ASP SUMMIT
CONTINUOUS MEDICAL EDUCATION WEBINARS

Economic considerations for Medical Devices reprocessing technologies in a Circular Economy

2022 CME WEBINARS SERIES # 3

webinar 3

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intro

WHEN MAKING DECISIONS ABOUT INVESTMENT IN NEW TECHNOLOGY OR SERVICES IN HEALTHCARE, IT IS IMPORTANT TO CONSIDER A RANGE OF FACTORS. MAKING A DECISION BASED ONLY ON WHAT IS "CHEAPEST" OR "BEST" MAY BE SHORT-SIGHTED. OFTEN THERE IS MORE TO A PRODUCT OR SERVICE THAN WHAT YOU SEE UP FRONT.

Economic evaluation allows both costs and effectiveness to be considered together, and modelling can take into account different time frames or uncertainty, to enable comprehensive understanding of the impact of different choices. The principles can be applied to issues of carbon footprint such as energy, water use and waste.

Image: https://pixabay.com/photos/drugs-pills-tablets-stethoscope-1961431/

The evaluation of both the ongoing costs and outcomes related to a new product or service is important as many countries are now spending close to 10% of GDP on health. Spending more means less money for other public services including education, and infrastructure such as roads. **Spending more does not guarantee better outcomes.**

If we fail to consider both costs and effects when investing in new technology, we may inadvertently **draw resources away from other services which generate good outcomes for patients or the health system.** The principles behind health economic evaluation of treatments and services can be applied to other decisions to **help understand the costs and consequences of choosing different types of sterilization systems.**

Key factors in health economic evaluation

- **benefits** OF EACH OPTION
- **costs** RELATED TO EACH OPTION
- **timeframe** APPROPRIATE
- **uncertainty** IN ESTIMATES OF COSTS AND BENEFITS – ENABLES A MORE COMPLEX ANALYSIS

Image: https://www.pexels.com/photo/photo-of-person-wearing-protective-wear-while-holding-globe-4167541/

STERILIZER FACTORS TO CONSIDER

"The key factors to consider when examining the costs and carbon footprint associated with different sterilizers are: energy consumption, water consumption, effect on or damage to instruments, disposable or single use consumable items."

When thinking about the carbon footprint related to consumables, it is important to consider the impact of their production and disposal, the choice of reusable versus single-use wraps, pouches and trays.

Case Studies of steam sterilizers

Case studies have shown that steam sterilizers use large amounts of electricity and water, even when idle. The examination of electricity use of steam sterilizers in a Melbourne hospital when on standby, accounted for 40% of the total energy use over 304 days.[1]

In **another study**, it was found that switching off idle sterilizers could reduce energy use by 26% and water use by 13%, and **reduced annual CO_2 emissions by 79 tons.**[2]

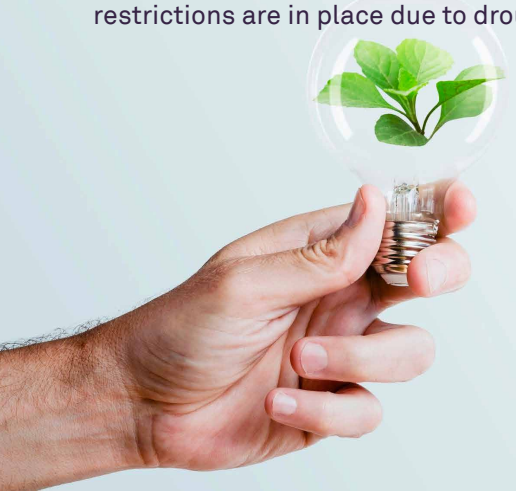
Image: https://www.pexels.com/photo/syringes-in-thermoforming-packagings-7722565/

Case Studies of low-temperature sterilizers

A case study of low-temperature (hydrogen peroxide gas plasma) sterilizers with an average 8.4M2 per day showed that while there were additional per-cycle costs of consumables (€6.51/US$6.46), sterilant (€19.58/US$19.44) and testing (€1.03/US$1.02), the energy use was much lower. For one year of average use at 8.4M2 per day, the low temperature systems used between 3.7kWh and 10 kWh, compared to 32kWh for a similar steam sterilizer.[3]

INCREASING COSTS OF ELECTRICITY AND WATER

There have been dramatic increases in the cost of electricity due to the war in the Ukraine. It is expected that prices will continue to increase. Use of electricity is therefore also costly from a financial perspective, as well as contributing to the carbon footprint. The costs of water are also increasing and in some places restrictions are in place due to drought conditions.



In a world affected by climate change and drought, as well as increasing energy prices due to war and other factors, it is important to moderate use of these resources where possible.

MONTHLY ELECTRICITY PRICES[4] (€/MWh)	2020	2022	(%)
Italy	47,46€	441,74€	+931%
Germany	34,98€	315,26€	+901%
France	37,97€	400,95€	+1056%

Source: Monthly electricity prices in selected EU countries 2020-2022; Published by Bruna Alves; Aug 23, 2022 | https://www.statista.com/statistics/1267500/eu-monthly-wholesale-electricity-price-country/

INSTRUMENT FACTORS TO CONSIDER

Different sterilization methods have different effects on medical instruments. In particular, instruments made of plastics, corrosion-susceptible metal alloys and electrical devices are affected by high temperature and humidity. Steam sterilization may damage such instruments meaning they need to be repaired or replaced more frequently. Repairs and replacement also have an effect on carbon footprint because of the energy and other resource requirements needed to repair instruments, make new parts or devices.

Image: iStock photo database accessed on 20220914: iStock-1327356968

Case Studies in **damage** to endoscopes and cost of repairs

A **case study on the frequency of damage** to rigid endoscopes when a hospital changed from using steam to a low-temperature system, showed a **33% reduction in the number of repairs and a 58% reduction in the number of repairs per procedure.**[5]

***Across 7 different studies of endoscope repairs**, the average cost was $US 3,749.35 per repair. Substantial savings can be made by reducing the frequency of damage to instruments like endoscopes:*

1. Landman J, Lee D, Lee C, Monga M. Evaluation of overall costs of currently available small flexible ureteroscopes. Urology 2003;62:218-22.
2. Mahawongkajit P, Techagumpuch A, Auksornchat K. Effects of basic endoscopic handling and care training on gastrointestinal endoscopy logistics. Endosc Int Open. 2022 Jan 14;10(1):E56-E61. doi: 10.1055/a-1630-6403.
3. Skogas J, Marvik R. Measures taken to reduce damage and repair costs of rigid endoscopes during their handling and processing in surgical practice. Minim Invasive Ther Allied Technol 2003;12:76-81.
4. Schafer B. Decreased number of repairs of rigid scopes as a result of low-temperature sterilization with H2O2 gas plasma. A field report form the Barmherzige Bruder Hospital in Trier, Germany. Central Serv 2009;17:194-6.
5. Sung J, Springhart W, Marguet C, L'Esperance JO, Tan YH, Albala DM, et al. Location and etiology of flexible and semirigid ureteroscope damage. Urology 2005;66:958-63
6. Canales B, Gleason J, Hicks N, Monga M. An independent analysis of flexible cystoscope repairs and cost. J Urol 2007;178:2098-102.
7. Statham M, Willging JP. Automated high-level disinfection of nonchanneled flexible endoscopes: duty cycles and endoscope repair. Laryngoscope 2010;120:1946-9
Inflation calculator: https://www.bls.gov/data/inflation_calculator.htm Ther Allied Technol 2003;12:76--81.)

Evaluation in your context

When evaluating different sterilization options it is important to think about what factors are relevant to the context.

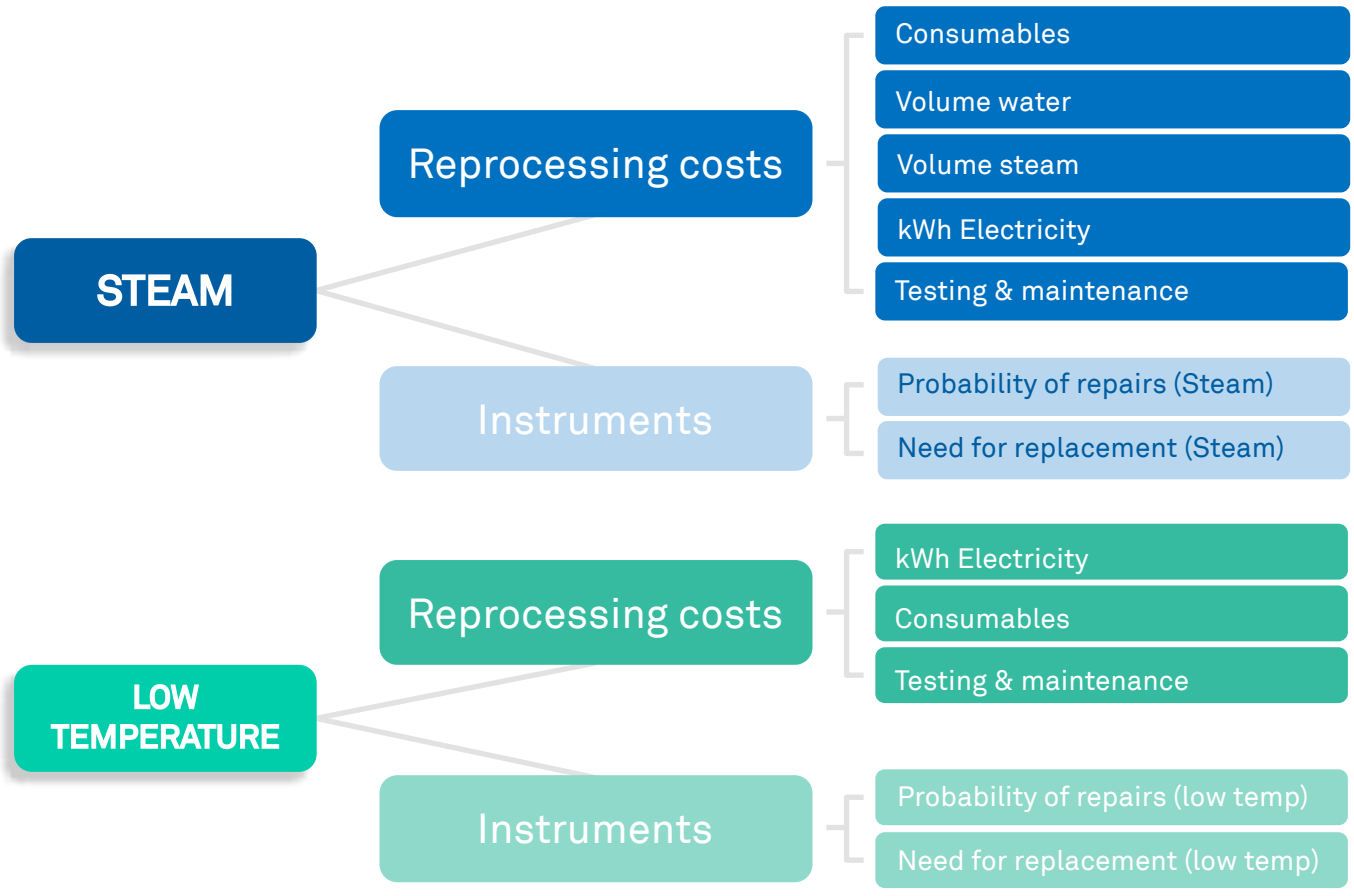
Key context-specific factors

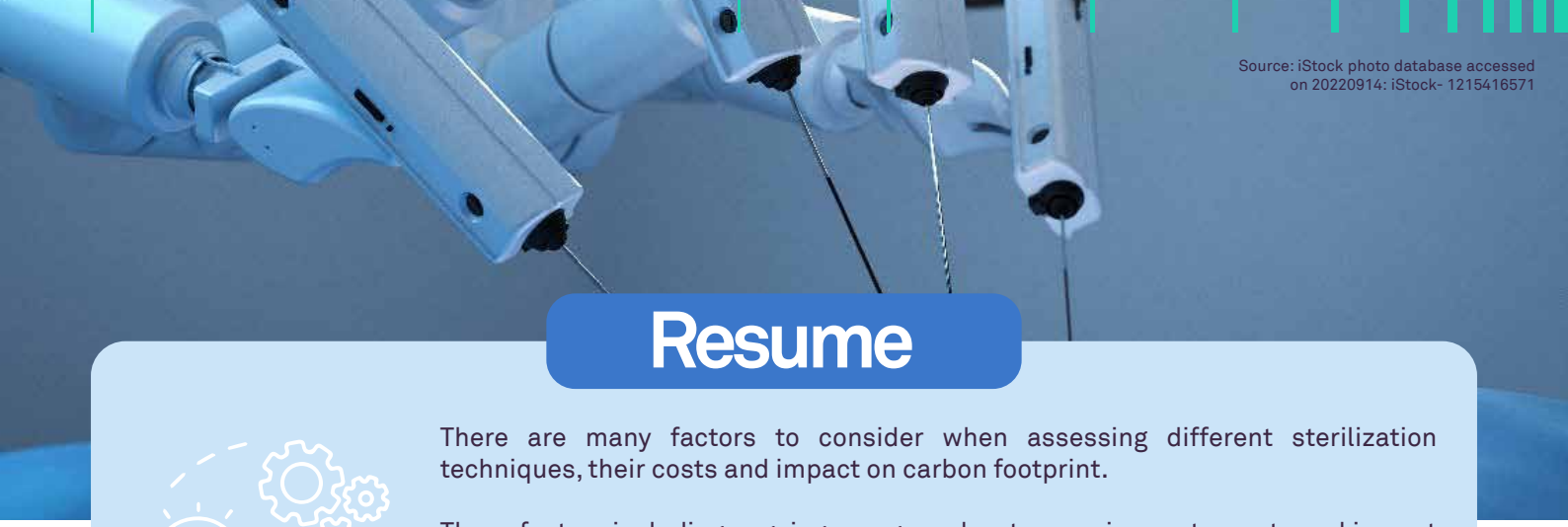
- RELEVANT TIMEFRAME
- INSTRUMENTS USED
- INFLATION – CHANGING COSTS OVER TIME
- BUDGETARY REQUIREMENTS FOR CAPITAL EXPENDITURE V. ONGOING
- LOCAL CONSIDERATIONS – RENEWABLE ENERGY, WASTE DISPOSAL, WATER

EXAMPLE MODEL

OTHER FACTORS MAY BE IMPORTANT IN YOUR CONTEXT

Models can be flexible to different to different inputs and timeframes. They can also be run multiple times with new values, to incorporate uncertainty in estimates of, for example, electricity usage and costs.





Source: iStock photo database accessed on 20220914: iStock- 1215416571

Resume

There are many factors to consider when assessing different sterilization techniques, their costs and impact on carbon footprint.

These factors including ongoing energy and water requirements, costs and impact of consumables, sterilants, testing and maintenance, require greater thought than what might be evident immediately.

The principles used in health economic evaluation can be applied to evaluate different options in different contexts to allow a more holistic decision-making approach and more comprehensive understanding of the environmental impacts and costs of different options.

take home messages

01 Important to look beyond the up-front costs of the sterilizer.

02 There are large differences in energy and water consumption: important in current environment.

03 Effect of different sterilizing processes on instruments important consideration (affects costs and carbon footprint).

04 Consumables/disposable items also contribute to carbon footprint.

05 Principles of health economics can be used to evaluate decisions in your context.

1 (McGain F, Moore G, Black J. Steam sterilisation's energy and water footprint. Aust Health Rev. 2017 Mar;41(1):26-32. doi: 10.1071/AH15142. PMID: 27075773. https://pubmed.ncbi.nlm.nih.gov/27075773/). 2 (McGain F, Moore G, Black J. Hospital steam sterilizer usage: could we switch off to save electricity and water? Journal of Health Services Research & Policy. 2016;21(3):166-171. doi:10.1177/1355819615625698) 3 (ASP: AD-160024-01-CT_C-MDR SteamVsSterrad Energy Water Study_TM_N (Energy) AD-120169-01-CT_A_ISPOR_Sterrad_Poster (Consumables) | https://www.in2013dollars.com/Euro-inflation (inflated prices from ISPOR poster 2014 to 2022), converted to US$ using xe.com) 4 Monthly electricity prices in selected EU countries 2020-2022; Published by Bruna Alves; Aug 23, 2022 5 Skogas J, Marvik R. Measures taken to reduce damage and repair costs of rigid endoscopes during their handling and processing in surgical practice. Minim Invasive Ther Allied Technol 2003;12:76-81. and McCreanor V, Graves N. An economic analysis of the benefits of sterilizing medical instruments in low-temperature systems instead of steam. Am J Infect Control. 2017 Jul 1;45(7):756-760. doi: 10.1016/j.ajic.2017.02.026.

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AD-220189-01-CT_A-MDR