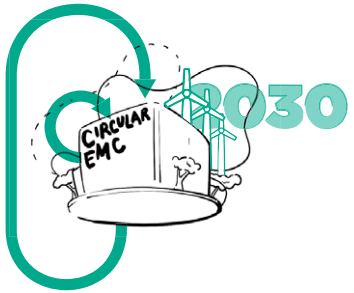
Towards Circular ICUs

Opportunities areas to catalyse circular transition or Erasmus Medical Center Intensive Care Units.

This booklet presents opportunity areas developed for Erasmus MC towards creating a circular ICU by by 2030.

Future healthcare can
heal without generating waste,
provide care while keeping resources in use,
and nurture not only human lives
but the whole ecosystem we are part of.

2030.
Imagine a future Erasmus Medical Center where ...



Devices are used for longer,
redesigned to use fewer and
cleaner resources.

Devices are reused instead of disposed
of after single-use.

Devices are procured from local
manufacturers to whom they will be
returned by the end of their use-life.
This way, devices and resource value
will be retained for longer.

Renewable energy powers the hospital
and makes Erasmus MC resilient.

Users are aware of the environmental
impact of their actions and minimize
wastefulness.

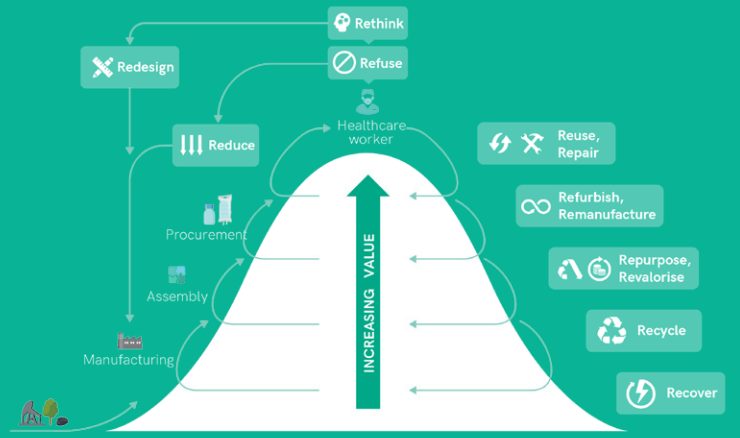
Circular ICUs

One patient day at EMC ICU is equivalent to driving 2000 km or deforesting a 200 square meter area. Compared to other parts of the hospital, the ICU produces extreme waste per patient. The transition towards a circular economy is crucial.

The circular economy is regenerative and restorative by design and is based on the following three principles: Designing out waste and pollution, keeping products and materials in use and regenerating natural systems. It would enable hospitals to retain value for longer and being less harmful to the environment.

These booklet presents opportunity areas detected throughout the graduation project which could bring Erasmus MC ICU closer to becoming circular.

Circular strategies to retain value



Refuse: Abandoning the function of redundant products

Rethink: Design towards a more intensively use product

Reduce: Increase efficiency in product manufacture or use by consuming fewer natural resources or materials

Reuse: Use of a product again for the same purpose in its original form or with little enhancement or change.

Repair: Bring a product back to working condition after failure.

Refurbish: Restore a used product to an original as-new condition.

Remanufacture: Restoring cores to original as-new condition and performance or better.

Repurpose: Use of products or parts that had have been discarded in a new product with a different function than the initial one.

Recycling: Process of material recovering for the original or other purposes.

Recover: Incineration of material with energy recovery.

Context

Systemic research of current practices and waste at Erasmus MC ICU was undertaken, to better understand the impact and complexity.

A set of opportunities areas were developed from the systemic study around intubations at Erasmus MC ICU.

A pilot proposal to reuse key intubation devices is proposed. This pilot, a first step towards circular ICUs, is only one of the many opportunities areas detected throughout the research.

A set of actions that Erasmus MC ICU could take to transition to full circularity by 2030 are summarized in this booklet, complementing the reuse pilot proposed.

Reading guide

Opportunity area. Explanation of the possible intervention.

R-strategy addressed | **Scope of action** ICU/EMC/Collabs

First the context and problem detected will be explained here.

Next, in bold, the proposed opportunity area will be presented.

Challenges addressed

- The challenges addressed
- within each proposal will be
- listed here.

Impact

- Here the different
- benefits of the proposal
- will be presented.

- These would look at benefits
- for people at the ICU,
- environmental impact and
- overall costs for EMC.

Stakeholders required

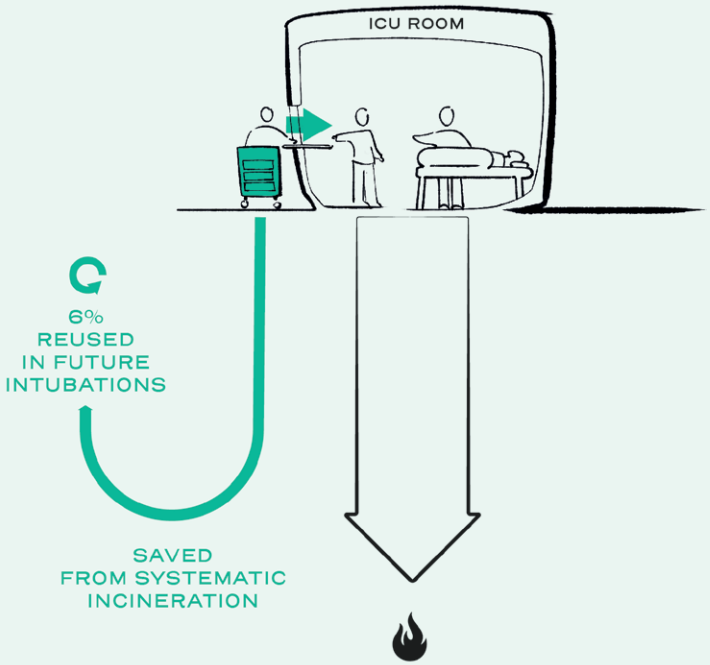
Here, the required stakeholders to be involved are listed

Short **Medium** **Long**

How long should this idea take to be implemented?

Here, a further explanation of each proposal timeframe estimation is provided, whether **short** (1 to 2 years), **medium** (2 to 5 years) or **long** (5 years or more)

1 EXTERNAL STORAGE



Avoid unused waste. Reduction of devices entering the room, external storage compartment in front of the ICU room.

Reduce | **Area** ICU Procedures

If devices enter in the ICU room of a patient considered infectious, they must be thrown away even if eventually not used. The unused waste was estimated at 6% through a waste observation of waste at Erasmus MC Pediatric ICU.

Currently, more devices than required are placed in the rooms during intubation procedures. As intubations need to be extremely time-efficient, the option of searching for these devices only if the necessity arise is not considered.

Adding an external storage in front of the ICU room allows devices easily accessible, still out of the room. This saves devices from incineration in case they are eventually not used.

Challenges addressed

- Unused waste

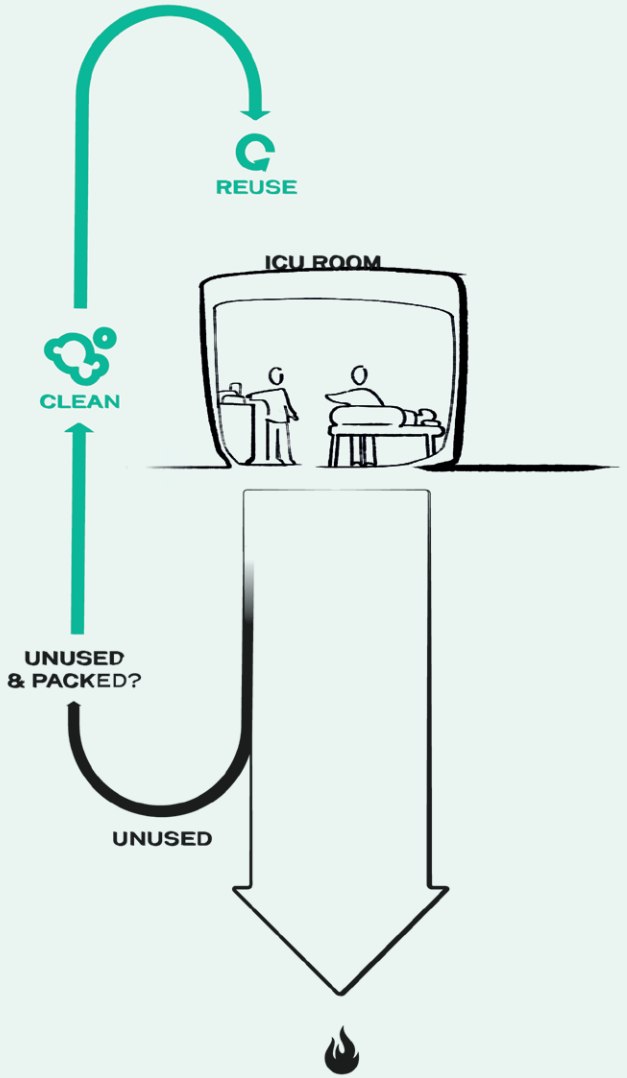
Impact

- Reduction of **waste** generated by the ICU
- **Material** reduction impact by avoiding unused devices going to waste
- **Energy** reduction used during waste incineration by reduction of the amount.
- **Pressure** reduction on doctors when deciding which devices to introduce in the room

Stakeholders required
Erasmus MC

Short term solution
Intubation trolleys are already available at the ICU, that could be placed next to the ICU rooms when needed.

2 CLEANABLE PACKAGING



Avoid unused waste. Cleaning unused devices that are still in their packaging with UV-C technology or adapting the packaging materials.

Reduce | **Area** Collaborations

Some devices that enter in the ICU room are thrown away unused and still packed. These packagings are made from materials that cannot be cleaned with the wiping system used at the ICU.

Erasmus MC could explore collaboration with manufacturers to redesign cleanable packaging, allowing cleaning and thus saving the packed devices from being thrown away unused.

Other cleaning alternatives can be also contemplated. The use of UV-C cleaning, a rather new yet certified cleaning technique, allows the cleaning of the current paper and plastic-based materials.

Challenges addressed

- Unused waste
- Slow implementation of reprocessing innovations in hospitals

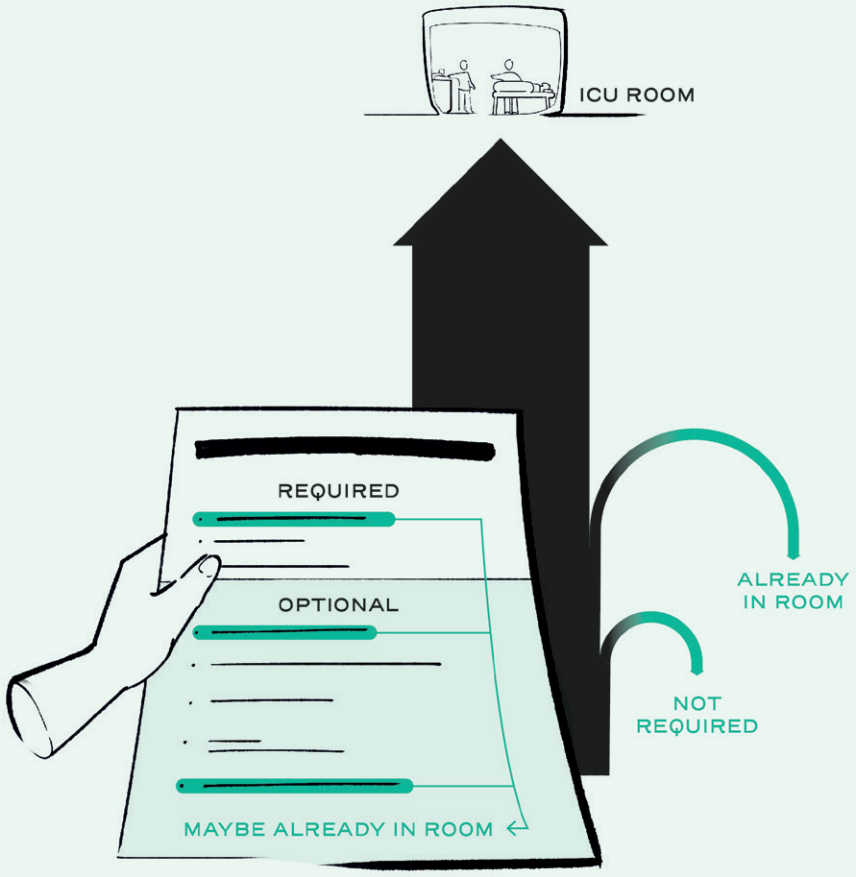
Impact

- Reduction amount of **waste** generated by the ICU
- Reduction **material** impact by avoiding unused devices going to waste and redesigning packaging
- Reduction **energy** used during waste incineration
- Avoiding **chemicals** replacing disinfectant impregnated wipes by UV-C cleaning

Stakeholders required
Erasmus MC - Manufacturers

Medium term solution
Implementation of new cleaning technology or collaboration with manufacturers towards packaging redesign are required.

3 REDESIGN PROTOCOLS



Avoid unused waste. Redesign intubation protocols to avoid redundancy.

Reduce | **Area** ICU Procedures

Rooms are filled by both care assistants and nurses. Basic devices are placed in the room in advance by care assistants, and nurses will add any additional device required for specific operations. Some devices mentioned in specific operation protocols are already available in the room. This overlap triggers the same devices to be brought twice into the room, leading to unused waste. Also, some devices mentioned in protocols are optional still always entered in the room for precaution.
A redesign of protocols that allows nurses to know which devices can be potentially already in the room can be envisioned.
Protocols could also distinguish better optional devices. Doctors could then take better decisions on what to enter in the ICU room.

Challenges addressed

- Unused waste
- Lack of communication between ICU users

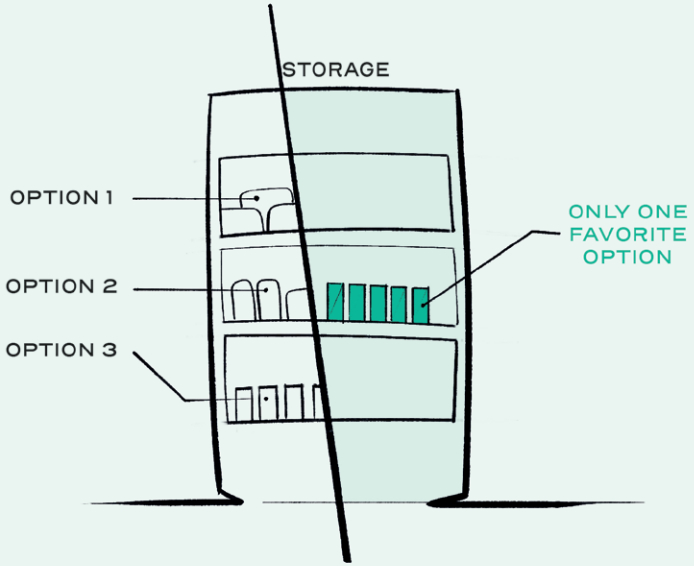
Impact

- Reduction amount of **waste** generated by the ICU
- Reduction **material** impact by avoiding unused devices going to waste
- Reduction **energy** used during waste incineration by reduction of the amount.
- Help nurses and doctors in the room filling **process**

Stakeholders required
Erasmus MC

Short term solution
Changes of the protocols can be done by Erasmus MC itself as long as they comply with regulation

4 AVOID TOO MANY OPTIONS



Avoid unsued waste by reducing the number of redundant device options at ErasmusMC ICU.

Refuse | **Area** EMC Procedures

During an interview with an ICU doctor, the interviewee discovered differen versions of the same device that she did not know were available.

Reducing redundant versions of the same device is needed to avoid less known versions going unused until expiration.

Challenges addressed

- Unused waste
- Pressure on doctors decision making with excisive choice

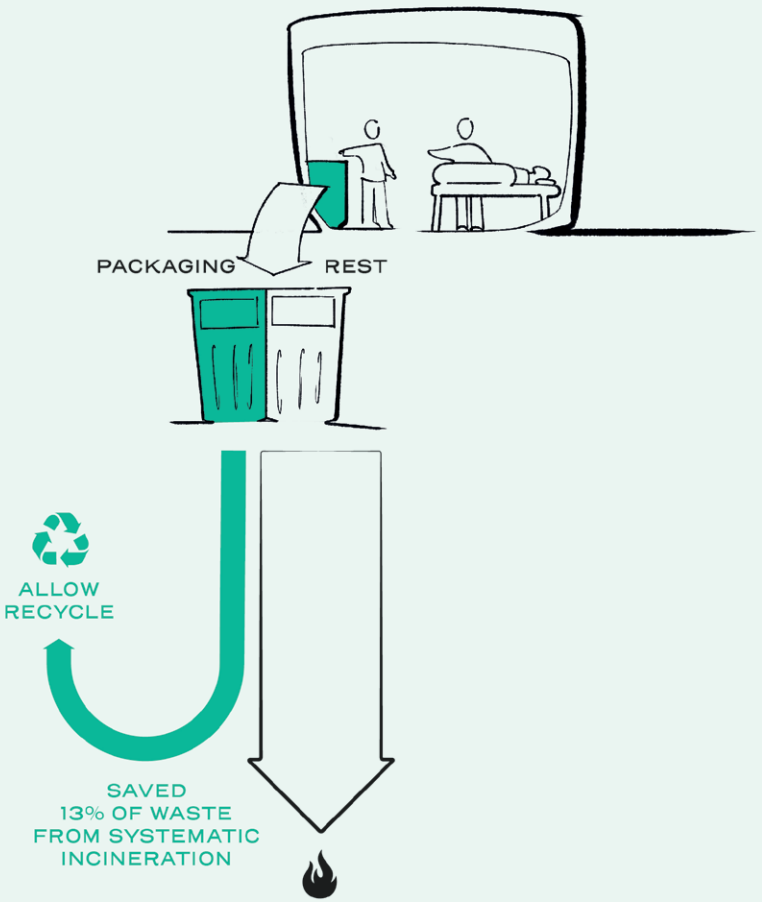
Impact

- Reduction **material** impact by avoiding waste
- Reduction **energy** used during waste incineration by reduction of the amount of waste
- Reduce hassle of current procedures and **decision makings** at EMC ICU.

Stakeholders required
Erasmus MC

Short term solution
Requires only changes within EMC procurement

5 SEPARATE PACKAGING



Allow waste separation. Redesign the waste separation process to allow separation and recycling of packaging.

Recycle | **Area** EMC Procedures

Almost everything that enters the ICU is thrown away in a single waste stream, including the device packaging. Packaging represents almost 13% of the total waste in weight during a study of Erasmus MC PICU.

Knowing that 'almost 60% of ICU general waste could be recycled' (McGain et al., 2009) it can be envisioned to separate devices packaging. Most devices packaging are made from the same range of materials (paper, laminated PA, LDPE, HDPE, etc.). The potential recyclability of these materials can be envisioned.

Challenges addressed

- Packaging waste
- Lack of waste separation within the ICU room

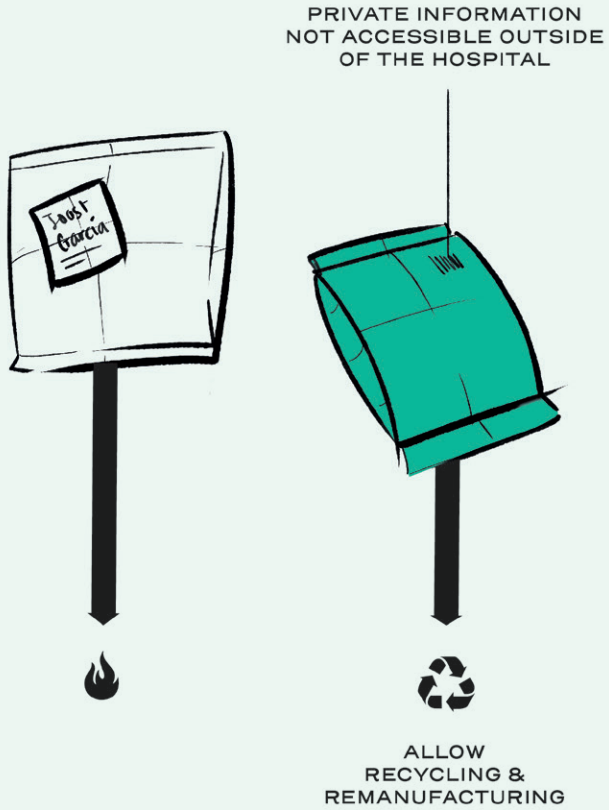
Impact

- **Material** reduction impact by avoiding incineration / allowing recyclability
- **Energy** used reduction during waste incineration by reduction of the amount of incinerable waste

Stakeholders required
Erasmus MC - Waste managament external service

Long term solution
Collaboration with waste management services complying to strict safety regulation and changes in waste logistics are required.

6 NO STICKERS



Allow waste separation. Allow post-use R-strategies by separating the waste and avoiding the use of stickers.

Remanufacture | **Area** Collaborations

Remanufacturing of single-use healthcare devices is possible. Collaboration with remanufacturers or manufacturers themselves can be envisioned to reduce Erasmus MC environmental footprint.

Devices must be separated from the main waste stream to enable remanufacturing by external stakeholders. Erasmus MC ICU must thus allow waste separation within the ICU room.

The ICU should also avoid placing stickers on products. Stickers can restrict remanufacturing technically, whereas the personal information present on stickers makes remanufacturing not possible from a regulatory point of view.

Challenges addressed

- Lack of waste separation
- Lack of post-use R-strategies implemented
- Use procedures jeopardizing the implementation of R-strategies post-use

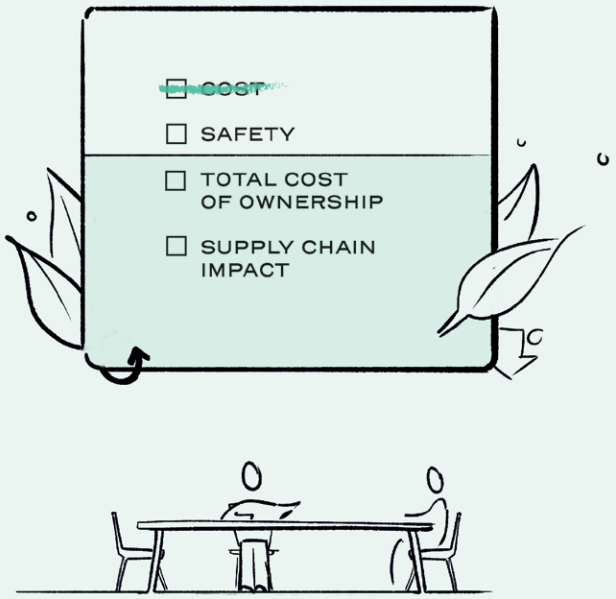
Impact

- Reduction **material** impact by avoiding incineration / allowing remanufacturing
- Reduction **energy** used during waste incineration by reduction of the amount of incinerated waste

Stakeholders required
Erasmus MC - Remanufacturer or manufacturers

Long term solution
Collaboration with waste management services and implementation of new waste streams and separation are required.

7 CONSCIOUS PROCUREMENT



Raise awareness. Enhance future responsible procurement through sustainable KPIs.

Rethink | **Area** EMC

Procurement decisions are relevant to achieve higher sustainability at Erasmus MC, as they will greatly affect the implementation of higher R strategies. However, current procurement is only based on cost and safety.

Taking into consideration the total cost of ownership of devices and their supply chain impact (CO2, land, water, toxicity, child labour) could increase hospital sustainability and the use of reusable devices.

Challenges addressed

- Current procurement KPIs prioritize disposables
- Negative connotation of sustainability in the healthcare environment
- Manufacturers pressure towards disposability

Impact

- Reduction **total cost of ownership** of devices used at Erasmus MC.
- Reduction **supply chain impact** by more responsible procurement.

Stakeholders required

Erasmus MC - Manufacturer - Regulations entities

Medium term solution

For this change to happen, Erasmus MC is dependent on manufacturing sharing additional information on their devices' life cycle. However, Erasmus MC procurement team is highly aware of this.

8 CONSCIOUS DECISION

Raise awareness. Educate Erasmus MC users of their wastefulness to reduce excessive device and clothes usage.

Refuse | **Area** Procedures at the ICU

Observations highlighted that personal protective clothing is used more than required, and devices enter into ICU rooms that are eventually not used.

Raising the awareness of ICU staff on these decisions could avoid nonessential use of resources and reduce waste.

Interviews showed that ICU user awareness is already higher than in other departments of Erasmus MC, given the volume of waste generated. But there is still room for improvement, especially around the balance between environmental impact, sustainability, and risk perception.

Challenges addressed

- Excessive use of single-use devices
- Excessive use of personal protective clothing
- Negative connotation of sustainability in the healthcare environment

Impact

- Reduction amount of **waste** generated and **resources** used by the Erasmus MC.
- Reduction **energy** used during waste incineration by reduction of the amount.

Stakeholders required
Erasmus MC

Meidum term solution
Changes in the sustainability connotation and risk perception of Erasmus MC users are needed.

Towards Circular ICUs.
Reuse of intubation devices as a catalyser for systemic change.

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