^{viii} bans a number of non-medical, single-use plastic items that are often used in healthcare food services, including:

- Cutlery (forks, knives, spoons, chopsticks)
- Plates
- Straws (except if needed for medical purposes)

vii Directive 2014/24/EU <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024>

viii Directive 2019/904/EU <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0904&qid=1631870594304>

- Beverage stirrers
- Expanded polystyrene food and beverage containers, including lids

Whilst the SUP Directive provides an excellent opportunity to reduce plastic waste, it is important not to simply replace banned single-use plastic items with single-use products made of other materials e.g. paper/carton, moulded fibre, or compostable/'biodegradable' options. Using such alternatives does not address overconsumption and recycling is not guaranteed. Furthermore, non-plastic single-use food contact materials can also still pose a risk to the environment and human health. When removing banned plastic single-use items from your healthcare food services, consider introducing safer, reusable products that do not only reduce waste, but also reduce long-term costs.^{ix}

^{ix} For more information, HCWH Europe (2021) Sustainable food contact materials in the European healthcare sector <https://noharm-europe.org/articles/news/europe/sustainable-food-contact-materials-healthcare>

Fork found by project participant during plastic waste audits

HEALTHCARE MARKET TRANSFORMATION NETWORK

Collaborate with other hospitals and share your experiences of integrating sustainability criteria into tenders, managing sustainable procurement processes, and adapting procurement contract language. HCWH Europe's Healthcare Market Transformation Network is a platform to collaborate on sustainability concerns and solutions in the healthcare supply chain, with the aim of creating sustainable procurement criteria for key products. Join our plastics work group to help transform the use of plastics in healthcare.^x

^x www.noharm-europe.org/healthcare-market-transformation-network

REUSABLE OR NOT, REDUCE THE IMPACT OF YOUR PROCUREMENT

Reusable alternatives to single-use items should be prioritised wherever possible, but even when this is not possible there are many other aspects of sustainable procurement to consider.

Ask your suppliers about the manufacturing process of their products (including packaging): what sort of chemicals are used? Can their product be made of a safer or more sustainable alternative (e.g. PVC-free blood bags, glass baby bottles)? Discuss opportunities to reduce plastic whilst maintaining performance. Can the packaging be reused or can non-plastic packaging alternatives be used? Considering the full supply chain and its social impact, ask suppliers about the employment rights and working conditions for those making the products. Leverage your purchasing power to generate demand for safer alternatives that use less plastic and guarantee fair, safe working conditions. Consider alternative business models e.g. servitisation^{xi} or take-back schemes.

In practice: Less plastic, same product

Plastic syringes that weigh less still offer the same performance, but can help reduce waste, climate impact, and costs. Having identified single-use plastic syringes as a key source of plastic waste in healthcare, Region Skåne (Sweden) worked with their supplier to switch to lighter alternatives that use less plastic, reducing waste by 4.5 tonnes.

INVOLVE STAFF IN PROCUREMENT DECISIONS

It is important to engage with all key stakeholders who have a role in decision-making or will be impacted by the procurement decisions at your facility. Staff who use the products are an important group to involve from the beginning of the process. Involve health professionals as well as procurement staff in discussions about the health and environmental impacts of plastics and waste – bringing them along on the journey will support the uptake of new procurement decisions. You can gain further support from your colleagues by:

- Encouraging teams to examine their plastic use and talk about potential solutions.
- Providing staff with incentives (e.g. contests, rewards) to give feedback and propose their own ideas - start with items that staff are already interested in.
- Engaging with the wider community e.g. patients, visitors, or retired staff (if there is interest).

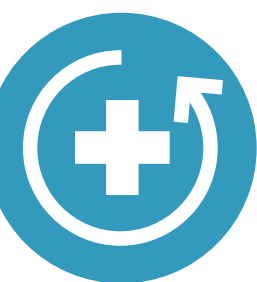
^{xi} Suppliers offering not just a product, but a service, including repair or reprocessing services, end-of-life product retrieval, or optimising the client's use of the product

In practice: Engaging staff in plastic reduction

Sussex Community Hospitals NHS Trust, UK, distributed a plastic reduction toolkit to staff as part of Plastic-Free July.¹⁰¹ The toolkit included the following questions:

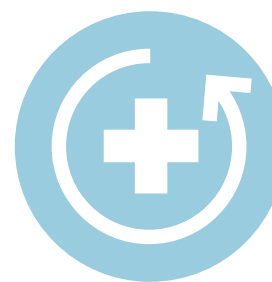
As a team, write down the 10 most used single-use plastic items you are using day to day (remember to include packaging), then answer these questions for each item (tip – start with the items that are easiest to tackle!)

1. Do we really need to use this item? Could we cut it out entirely or reduce the amount we are using?
2. Is there a way we could buy this with less packaging?
3. Is there a reusable or non-plastic/recyclable alternative available? What are the potential environmental impacts of the alternative products?
4. What is the cost difference for the alternative?
5. Is there anything we need to consider in terms of infection control?
6. What would our patients think of the change – any positive or negative impacts?
7. Who would we need to talk to, to help support this change? Procurement? Infection Control?



The Royal College of Nursing (UK)'s *Small Changes, Big Differences* initiative¹⁰² supports nurses in identifying areas of improvement in procurement and informing procurement colleagues. Nurses can highlight aspects of product suitability e.g. usability, safety, quality, patient comfort. The initiative puts nurses at the heart of the decision-making process when making purchases, as they are the users of the products. This can also lead to cost savings and make purchasing more efficient.

As part of the quality assurance process, a hospital in Canada allowed staff to submit environmental concerns about particular products (including excess packaging), to be discussed with suppliers. This resulted in a 17% reduction in packaging and waste for one item, and reduced costs by 20 cents per item for another.



TACKLING NON-MEDICAL PLASTICS

Non-medical plastics represent a high percentage of plastic waste in healthcare and can be easier to tackle than medical plastics. Many hospitals are already successfully reducing and replacing non-medical plastics, such as single-use items in food services for benefit of the environment and human health.

Plastic cups found during HCWH Europe's waste audits



In practice: Reduce single-use plastics in food services

- Easy-wins include offering tap water and/or water fountains instead of single-use plastic bottled water. The Clinical University Hospital Virgen de la Arrixaca (Spain) is saving approximately 95,000 plastic water bottles a year just by using filtered tap water in their staff dining room. Avoiding plastic drinks bottles can also help decrease exposure to microplastics.¹⁰³
- Though replacing items can incur a high initial investment, there are opportunities for long-term cost savings. The Newcastle upon Tyne Hospitals NHS Foundation Trust (UK) spent £12,000 GBP (approx. €13,600) to replace the single-use plastic dishware in patient catering with reusable ceramic alternatives. The initial investment was recuperated in just two months and the Trust has achieved annual savings of £80,000 GBP (approx. €93,000).
- The Centre Hospitalier Universitaire Vaudois (Switzerland) removed disposable dishes from their cafeterias and introduced a deposit return system for reusable food containers.¹⁰⁴ They have reduced their plastic waste by more than 4,300kg each year and are saving CHF 44,000 (approximately €40,800) annually.
- Non-medical items can also be reduced outside of food services. Instead of single-use cups, one nurse at the Sussex Partnership NHS Foundation Trust (UK) has started using reusable cups that can be sterilised after use for her medication rounds.¹⁰⁵ Within just one 20-bed acute inpatient ward, the Trust uses over 22,000 cups annually for medication rounds. If the initiative to use reusable cups was scaled up, the Trust could avoid this waste and save approximately £900 plus waste management costs per ward.
- To encourage healthcare facilities in the UK to reduce their unnecessary single-use plastic use, the NHS launched a single-use plastics reduction pledge in 2019, with a particular focus on canteen items.¹⁰⁶

Non-medical waste found by project participant during waste audits



APPLYING THE WASTE HIERARCHY

The waste hierarchy identifies the actions that should be prioritised to enable a circular economy and ensure that materials are used for as long as possible before they are disposed of. Ultimately waste prevention is the most important factor (see page 11).

Refuse: Is this item truly needed?

Reduce: Is it sometimes used unnecessarily; can its use be reduced?

Reuse, repair, reprocess: Are reusable and non-toxic alternatives available? Can the item be reprocessed or easily repaired?

- Prioritise items that can be reused or reprocessed
- Purchase durable and repairable products that can be used for longer periods of time.

Replace: Does the item contain toxic chemicals? Can it be replaced with a toxic-free alternative?

Recycle: Can this item be recycled locally? Does the recycled item provide any value?

REFUSE AND REDUCE

A considerable amount of waste generated by hospitals comprises unused items. Disposable custom packs, for example, are customised to include single-use sterile items for specific procedures, but they often contain items that are not normally used in the procedures and, once opened, all items within the pack are discarded, including unused products. Optimising hospital operations to ensure that no items are wasted can lead to increased environmental protection and a reduction in costs.

Unused item still in its packaging found during HCWH Europe's waste audits



In practice: Refuse unused items

- In one hospital in the US, pre-made kits for tonsil surgery included 12 unnecessary single-use items out of 40, and removing these items reduced costs from \$77.29 to \$66.04 USD per pack.¹⁰⁷
- By identifying items that were never used, the University of Minnesota Medical Center (US) decreased the number of items in their IV port kits for chemotherapy from 44 to 27.¹⁰⁸ This decreased the amount of waste by 0.45kg and supply costs by \$50 per procedure. They scaled this up to multiple OR packs and made infrequently used items available separately in the OR (i.e. not in the custom pack), reducing approximately 3,534kg of waste and saving \$104,658 in a year.¹⁰⁹

- After monitoring the surgery departments of three hospitals, the Västra Götaland region (Sweden) found significant variations in the supply and use of disposables during operations for total hip replacement, and identified opportunities to reduce the total weight of consumables used per surgery from 5.7kg to 3.9kg by removing unnecessary or unused items.¹¹⁰ Critical review of care routines and use of materials is a powerful tool for streamlining healthcare operations, as well as reducing environmental impact.
- The hospital at home team at Sussex Community Hospitals NHS Trust (UK) observed that they were producing a lot of waste in patient homes, primarily from the 30+ dressing packs used daily. Most of the items in the dressing packs were made of plastic, and though not all were being used they still had to be thrown away once the dressing pack was open.

Working with the sustainability team they switched to individual items instead of packs, many of which could be bought in bulk and were not individually packaged. The team could use reusable containers to transport items.

To further reduce unnecessary plastic use, the Trust's aseptic non-touch technique (ANTT) policy was also rewritten together with the infection prevention and control team, and now gloves are not required for drawing up IV.

While custom packs can significantly reduce packaging and staff workload, continually monitoring custom packs and the removal of unnecessary items can significantly reduce waste and costs. Items that might only be needed occasionally can be made available separately. Reusable custom packs should be preferred.

Another way of avoiding unused items being thrown away is to avoid opening them until they are actually needed for the surgery.¹¹¹ In one hospital, for example, staff have stopped the routine unpacking of saline bags and tubing during haemodiafiltration, only opening them once actually needed.⁵⁶

In practice: Reducing wasted items

During the waste audits conducted as part of the *Towards Plastic-free Healthcare in Europe* project, our participants noted that more wipes were taken out of the box than needed because of improper packaging. This issue has also been observed with gloves, whereby taking out one glove might result in multiple gloves being removed and subsequently thrown away. The Skåne Region in Sweden found that 6% (almost 3 million) of their gloves were annually discarded due to them falling on the floor.¹¹² Adapting procurement criteria and discussions with suppliers can help improve packaging to avoid these issues and minimise waste.

REDUCE UNNECESSARY USE

Gloves are one of the disposable products purchased in the highest volumes in healthcare, and since the start of the COVID-19 pandemic their use has increased significantly, and is expected to further grow in the following years, with serious consequences for the environment.

Evidence suggests, however, that gloves are often used inappropriately in clinical practice – they are used unnecessarily, put on too early, taken off too late, or not changed when needed.⁴⁰ Improper use of non-sterile gloves can lead to cross contamination and has been implicated in infection outbreaks.^{114,41} Research also shows that patients often feel uncomfortable with inappropriate use of gloves for personal tasks and one in five nurses develop hand dermatitis from gloves, which may require them to be moved out of clinical areas.^{114,115}

The majority of gloves used in healthcare are non-sterile (examination) gloves, used to protect the practitioner. They should be used if there is potential exposure to bodily fluids or mucous membranes, and assessments should be done before each intervention to determine this risk.¹¹⁶ Gloves should not replace hand hygiene as the most critical intervention to protect against pathogens and healthcare acquired infections. In surgery and other clinical settings, sterile gloves are used to protect the patient. When used, sterile and non-sterile gloves should be removed immediately after a procedure to prevent cross contamination.¹¹⁶

In practice: Reducing the unnecessary use of gloves

At the Great Ormond Street Hospital (GOSH) in the UK, infection control audits showed that the overuse and inappropriate use of gloves led to inadequate hand hygiene. For example, gloves were worn when moving patient beds or during preparation and administration of oral and IV medication. The hospital developed the *Gloves Are Off* campaign to improve staff hand hygiene and decrease unnecessary use of gloves.¹¹⁷

The aims of the campaign were:

- To reduce healthcare-associated infections and encourage staff to undertake risk assessments on whether gloves are necessary
- To improve hand hygiene compliance
- To reduce the staff's level of dermatitis due to the overuse of gloves
- To reduce their environmental impact

The campaign started in 2018 and, after one year, it had already helped reduce annual use of gloves by 4.3 million – a reduction of 21 tonnes of waste and savings of over £100,000 GBP in purchase costs and more than £1,500 GBP in disposal costs (approx. €117,200 and €1,760 respectively). There were no observed negative changes in hospital-acquired infections, staff reported better skin conditions, and hand hygiene has improved.

Patient safety remains the most important thing for staff, so the focus of the campaign was to help them understand when gloves are necessary and when they are not. The campaign emphasised the importance of prioritising good hand hygiene over the unnecessary use of gloves, which can actually increase infection risk.

Throughout the campaign, their successful results were communicated to motivate staff: “We have saved 21 tonnes of plastic, which is brilliant. That’s three and a half Tyrannosaurus Rex’s worth of plastic!”

Broad stakeholder engagement from all departments was crucial to the campaign’s success. Staff were also challenged to consider reducing their use of aprons and syringe bungs. You can learn more about the campaign’s communication strategy on page 63.



REUSE, REPAIR, REPROCESS

When reduction is not possible, reusing, repairing, and reprocessing should be considered as a next step. There are many opportunities for reusing items in healthcare, and single-use products should be reserved only for essential applications when no viable alternative exists, or when there is a proven high risk of infection (see page 23 for more information on how common misconceptions have led the healthcare sector to switch to single-use items).

REUSE

Reusable systems can significantly reduce healthcare's environmental impact and ensure resilience. Environmental and climate risks are growing and it is crucial that our healthcare systems are resilient and can maintain the delivery of care. Adopting reusable items helps maintain a more reliable inventory of necessary items and can help avoid supply shortages similar to those we have seen during COVID-19.¹¹⁸

Many items in healthcare can be safely reused e.g. basins/pitchers, blood pressure cuffs, tourniquets, sharps containers.¹¹⁹ Single-use textiles represent a high proportion of the total plastic waste generated in healthcare, e.g. medical protective clothing, drapes, or bed pads. Reusable textiles offer a more sustainable alternative, reducing not only waste but also costs. There is also further potential for reducing hazardous chemicals in reusable products.¹²⁰ There are of course several considerations when adopting reusable systems, such as washing facilities and storage space, and these should be carefully assessed.

In practice: Reusing items in healthcare

Reusable gowns – improving resilience

The reduced availability of disposable items as a result of the COVID-19 pandemic led the University Clinical Hospital Virgen de la Arrixaca (Spain) to introduce reusable gowns. Following their initial success the hospital now aims to continue using these items indefinitely, citing the environmental and economic benefits.

In April 2020, the hospital began using two models of reusable gowns: a gown that offers a high-level protection for use in high-risk processes (PPE), which is specifically designed for reuse. Consumption of hospital gowns, however, is concentrated in processes that do not require such level of protection for staff. The general use gowns are used in greater quantities; for this product they have purchased polypropylene (PP) fabric and contracted a factory to manufacture their own design. Though initially disposable, the general use gowns made from PP were higher quality than the gowns used before the pandemic. Conducting tests within their own laundry facilities, they identified that the new disposable gowns could in fact be reused for more than 20 wash cycles whilst maintaining an adequate level of protection.

The hospital's own life cycle comparison studies show that reusable gowns drastically reduce the hospital's plastic consumption, waste production, carbon footprint, and costs compared to single-use gowns. Projections estimate that reusable non-PPE gowns would save 30-60% compared to current costs, while reusable PPE gowns would save approximately 67%. Though reusable gowns result in increased water consumption due to washing, the team at Arrixaca consider this offset by lower carbon footprint.

Reusable nappies – reduced waste and harmful exposures

Single-use nappies are not only a large source of waste; studies have also found several chemicals dangerous for human health present in them that exceed safe levels. These chemicals can migrate through urine, for example, and enter into prolonged contact with babies' skin.⁴³

The maternity team at Center Hospitalier (CH) Angoulême (France), together with the management team and the hygiene team have engaged with suppliers to introduce washable reusable nappies in the maternity department.

Approximately 1,500 babies are born every year at CH Angoulême and the maternity team has ordered 300 washable nappies at a cost of €8,000, with anticipated maintenance costs of €3,500 per year (including purchase of new stock). By washing the nappies at their own facility (at 60° and using eco-labelled detergents) they will reduce their waste management costs.

Babies require 4,000 nappies in the first three years of their life¹²¹ and maternity departments can extend their efforts beyond the hospital. Using their trusted position, they can set an example within their community and encourage parents to choose products that are not harmful to the health of their babies and have a reduced environmental impact.

Maternity staff at CH Angoulême plan to host workshops for parents on the harmful health and environmental effects of disposable nappies and the advantages of reusable alternatives (including the financial benefits). The team also provides advice on safe detergents as well as eco-labelled disposable nappies for when reusables are not feasible or available. See page 59 to learn more about how healthcare professionals can act as leaders in the global sustainability movement and support their communities.

Reusable sterilisation containers – an alternative to blue wrap

Made of polypropylene (PP), blue wrap is often used for sterilisation and storage of sterile equipment. It represents a significant amount of waste in healthcare and nearly 19% of waste from the OR.¹²²

Aluminium sterilisation containers are used across the world as a reusable alternative to disposable blue wrap and can offer an almost 50% reduction in related greenhouse gas emissions.¹²³ Sterilisation techniques using reusable containers can also reduce costs, as they are cheaper than blue wrap per procedure:¹²⁴

- Sterile container without inner wrap: €2.05
- Sterile container with inner wrap: €3.24
- One-step sterilisation wrap: €3.44
- Two sheets sterilisation wrap: €3.87

One hospital in the US reduced their consumption of blue wrap by 70% when switching to sterilisation containers – approximately 4.5 tonnes per year.¹²⁵ They also expect to recuperate the initial investment within 2.5 years.

When reusable alternatives are not yet available on the market, engage with suppliers and consider collaborating with other healthcare institutions to aggregate demand. It is important to also consider the storage space that might be needed for reusable sterilisation containers.

Waste found by a project participant during waste audits

REPROCESS

Reprocessing single-use devices is another way to improve sustainability through the reuse of products, minimising waste and associated costs.^{126,127} Medical devices reprocessing allows for the safe reuse of a product, through cleaning, disinfection, sterilisation and related procedures, as well as testing and restoring technical and functional safety of the used device.¹²⁸

Reprocessing saves an estimated \$471m USD (approx. €496m) of costs in Europe, US, and Canada, and approximately 7,000 tonnes of waste.¹²⁹ Life cycle analysis shows that, compared to new products, remanufactured electrophysiology catheters lead to a reduction of greenhouse gas emissions by 50.4% and resources by 28.8%.¹³⁰ The environmental impact is reduced further with increased collection and reprocessing rates of catheters.

In the EU, the medical devices regulation (MDR) allows for the reprocessing of single-use medical devices provided that it is permitted by Member State's national law and follows the list of common specifications proposed by the European Commission, which sets strict conditions.¹³¹ EU Member States have to be proactive as the reprocessing of medical devices requires an opt-in – we therefore encourage healthcare institutions in the EU to request this from their governments.^{xii}

In practice: Reprocessing linear suture machines and harmonic shears

The Centro Hospitalar de São João (Portugal), reduced their costs by up to 50% per device when reprocessing linear suture machines and harmonic shears, leading to yearly savings of more than €90,000 for these two items alone. The reprocessed devices achieved the same clinical results as the original single-use devices, with no added risk.¹³²

Many healthcare facilities are successfully reprocessing a variety of medical devices including ultrasound and electrophysiology catheters and cables, endoscopic devices, compression sleeves, and many more.¹³³ Guidance from Practice Greenhealth in the US for introducing reprocessed devices in hospital facilities can also be applied within Europe.¹³⁴



xii Contact details for the relevant national authorities: www.ec.europa.eu/health/sites/health/files/md_sector/docs/md_contact_points_of_national_authorities.pdf

RECYCLING

Recycling is a low priority within the waste hierarchy and should be a last resort as it only provides a partial solution to the problem of plastic waste, especially at the current rates of plastic production (see page 12). There can be difficulties, however, in applying the first steps of the waste hierarchy to some healthcare items and reusable items ultimately have a finite lifecycle, in which case recycling can provide an opportunity to keep materials in use.

Before considering plastic recycling, it is important to ensure that:

- Local waste collection providers accept plastics recycling waste streams.
 - Discuss with waste collectors what types of plastic waste they accept and what happens to plastic once they collect it, and clarify potential misconceptions regarding healthcare waste i.e. 85% is comparable to domestic waste.¹³⁵
- Plastics do not contain hazardous chemicals that disqualify them from recycling.
 - Hazardous chemicals can impede recycling or end up in recycled products where they can still pose health problems. PVC recycling in particular should be avoided due to the toxic chemicals present.⁸⁰
- There is demand for the recycled material.
 - Virgin materials are currently cheaper, making recycled material less economically attractive.
- Waste is properly segregated.
 - Provide effective means of material segregation at the point of disposal and educate staff and visitors to properly segregate waste to avoid contaminating plastic recycling streams.
- That the plastic waste is recycled domestically.
 - Due to insufficient plastic recycling capacity in the EU, plastic waste is commonly shipped to other countries, which lack robust recycling systems.
 - Be sure to ask your waste contractor or collection authority where waste segregated for recycling ends up and what the recycled material is used for. Put pressure on your contractor to avoid the practice of shipping recyclable materials overseas. This can be done more effectively by collaborating with other healthcare providers - consider undertaking collaborative procurement exercises when tendering for new waste contracts and incorporate rigorous requirements relating to recycling and plastics waste reduction into the tender. By aggregating demand (i.e. running a joint procurement exercise with other hospitals) it can be possible to achieve higher waste management standards.

Recycling should be considered the last resort option before disposal: follow the waste hierarchy to ensure that you get the most out of your products and keep in mind that materials such as glass, metal and paper have a better recycling potential than plastic.

RAISE AWARENESS WITHIN YOUR FACILITY

Waste audit done by one of the project participant: items divided by categories



Research the problem and the solution

Begin by observing staff practices and identify where plastic use can be replaced or reduced. Staff surveys are one way to measure awareness of plastic use in healthcare and its impact on health and the environment. When one of the project participants conducted such a survey, they found that 71% of respondents thought that plastic use in their departments could be reduced. When working on plastic reduction awareness raising campaigns, it is crucial to collaborate with key teams that are affected by the change (e.g. teams on the ground, infection prevention and control teams). Engage the support of team leaders, senior clinical staff and environmental champions and leverage their influence.

After choosing your target product, identify alternative items/behaviours, ensuring they are backed up with available scientific and regulatory evidence, especially if targeting medical items. It is important to highlight:

- **Patient safety** is the most important concern for healthcare professionals, so highlight the positive health impacts of reducing plastic use or, if proposing reusables, the fact that they wouldn't lead to an increase in infection risk.
- **Cost savings** can be a motivation – e.g. showing surgeons the significant cost of disposable supplies has led to cost savings for some hospitals, which can be reinvested into patient care.¹³⁶
- **Environmental impacts** are currently high on the public agenda, yet many people might not be aware of the link between plastic and the climate crisis (see page 8).

Make the alternative visible and accessible

It is important that not only the problem is visible, but also the solution: your target audience should be able to understand and adapt to make positive change. Support your audience to make this change, e.g. to encourage employees to use their own water bottles ensure there are plenty of refill stations on site. As well as how to make the change, you should communicate to your audience why the change needs to be made - people are more receptive to change if they understand why it is needed. A sense of community can lead to peers influencing each other with good practice, and you can further promote this peer-exchange with a competition or pledge.

Make it local

A good awareness raising campaign should be designed according to the local context, needs, and knowledge. Think of the specific stakeholders being targeted by the campaign e.g. nurses, doctors, patients and adapt your campaign accordingly.

Keep it positive

A positive mood is important in healthcare environments and is also more likely to lead to long-term behaviour changes. Avoid using guilt to convince people to change behaviour and focus on the positive change that can be achieved through alternative behaviours.

Use visuals and unique narratives

When communicating your message, you can make use of 'the curiosity gap' - grab people's attention with a catchy question, phrase, or object that makes them curious to find out more about your message. An element of fun, playfulness, or humour can be an effective way for your message to stick with your audience; as well as changing behaviour, this can also change the

mood of your audience. Games or competitions, e.g. a 'treasure hunt' or competitive challenges, are another way to engage with staff and patients.

Track and communicate progress

It is important to communicate your achievements in reducing plastic use – sharing progress and milestones with your audience demonstrates the positive impact they are making and can also motivate them to further reduce plastic use. You can further motivate audiences, particularly staff, by offering rewards for milestones achieved.

In practice: Correcting misconceptions about reusables

The Region Östergötland (Sweden) recorded an 80% increase in the use of single-use, disposable scrubs over a three-year period in healthcare facilities across the region. The region then led a campaign to encourage staff to use reusable scrubs, achieving a reduction of 20% within 12 months. The campaign focussed on correcting employees' common misconceptions – that disposables are cheaper, more hygienic, more environmentally friendly and that the supply chains of disposables are more secure.

The campaign aimed to assure staff of the safety, cost savings, and environmental benefits of reusable textiles. They showed, for example, that despite the recent 80% increase in use of single-use scrubs, the region did not observe a decrease in healthcare associated infections compared to the rest of Sweden. Conversely, the infection rate actually went up (though there is no causation proven).

Conducting a thorough cost comparison and sharing their findings, the region's campaign demonstrated that single-use scrubs are not only 35% more expensive, but also lead to significant waste costs. They calculated that 100 employees wearing two garments a day, five days a week, amounts to €10,900 annually. The region has its own laundry facilities, which were also negatively affected by the increase in single-use scrubs, as the demand for their services dropped.

Using positive imagery and playfulness, the campaign produced posters describing healthcare professionals who use reusable scrubs as superheroes. The campaign also placed mannequins in healthcare facilities wearing the disposable and reusable scrubs with price tags displaying the 55% difference in costs. After 12 months, the results of the campaign were also communicated, including posters celebrating the 20% reduction of single-use scrubs and chocolate bars with positive messages were distributed to staff.

Using positive imagery and playfulness, the campaign produced posters describing healthcare professionals who use reusable scrubs as superheroes



The campaign also placed mannequins in healthcare facilities wearing the disposable and reusable scrubs with price tags displaying the 55% difference in costs.



RAISE AWARENESS WITHIN YOUR COMMUNITY

As respected community figures, healthcare professionals and the wider sector can lead by example in reducing plastic. They can be effective influencers within healthcare facilities and wider communities including policy-makers at regional, national, and international levels.

Healthcare professionals can also engage in this growing environmental movement by keeping up to date with the latest scientific literature on the effects of plastics on the environment and human health, as well as carrying out and publishing their own research on the issue.

In practice: Healthcare influencing their communities

Healthcare institutions in France played a major role in campaigning for legal restrictions on the use of endocrine-disrupting chemicals in healthcare as well as in products used by the general population.¹³⁷

In an effort to reduce infant exposure to harmful chemicals, as well as protect the environment, the University Clinical Hospital Virgen de la Arrixaca (Spain), has distributed over 40,000 letters to new parents discharged from the maternity unit, providing information on how to store breast milk and infant food using glass instead of plastic containers.¹³⁸

COMMUNICATION CHANNELS

There are a number of low-cost options available to most healthcare facilities for communicating with colleagues and the wider community - more than you might realise! Consider all the places where your target audience could see your message, especially if it is a location related to plastic use. Here are just some examples:

- Posters (staff-only, patient, and visitor areas)
- Staff or public newsletters
- Briefings/memos from executive management
- Social media
- Screensavers/information screens
- Email signatures/Out of office messages
- Editorials, infographics, factsheets, clinic brochures
- Waiting rooms, staff lockers
- Stands/kiosks – start conversations with staff and visitors
- Vending machines, food or beverage containers
- Waste bins
- Tables, chairs, toilets, soap dispensers

As well as locations to display images and messages, you can also consider organising more engaging activities, such as:

- Film screenings, educational exhibits, stage plays, flash mobs
- Webinars, lectures
- Round-table discussions
- Petitions/pledges
- Contests, awards

In practice: Setting up a communication campaign

The *Gloves Are Off* campaign at Great Ormond Street Hospital (GOSH) in the UK, relied heavily on staff engagement and communication.

The first step in the process was observing current practices in wards, and the conclusion was that gloves were often being misused and proper hand hygiene was neglected. A working group was then created, comprising infection prevention and control nurses, practice educators, quality improvement team, who regularly met throughout the campaign to monitor progress. They conducted a literature review, gathering scientific evidence to support the proposed reduction of gloves, and also engaged with key stakeholders, including patients and their parents. The project proposal was then presented to infection prevention and control for approval, as well as at hospital stakeholder key meetings e.g. nursing board. The team then made a measurement plan and collected historic data, and prepared a training package, together with communication materials for a trust-wide rollout of the campaign. Practice education teams were trained for local dissemination and education teams carried out trainings in local areas.

Channels used in the *Gloves Are Off* campaign:

- PowerPoint presentation
- Discussions and training with groups of staff
- Further teaching for hospital school, cleaners, porters, etc.
- List of medications that gloves should be worn for
- Risk assessment matrix as part of training
- FAQ sheets
- Webpage with resources for staff
- Screensavers/posters
- Trust brief/newsletter
- Hand hygiene event

CLOSING REMARKS

The healthcare sector is uniquely positioned to pave the way towards a circular economy in which single-use plastic use is reserved only for when it is strictly necessary. With over 15,000 hospitals in the EU, healthcare accounts for approximately half of EU public spending – 14% of annual EU GDP in total. The purchasing power of the European healthcare sector can influence the market and policies, and encourage the production and consumption of more sustainable, reusable products. A transition towards reusable items wherever possible can also help build healthcare resilience to future crises, by minimising reliance on steady single-use supply chains.

With their knowledge of the human health and of environmental factors affecting health, healthcare professionals have the means to understand and disseminate the negative health and environmental effects of plastic production, consumption and disposal. In addition, they are a trusted voice that can inspire change and inform their communities about the issues surrounding plastic use and the actions needed to reduce impact. However, change needs to begin with a recognition of the healthcare sector's own use of plastic products and materials and the steps laid out in this toolkit provide a starting point for taking action at the hospital level. In support of their healing mission, hospitals and health professionals should strive to prevent and reduce the negative health and environmental impacts of the healthcare sector's activities by reducing unnecessary plastic use and seeking safer and more sustainable alternatives.

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