top ten
in gastroenterologia
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Sostenibiltà in endoscopia digestiva

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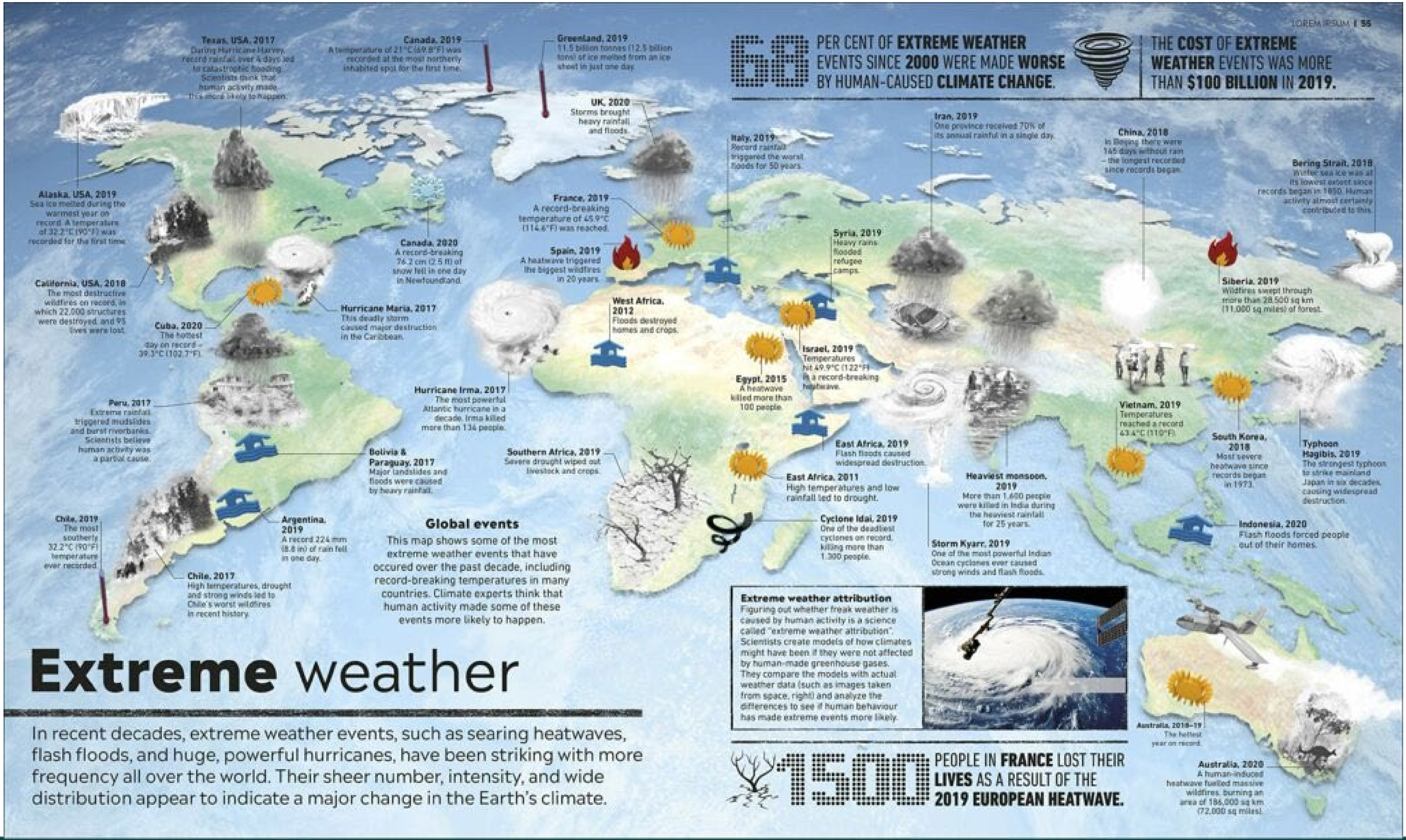
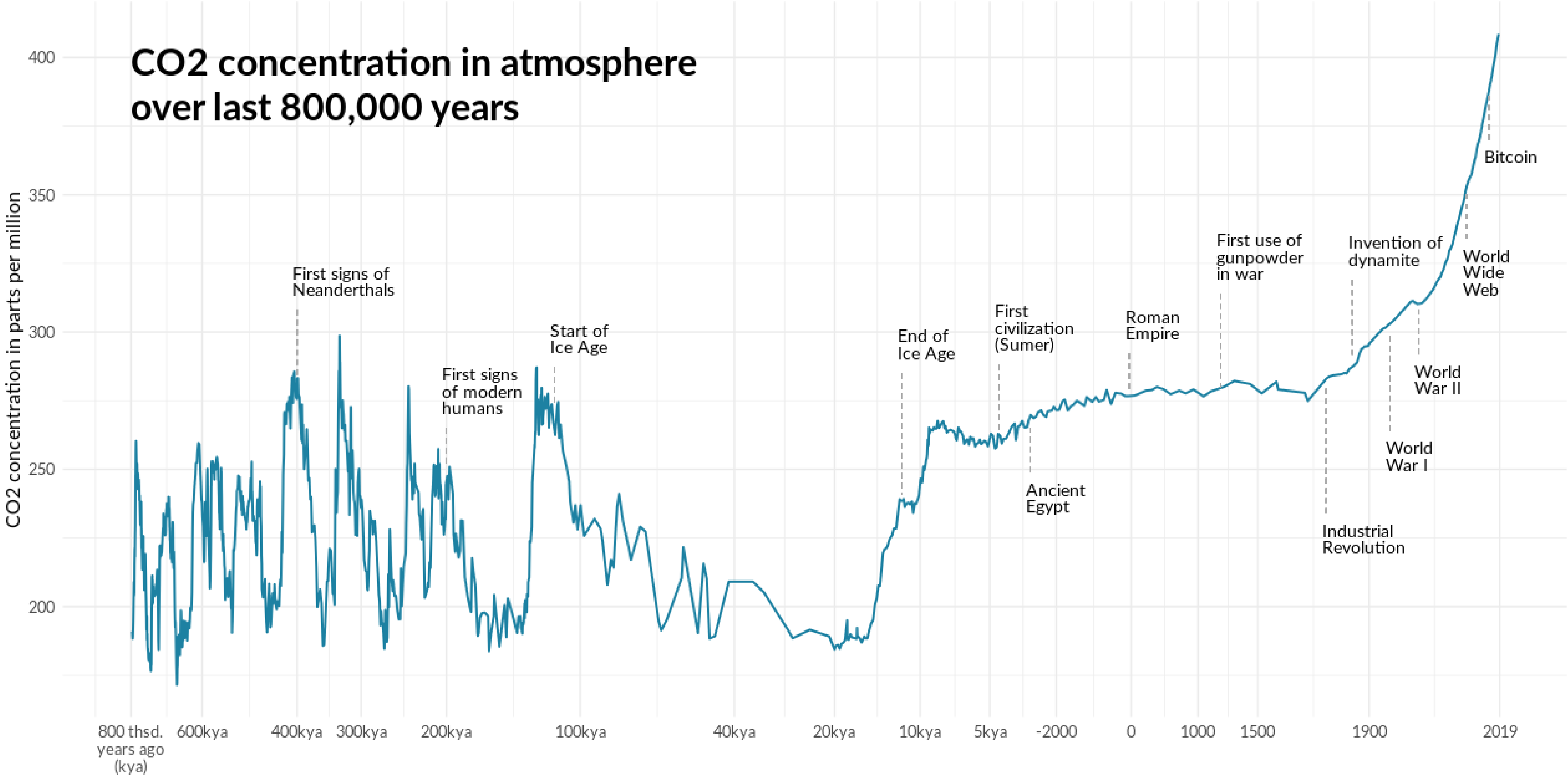
Competing Interests Disclosure

I herewith declare anything that may potentially be viewed as a conflict of interest during the past three years such as paid or unpaid consultancies, business interests or sources of honoraria payments:

None


LOREM IPSUM | 55
68 PER CENT OF EXTREME WEATHER EVENTS SINCE 2000 WERE MADE WORSE BY HUMAN-CAUSED CLIMATE CHANGE.
THE COST OF EXTREME WEATHER EVENTS WAS MORE THAN $100 BILLION IN 2019.
Texas, USA, 2017
During Hurricane Harvey, record rainfall over 4 days led to catastrophic flooding. Scientists think that human activity made this more likely to happen.
Canada, 2019
A temperature of 21°C (69.8°F) was recorded at the most northerly inhabited spot for the first time.
Greenland, 2019
11.5 billion tonnes (12.5 billion tons) of ice melted from an ice sheet in just one day.
UK, 2020
Storms brought heavy rainfall and floods.
Italy, 2019
Record rainfall triggered the worst floods for 50 years.
Iran, 2019
One province received 70% of its annual rainfall in a single day.
China, 2018
In Beijing there were 145 days without rain – the longest recorded since records began.
Bering Strait, 2018
Winter sea ice was at its lowest extent since records began in 1850. Human activity almost certainly contributed to this.
Alaska, USA, 2019
Sea ice melted during the warmest year on record. A temperature of 32.2°C (90°F) was recorded for the first time.
France, 2019
A record-breaking temperature of 45.9°C (114.6°F) was reached.
Canada, 2020
A record-breaking 76.2 cm (2.5 ft) of snow fell in one day in Newfoundland.
Spain, 2019
A heatwave triggered the biggest wildfires in 20 years.
Syria, 2019
Heavy rains flooded refugee camps.
Siberia, 2019
Wildfires swept through more than 28,500 sq km (11,000 sq miles) of forest.
California, USA, 2018
The most destructive wildfires on record, in which 22,000 structures were destroyed, and 95 lives were lost.
Hurricane Maria, 2017
This deadly storm caused major destruction in the Caribbean.
West Africa, 2012
Floods destroyed homes and crops.
Cuba, 2020
The hottest day on record – 39.3°C (102.7°F).
Israel, 2019
Temperatures hit 49.9°C (122°F) in a record-breaking heatwave.
Egypt, 2015
A heatwave killed more than 100 people.
Hurricane Irma, 2017
The most powerful Atlantic hurricane in a decade, Irma killed more than 134 people.
Vietnam, 2019
Temperatures reached a record 43.4°C (110°F).
South Korea, 2018
Most severe heatwave since records began in 1973.
Typhoon Hagibis, 2019
The strongest typhoon to strike mainland Japan in six decades, causing widespread destruction.
Peru, 2017
Extreme rainfall triggered mudslides and burst riverbanks. Scientists believe human activity was a partial cause.
Bolivia & Paraguay, 2017
Major landslides and floods were caused by heavy rainfall.
Southern Africa, 2019
Severe drought wiped out livestock and crops.
East Africa, 2019
Flash floods caused widespread destruction.
East Africa, 2011
High temperatures and low rainfall led to drought.
Heaviest monsoon, 2019
More than 1,600 people were killed in India during the heaviest rainfall for 25 years.
Chile, 2019
The most southerly 32.2°C (90°F) temperature ever recorded.
Argentina, 2019
A record 224 mm (8.8 in) of rain fell in one day.
Cyclone Idai, 2019
One of the deadliest cyclones on record, killing more than 1,300 people.
Storm Kyarr, 2019
One of the most powerful Indian Ocean cyclones ever caused strong winds and flash floods.
Indonesia, 2020
Flash floods forced people out of their homes.
Chile, 2017
High temperatures, drought and strong winds led to Chile's worst wildfires in recent history.
Global events
This map shows some of the most extreme weather events that have occured over the past decade, including record-breaking temperatures in many countries. Climate experts think that human activity made some of these events more likely to happen.
Extreme weather attribution
Figuring out whether freak weather is caused by human activity is a science called "extreme weather attribution". Scientists create models of how climates might have been if they were not affected by human-made greenhouse gases. They compare the models with actual weather data (such as images taken from space, right) and analyze the differences to see if human behaviour has made extreme events more likely.
Australia, 2018–19
The hottest year on record.
Extreme weather
In recent decades, extreme weather events, such as searing heatwaves, flash floods, and huge, powerful hurricanes, have been striking with more frequency all over the world. Their sheer number, intensity, and wide distribution appear to indicate a major change in the Earth's climate.
1500 PEOPLE IN FRANCE LOST THEIR LIVES AS A RESULT OF THE 2019 EUROPEAN HEATWAVE.
Australia, 2020
A human-induced heatwave fuelled massive wildfires, burning an area of 186,000 sq km (72,000 sq miles).

CO2 concentration in atmosphere over last 800,000 years



Time is warped using sqrt scale before 1900 for readability. Graphic: Gregor Aisch, vis4.net

Source: NOAA (1959-today), NASA (1850-1958), Monnin et al., Petit et al., Siegenthaler et al., Luethi et al. (800kya-1850)

Carbon footprint of heath care activities

- Health care activities 1-5% of human enviromental impact
- 4.4% of greenhouse gas emission worldwide
- Increase of GHG emission by a third in the last two decades
- USA+EU+China account for more than half of all emissions

- 8.5% in USA
- 7% in Australia,
- 5% in Canada
- 3% in England

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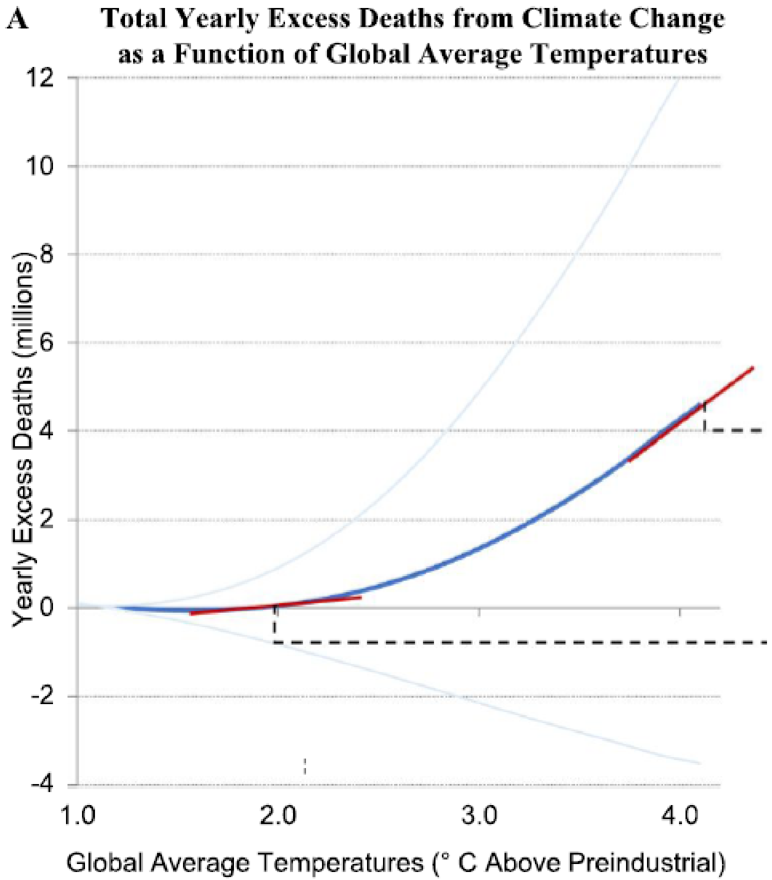
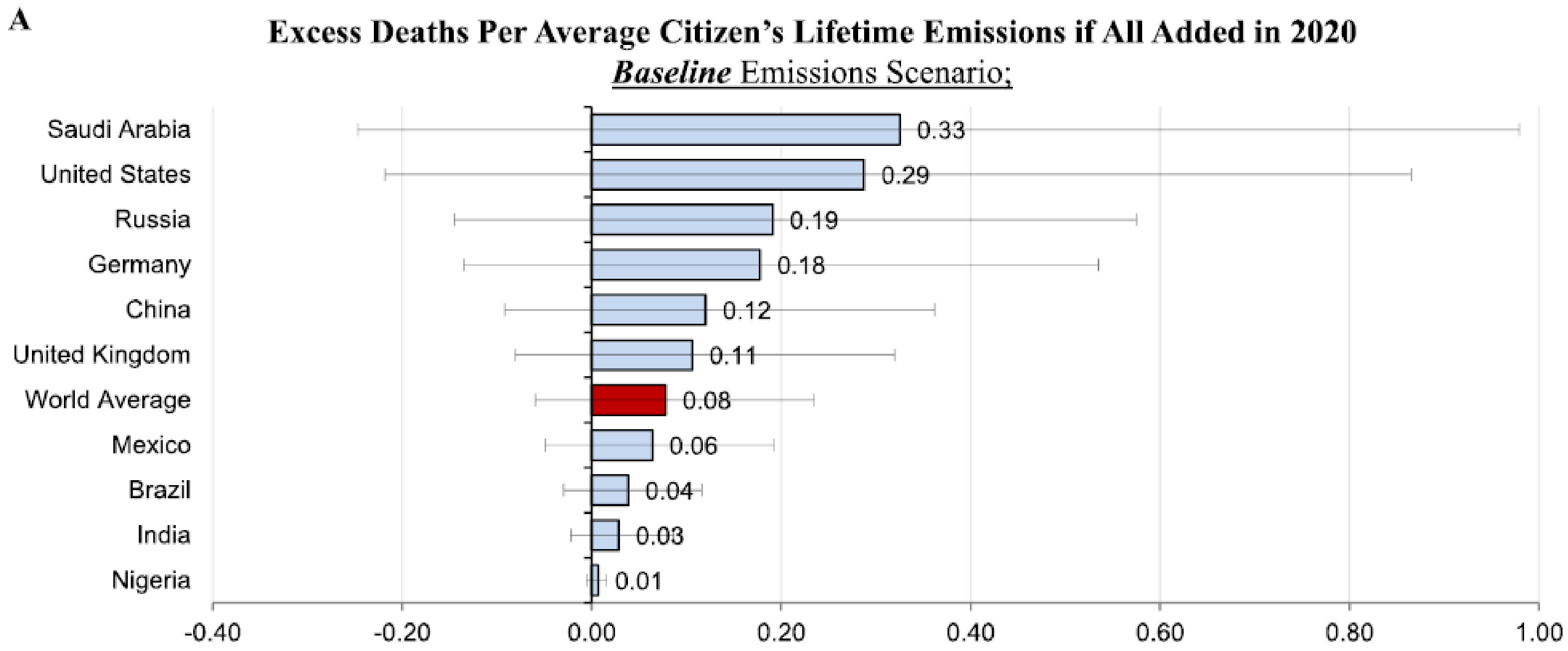


ARTICLE

https://doi.org/10.1038/s41467-021-24487-w OPEN

The mortality cost of carbon

R. Daniel Bressler[1,2,3]



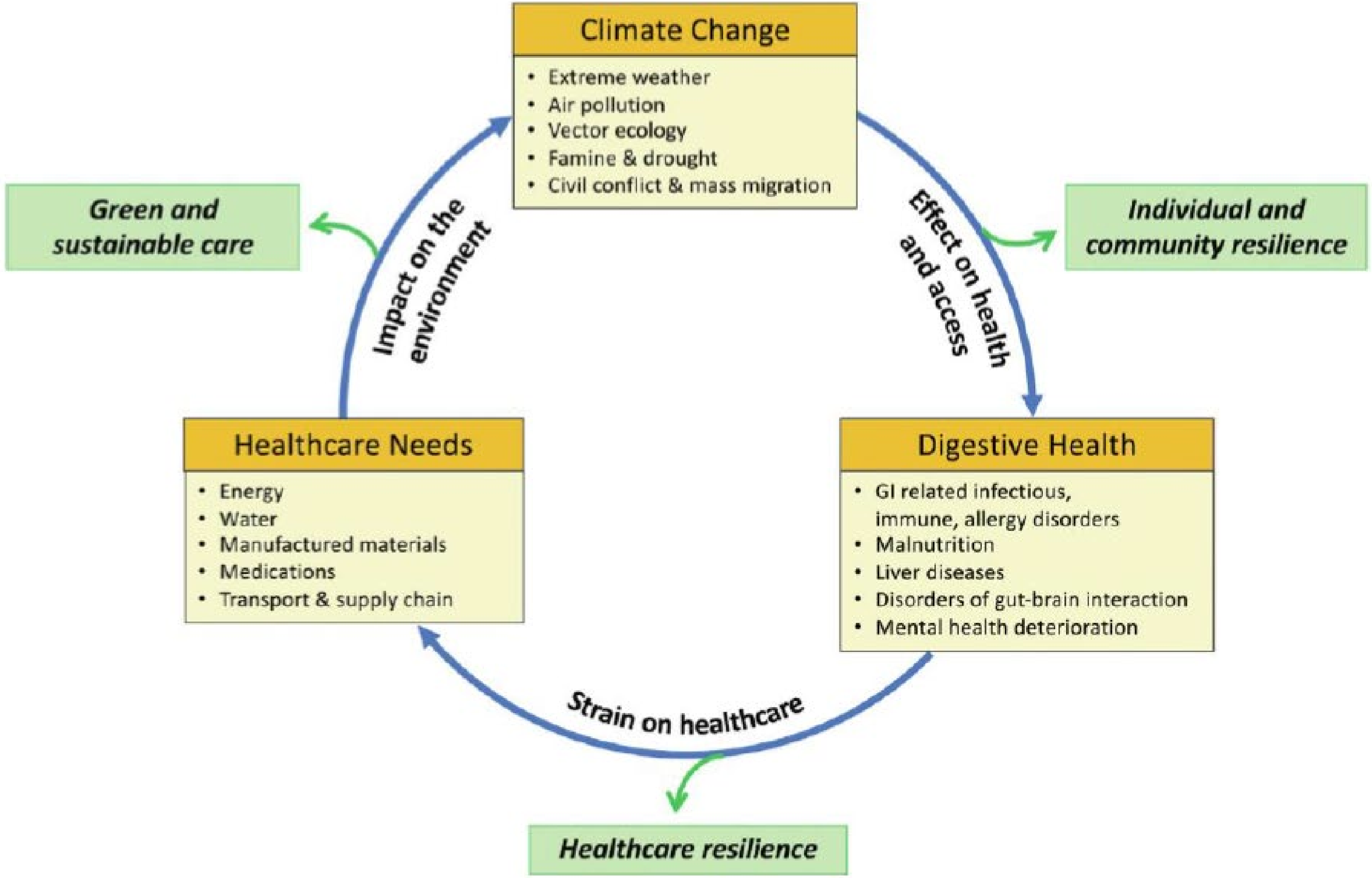


Figure 1. Intersection between health care, climate change, and digestive health and possible intervention areas to affect change and help mitigate the climate crisis.

Green endoscopy

- GHGs: gases emitted (carbon dioxide, methane, nitrous oxide, water vapour and ozone)
- Carbon footprint: The amount of GHGs generated by individual, organization or event
- Emission generation vs anthropogenic removal (emission reduction) => net zero emission over a period of time

Net zero carbon emissions target by the year 2040 by the UK National Health Service and the National Institute for Health and Care Excellence

Maurice JB, et al. Green endoscopy: a call for sustainability in the midst of COVID-19. Lancet Gastroenterol Hepatol 2020;5:636–8.
Maurice JB, et al. Green endoscopy: using quality improvement to develop sustainable practice. Frontline Gastroenterol 2022;13:342–5.
Torjesen I. NHS aims to become world's first "net zero" health service by 2040. BMJ 2020;371:m3856.

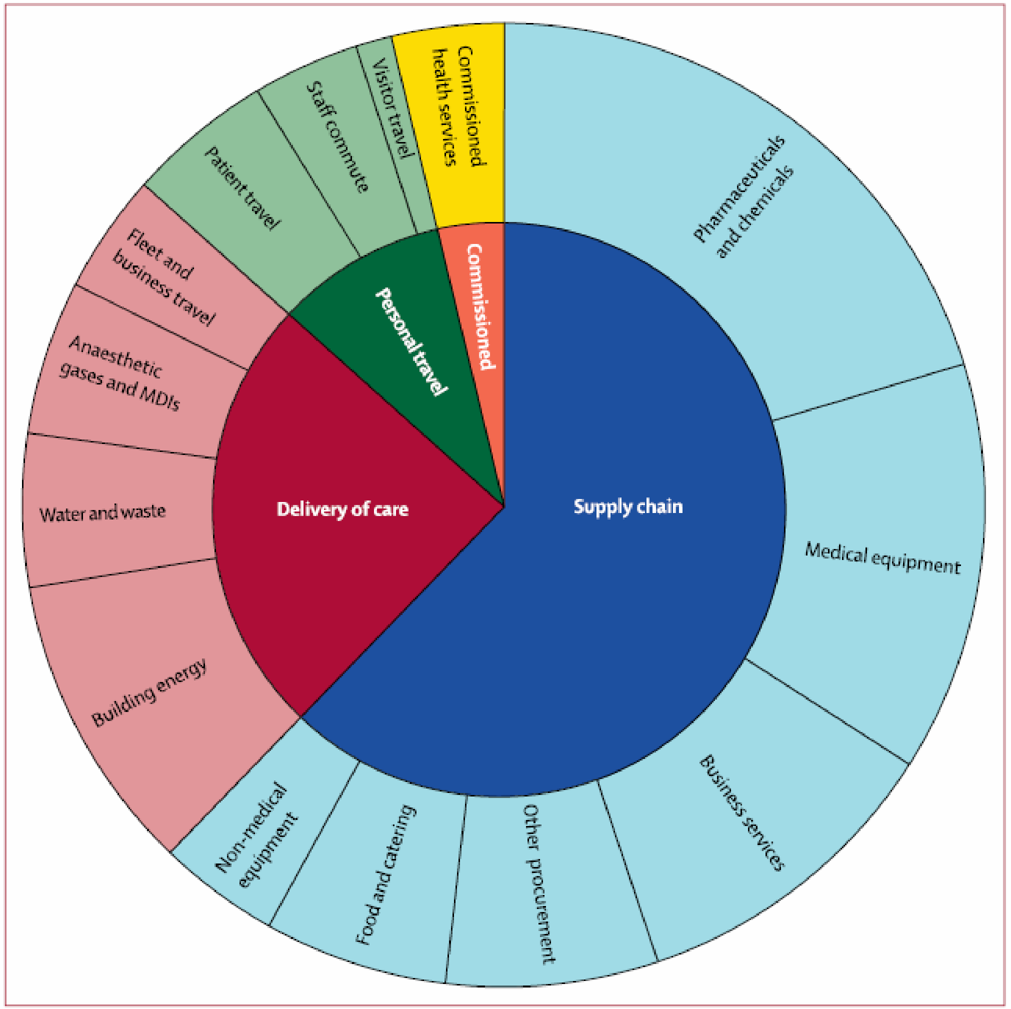


Figure 4: **Contribution of different sectors to the greenhouse gas emissions of the NHS England, 2019**
Data available in appendix 1 (p 39). MDI=metered dose inhaler. NHS=National Health Service.

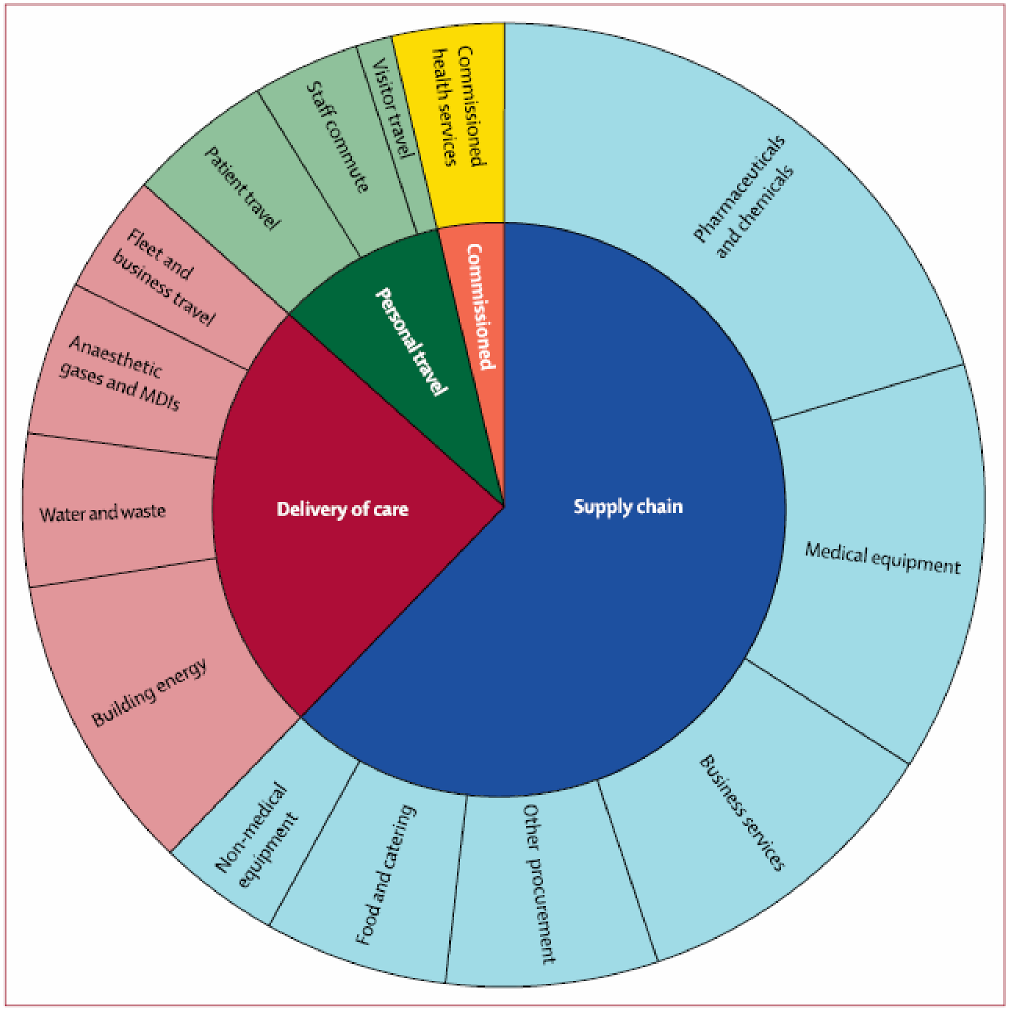
Table 1
Main components of a hospital's carbon footprint [4].

Hospital carbon footprint
Electricity
Heating and cooling
Staff travel and products transportation
Equipment and supplies production and disposal

Emission generation in healthcare could be:

- direct (eg, use of anaesthesia gases)
- indirect (energy consumption)
- supply chain related

2



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Health care's response to climate change: a carbon footprint assessment of the NHS in England

chlorofluorocarbon propellants

Imogen Tennison, Sonia Roschnik, Ben Ashby, Richard Boyd, Ian Hamilton, Tadj Oreszczyn, Anne Owen, Marina Romanello, Paul Ruyssevelt, Jodi D Sherman, Andrew Z P Smith, Kristian Steele, Nicholas Watts, Matthew J Eckelman

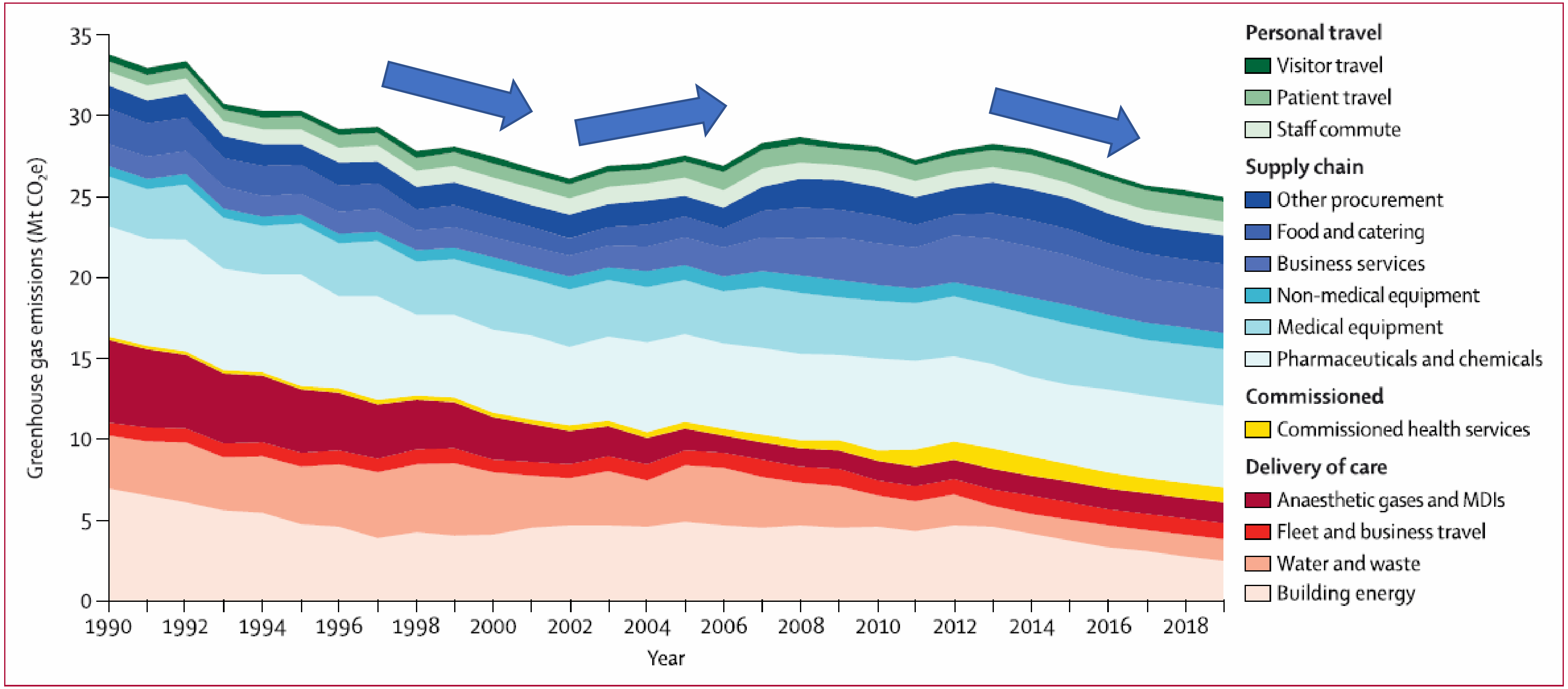
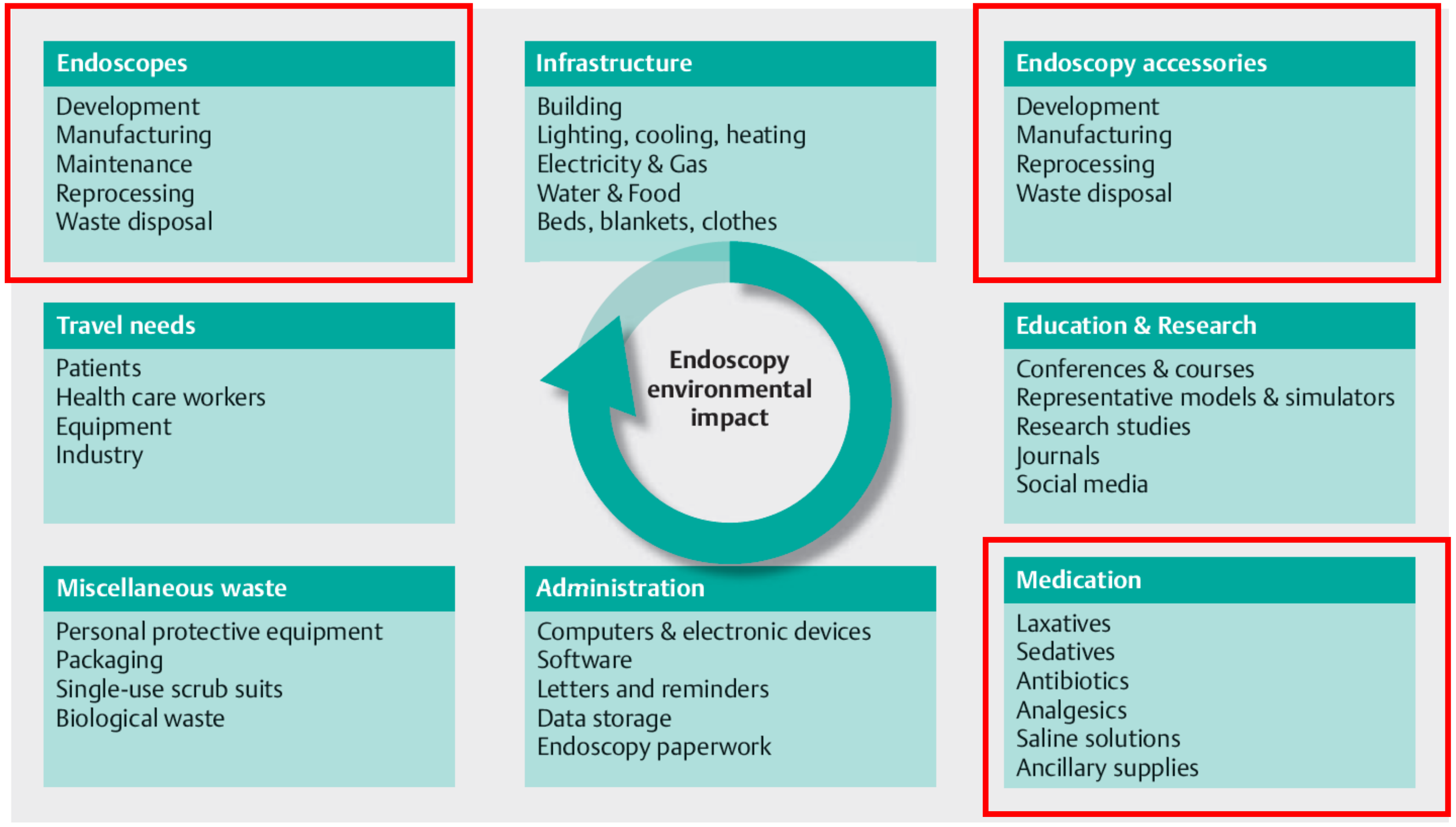


Figure 2: **Time series results for the greenhouse gas emissions of the NHS in England, broken down by source of emission, 1990–2019**
Data available in appendix 1 (p 39). MDI=metered dose inhaler. Mt CO_2e=megatonnes of carbon dioxide equivalent. NHS=National Health Service.

GI endoscopy: the third highest generator of hazardous waste in heath care facilities

1. Anaesthetics (5.96 kg day^{-1} bed^{-1}),
2. Paediatric and intensive care (3.37 kg day^{-1} bed^{-1})
3. Gastroenterology-digestive endoscopy (3.09 kg day^{-1} bed^{-1})

Vaccari M, et al . Costs associated with the management of waste from healthcare facilities: an analysis at national and site level. Waste Manage Res 2018;36:39–47.



▶ **Fig. 1** The environmental impact of gastrointestinal (GI) endoscopy.

3

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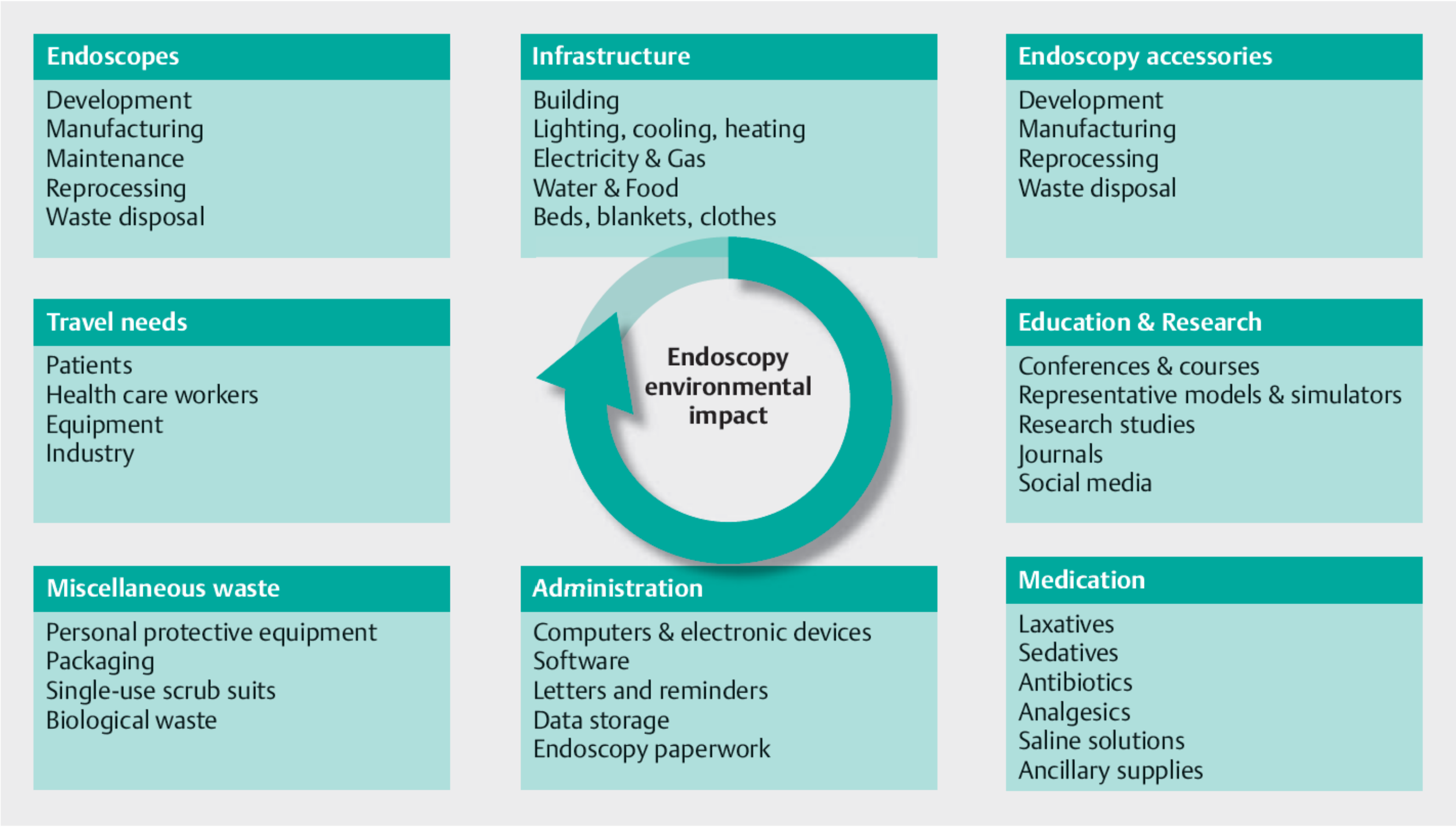


Fig. 1 The environmental impact of gastrointestinal (GI) endoscopy.

Environmental Impact of Endoscopy: "Scope" of the Problem

Swapna Gayam, MD[1]

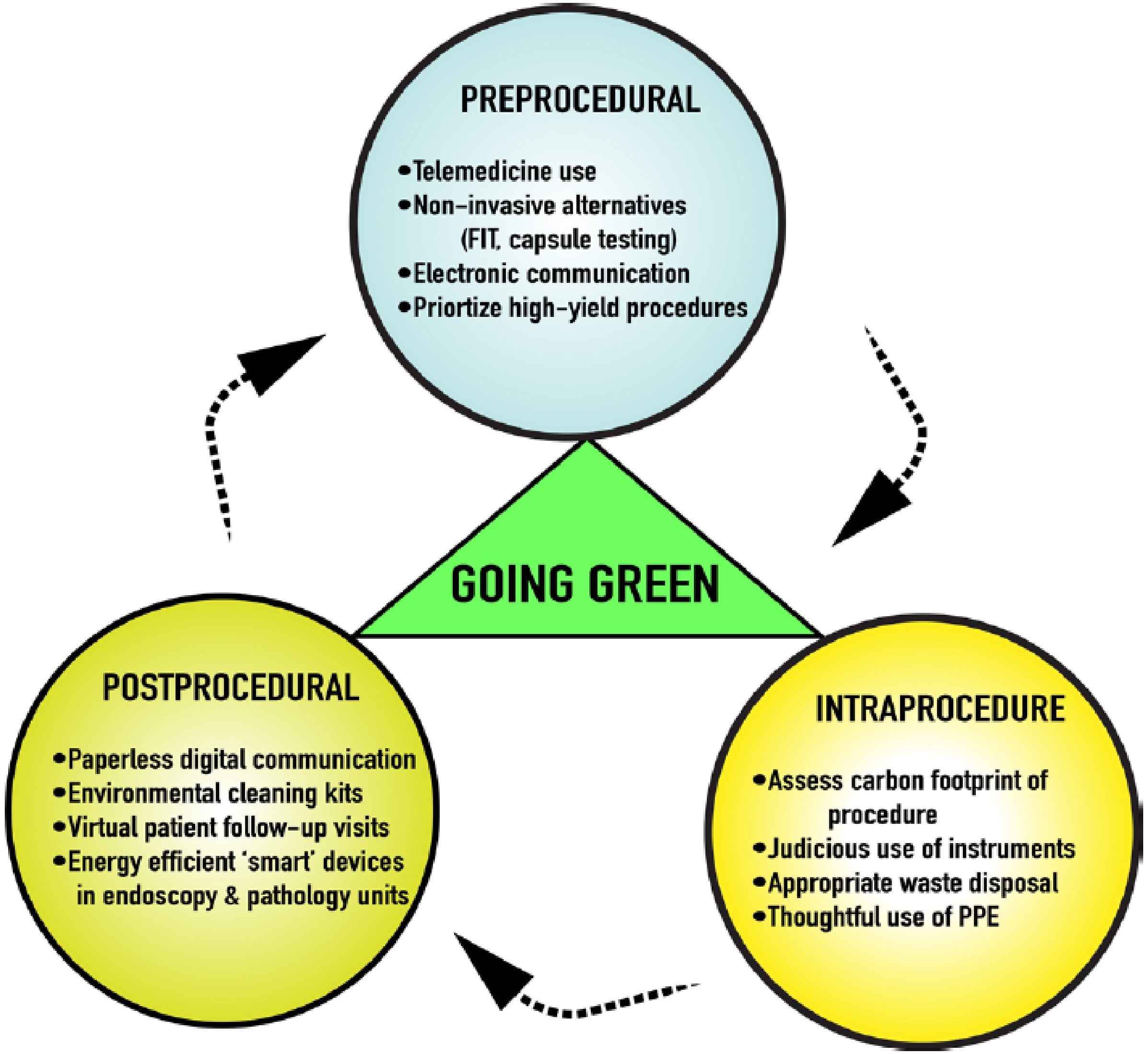
Table 1. Waste generated by an endoscopic procedure

Plastic box that contains 4 × 4 gauze
Plastic water bottle
Plastic bite block
Plastic suction canister
Plastic suction tubing used for endoscopy
Plastic suction canister used by anesthesia
Plastic suction tubing used by anesthesia
Plastic suction catheter used by anesthesia
Plastic isolyzer bottle
Plastic packaging of biopsy forceps
Plastic packaging of disposable scope buttons
Gloves

Table 2. Energy consumption by our endoscopy unit in a single day

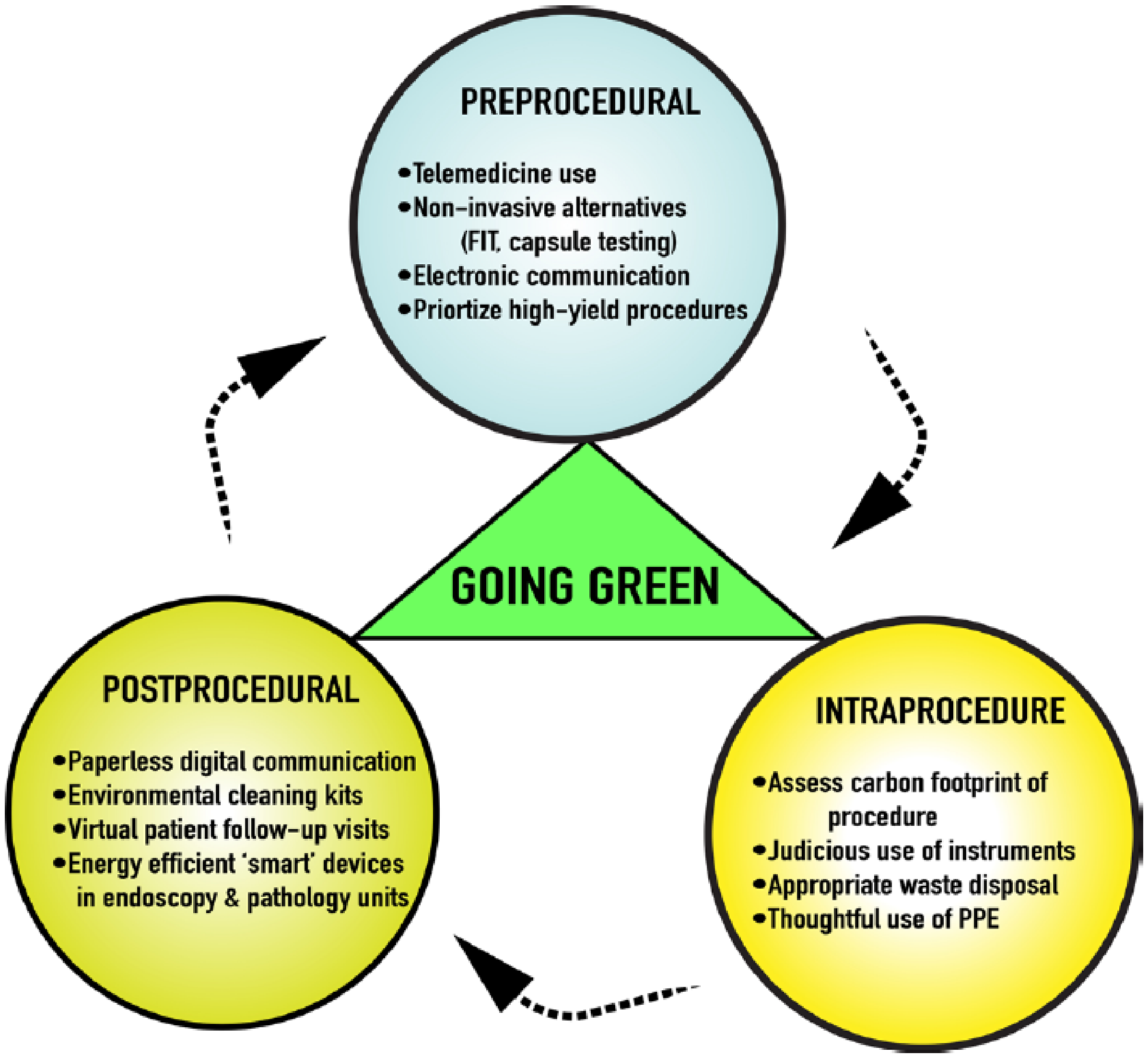
Unit	Energy consumption per day
Wash machines (5)	24.67 kW h[a]
Endoscopy machines (6)	27.00 kW h[a]
Anesthesia machine (6)	12.00 kW h[a]
Room lighting (6)	47.88 kW h[a]
Total	111.55 kW h[a]

[a]Please refer to Tables (see Supplementary Digital Content 1, hiips://links.lww.com/AJG/B747) for breakdown of energy calculations.



PREPROCEDURAL
•Telemedicine use
•Non-invasive alternatives (FIT, capsule testing)
•Electronic communication
•Priortize high-yield procedures
GOING GREEN
POSTPROCEDURAL
•Paperless digital communication
•Environmental cleaning kits
•Virtual patient follow-up visits
•Energy efficient 'smart' devices in endoscopy & pathology units
INTRAPROCEDURE
•Assess carbon footprint of procedure
•Judicious use of instruments
•Appropriate waste disposal
•Thoughtful use of PPE

4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Adherence to guidelines ensuring the appropriateness of the indication for GI endoscopy is vital to optimizing use of resources

20-30% inappropriate use of upper and lower GI endoscopy

ESGE-ESGENA consider that reducing the current rate of unnecessary GI endoscopic procedures is key to that end and should be prioritized by GI endoscopy services and health care systems. This is probably the most effective action to mitigate the GHG emissions of GI endoscopy.

Endoscopy services should regularly assess appropriateness of endoscopy and take action in case of inappropriate procedures

Up to 80% reduction in surveillance endoscopy following guidelines

5

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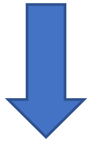
The Italian scenario

- 45 endoscopies/1,000/year in Italy (2,699,239 procedures)
- 54% EGD (1,457,589) and 46% CLS (1,241,650)
- 5.43 kg of CO_2 emitted for EGD
- 6.71 kg of CO_2 for CLS

- Inappropriate endoscopy-related emission is 4,133 tons (3,527-4,759, 95% CI)
- Inappropriate CLS-related CO2 emission: 2,416 tons (1,833-2,999, 95% CI)
- Inappropriate EGDS-related CO2 emission: 1,717 tons (1,694-1,750, 95% CI)

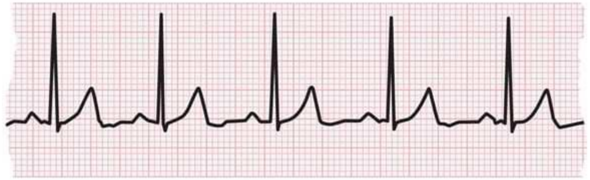


Equivalent to1,760,446 liters of gasoline

Elli et al, GIE 2023

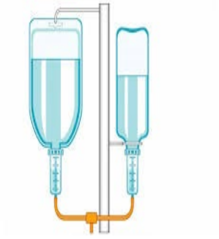
Optimizing the pre-endoscopic management

Avoid routine pre-endoscopic testing (blood, ECG, Rx)



Appropriate use of drugs before, during and after the procedure (iv saline, antibiotic prophylaxis, sedation, antagonists)

CO_2 footprint of 10-1000g for 1 g drug (1 g oil 3 g CO_2)



Low sedation < deep sedation < endotracheal intubation

Use of low-waste less invasive alternatives to endoscopy and make your endoscopy less impacting

STATEMENT

4 ESGE-ESGENA recommend using low-waste, less invasive alternatives to endoscopy (e. g. fecal calprotectin, urea breath test, etc.) within the bounds endorsed by evidence-based clinical guidelines.

Table 4 Less invasive tests approved by regulatory agencies as alternatives to gastrointestinal endoscopy.

Less invasive test	Indication endorsed by guidelines	Research
Fecal immunohistochemical testing [48]	Colorectal cancer screening Triage of symptomatic patients in primary health care	Postpolypectomy surveillance in high risk individuals Iron-deficiency anemia Colorectal cancer prognosis Endoscopy waiting list triage
Multitarget DNA stool test	Colorectal cancer screening	Postpolypectomy surveillance
Fecal calprotectin [49, 50]	Chronic diarrhea Monitoring patients with inflammatory bowel disease	Biomarker in other inflammatory diseases Protein-losing enteropathy
Urea breath test [51] Stool antigen test [51]	Diagnosis and eradication of *Helicobacter pylori*	
Cytosponge [52]	None	Barrett's esophagus Eosinophilic esophagitis
Elastography and platelet count [53]	Screening of esophageal varices in cirrhosis Monitoring liver disease	Noninvasive diagnosis and prognosis of liver disease
Small-bowel capsule [54]	Obscure gastrointestinal bleeding Iron-deficiency anemia Inflammatory bowel disease workup Refractory celiac disease	Monitoring mucosal healing in Crohn's disease
Esophageal and colon capsules [55]	None	Upper gastrointestinal symptoms and bleeding Detection of esophagitis and varices Colorectal cancer screening Postpolypectomy surveillance Incomplete colonoscopy
Transnasal unsedated endoscopy [56]	None	Barrett's esophagus Eosinophilic esophagitis Variceal screening Gastric cancer

Optimizing the intraprocedural management

Take biopsies only when appropriate!

STATEMENT

6 ESGE-ESGENA suggest that diagnostic strategies that safely reduce the number of samples sent for histological analysis can reduce the environmental impact. This can be achieved via optical diagnosis and adherence to guidelines on the indications for endoscopic tissue sampling.

Greenhouse Gas Emissions of Gastrointestinal Biopsy for a Single Patient, by 2 Approaches in kg CO_2e (% of Scenario Total)

Scenario[a]	Supply Production	Chemicals/ Reagent Production	Waste Treatment	Staff Travel	Energy	Total
Scenario 1	0.11 (38)	0.08 (26)	0.05 (19)	0.04 (13)	0.01 (4)	0.29 (100)
Scenario 2	0.28 (36)	0.23 (29)	0.12 (16)	0.12 (15)	0.04 (5)	0.79 (100)

[a] Scenario 1 is 3 biopsy samples in 1 jar. Scenario 2 is 3 biopsy samples in 3 jars.

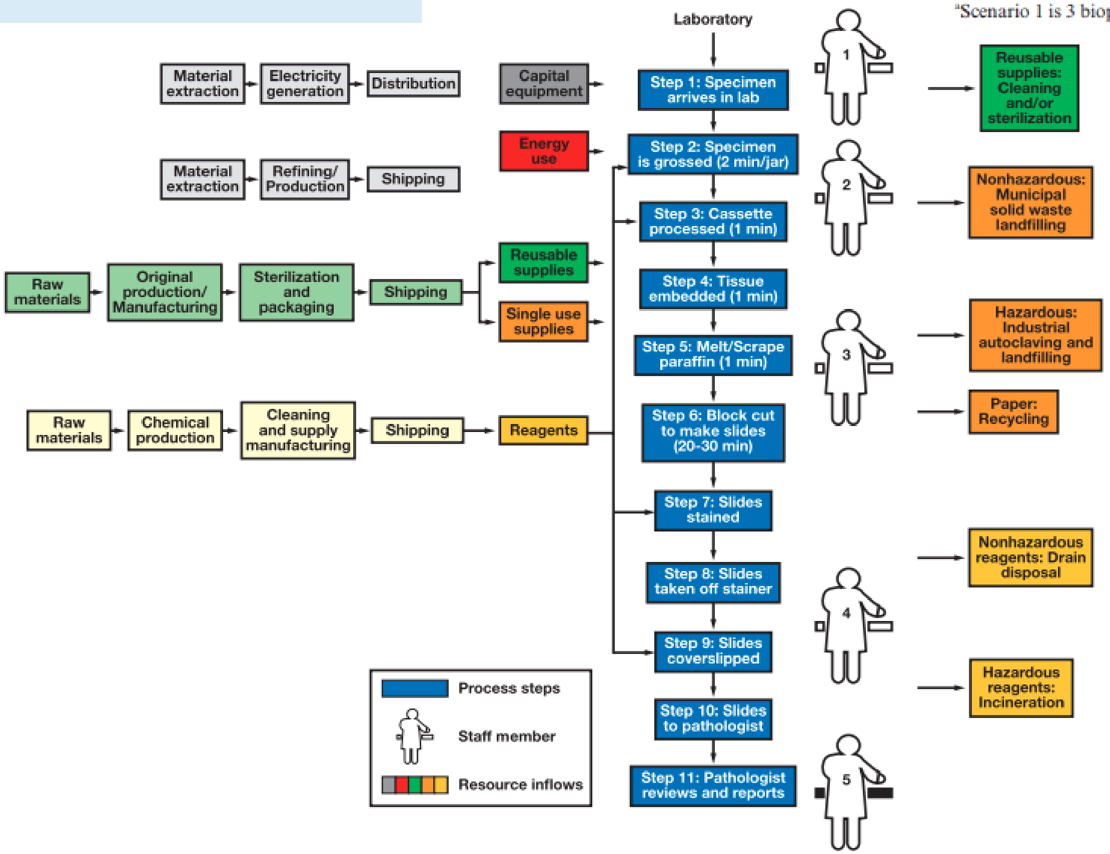


Figure 1 Process flow diagram of the gastrointestinal biopsy process in a surgical pathology laboratory.

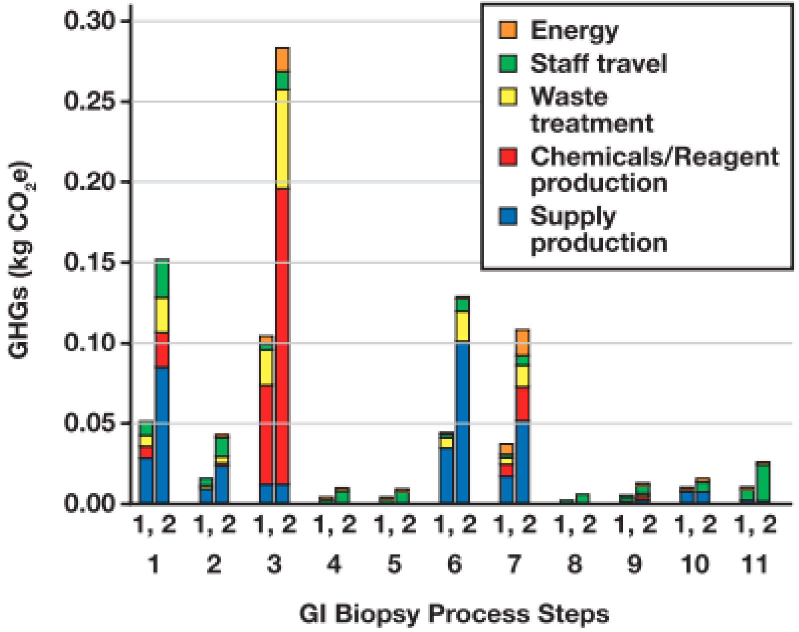
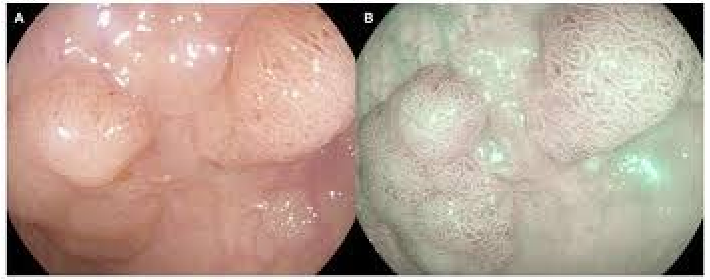


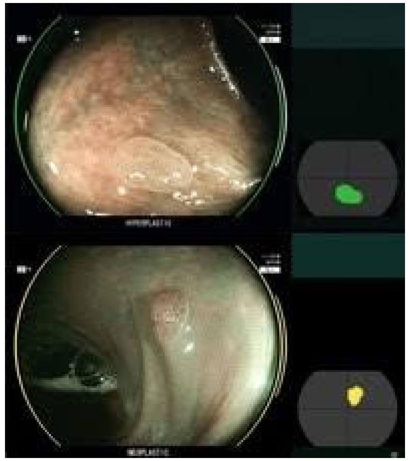
Figure 2 Greenhouse gas (GHG) emissions from gastrointestinal (GI) biopsy by process step (1-11) and by 2 approaches. Scenario 1 uses one biopsy jar; scenario 2 uses 3 biopsy jars.

Endoscopy’s histopathological output reduction without altering patients’ management

Adherence to biopsy-protocols guidelines



Adopting optical diagnosis with virtual chromoendoscopy and magnification



Artificial intelligence

Resect-and-discard strategy for diminutive polyps

Optimizing the use of disposable equipment

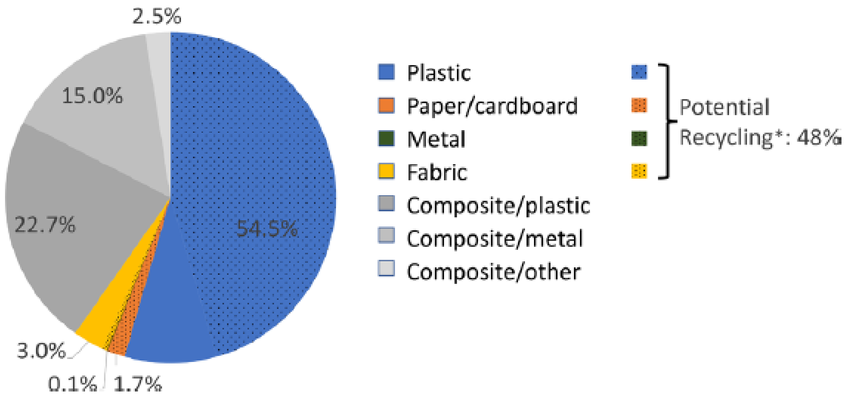
Table 1 Hospital endoscopic procedure volume and waste generated during 5-day audit

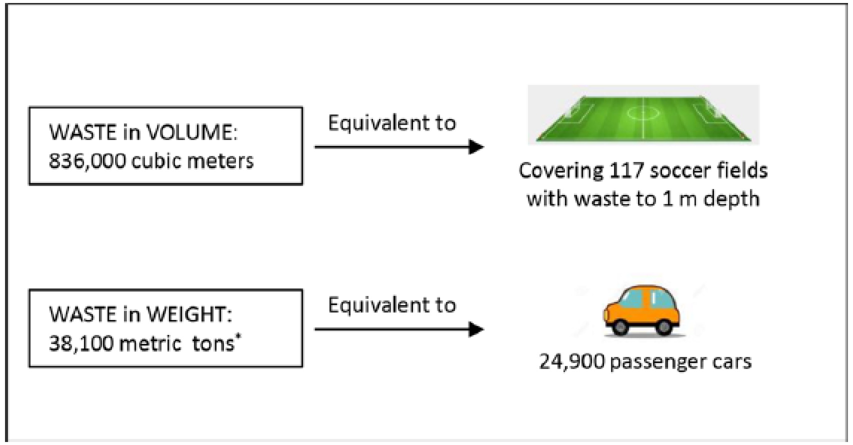
	All	Low endoscopy volume centre	High endoscopy volume centre	Relative difference*
Endoscopic procedures per year, n	15 000	2000	13 000	6.50
Procedures performed during 5-day audit, n	278	37	241	6.51
Colonoscopies, n	135	21	114	5.43
EGD, n	112	10	102	10.20
ERCP, n	7	2	5	2.50
EUS, n	17	1	16	16.00
Sigmoidoscopy, n	7	3	4	1.33
Waste produced during 5-day audit†				
Volume, n trash bins (20 Ga or 76 L)	190	19	171	8.95
Mass, kg	619	73	546	7.51
Waste per endoscopy				
Volume, n bins (20 Gal or 76 L)	0.61	0.52	0.71	1.37
Direct landfill waste, n bins (%)	0.41 (67)	0.38 (74)	0.43 (61)	
Biohazard waste, n bins (%)	0.10 (17)	0.14 (26)	0.07 (10)	
Recycled waste, n bins (%)	0.10 (17)	0 (0)	0.21 (29)	
Volume, m^3	0.05	0.04	0.05	1.37
Mass, in kg	2.11	1.96	2.27	1.15
Direct landfill waste, kg (%)	1.34 (64)	1.33 (68)	1.36 (60)	1.03
Biohazard waste, kg (%)	0.59 (28)	0.64 (32)	0.54 (24)	0.85
Recycled waste, kg (%)	0.18 (9)	0 (0)	36 (16)	–
Waste of reprocessing one endoscope				
Volume, trash bins (20 Gal or 75 L)	0.07	N/A	0.08	–
Volume, m^3	0.005	N/A	0.006	–
Mass, kg	0.30	N/A	0.33	–

N/A, not available
*High vs low volume centre.
†Without reprocessing of endoscopes.
EGD, esophagogastroduodenoscopy; ERCP, endoscopic retrograde cholangiopancreatography; EUS, endoscopic ultrasound.

Estimating the environmental impact of disposable endoscopic equipment and endoscopes

Sathvik Namburar,[1] Daniel von Renteln,[2] John Damianos,[1] Lisa Bradish,[3] Jeanne Barrett,[4] Andres Aguilera-Fish,[5] Benoit Cushman-Roisin,[6] Heiko Pohl[1,4,5]





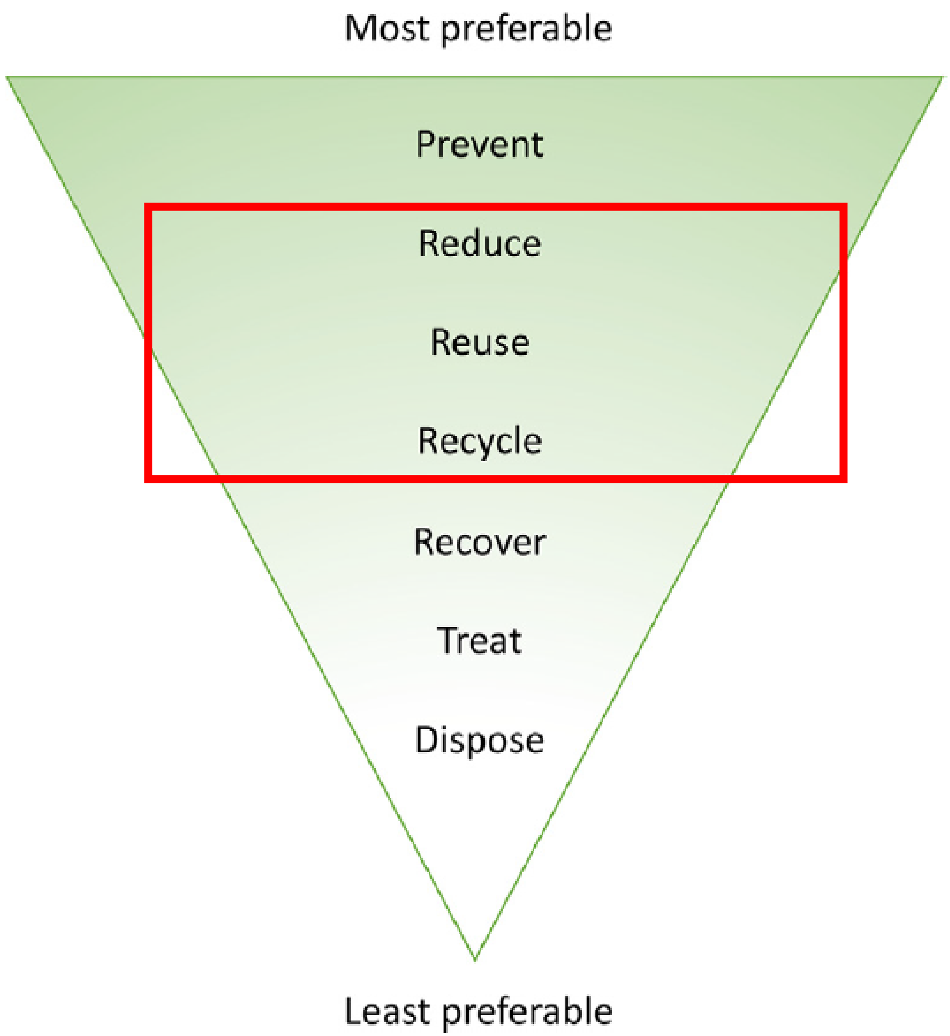


Fig. 2. The waste-management hierarchy according to the Wordl Health Organization (WHO).

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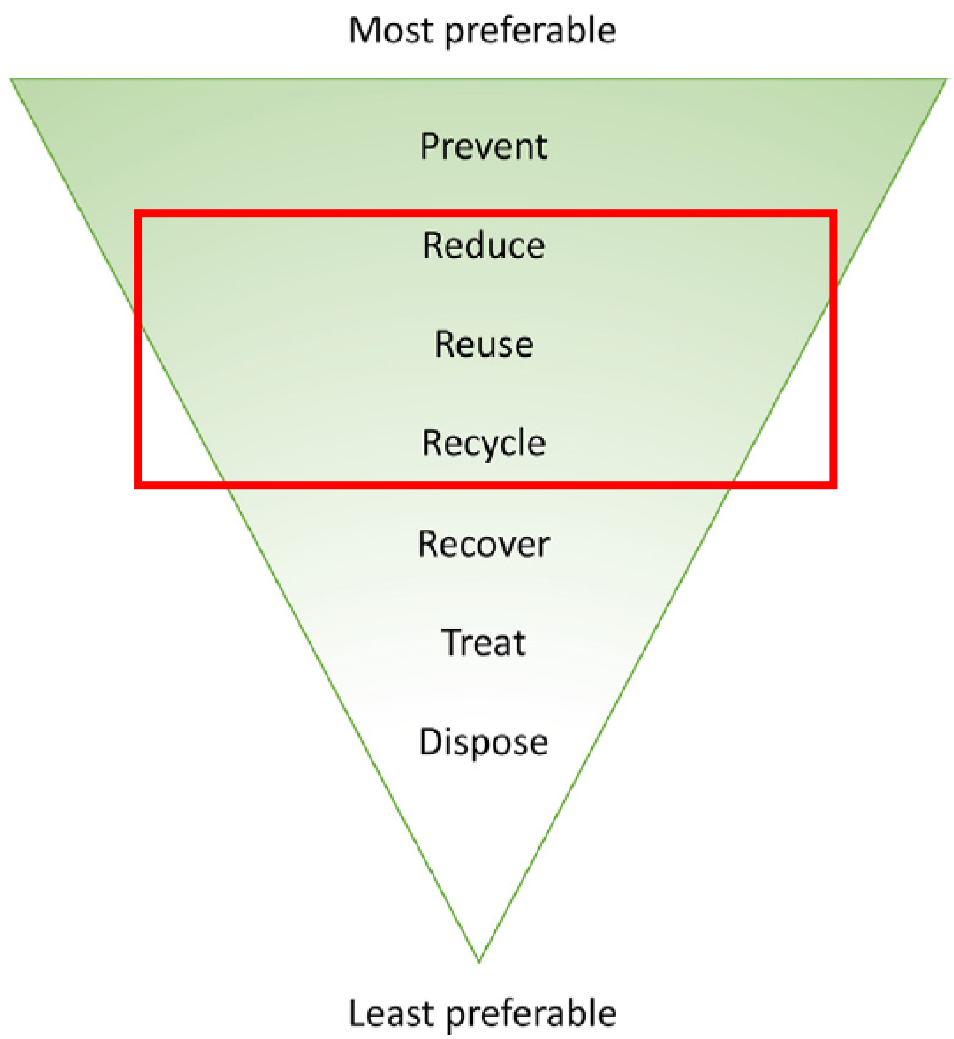

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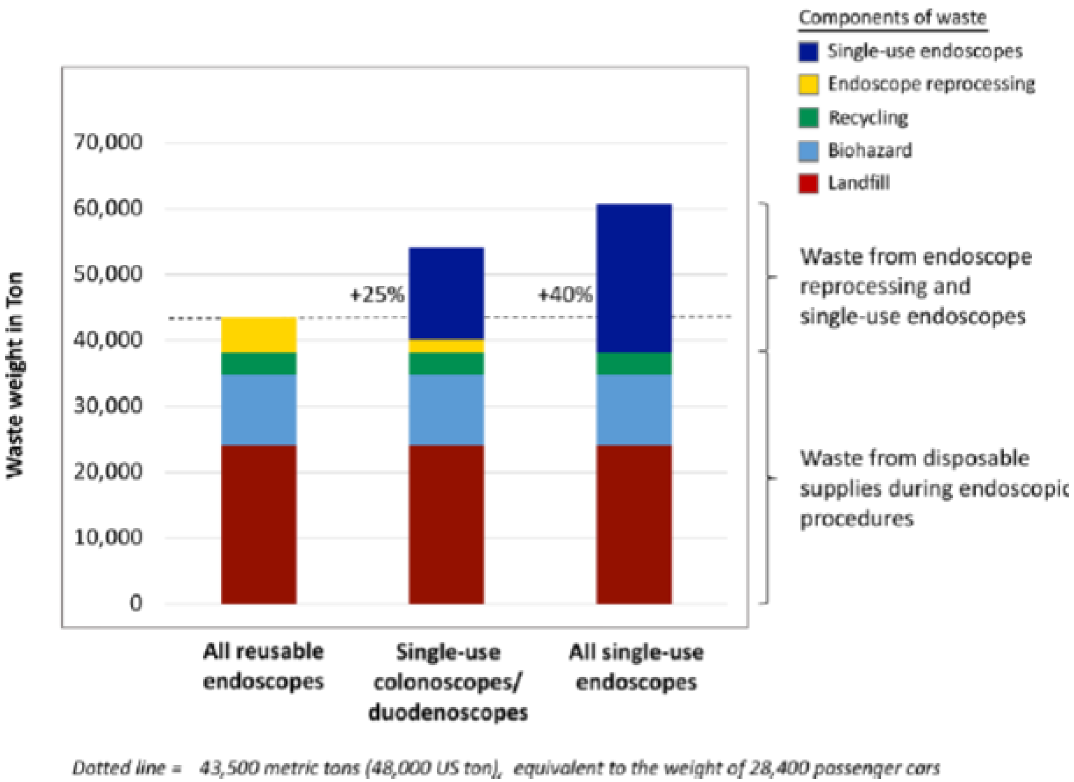

Figure 3 Annual waste produced during endoscopic procedures in the US overall and by proportion of procedures performed with reusable or single-use endoscopes. Percentages represent the absolute increase in waste from using disposable endoscopes.

Original research

Estimating the environmental impact of disposable endoscopic equipment and endoscopes

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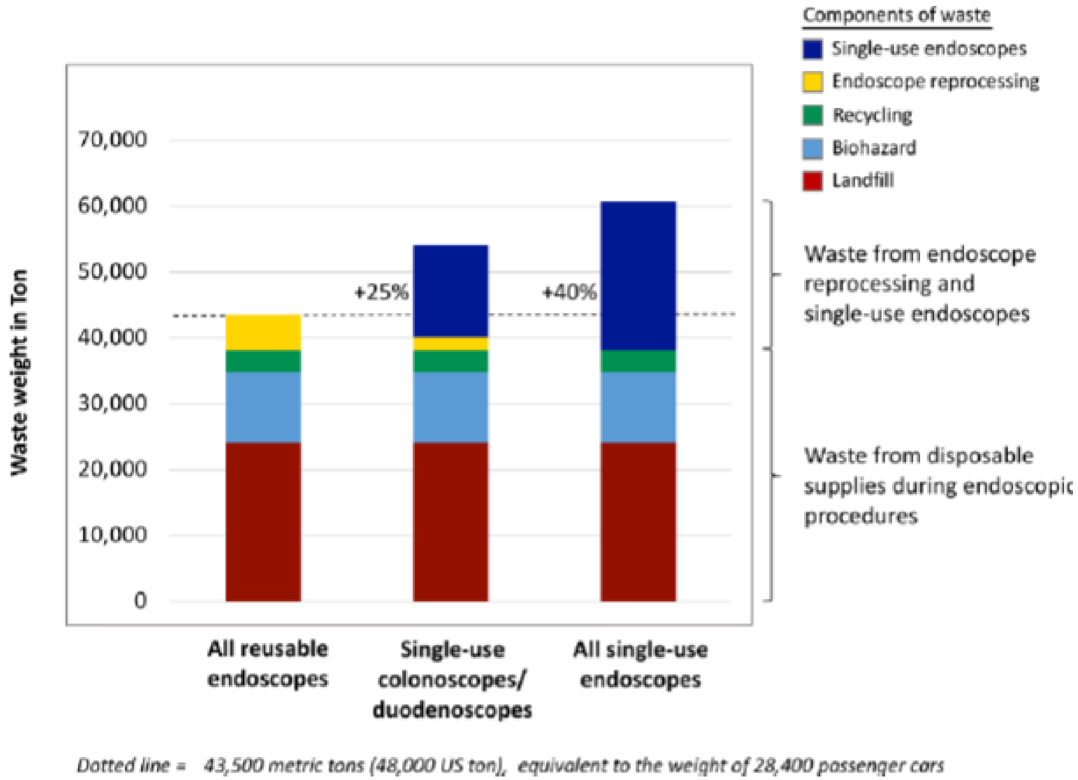

Figure 3 Annual waste produced during endoscopic procedures in the US overall and by proportion of procedures performed with reusable or single-use endoscopes. Percentages represent the absolute increase in waste from using disposable endoscopes.

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Original research

Estimating the environmental impact of disposable endoscopic equipment and endoscopes

Sathvik Namburar,[1] Daniel von Renteln,[2] John Damianos,[1] Lisa Bradish,[3] Jeanne Barrett,[4] Andres Aguilera-Fish,[5] Benoit Cushman-Roisin,[6] Heiko Pohl[1,4,5]

Phases in the life cycle of an endoscope and expected main environmental impact		NATURAL RESOURCES	MANUFACTURING	TRANSPORT	PROCEDURE PERFORMANCE	REPROCESSING	DISPOSITION
		• CO2 • Minerals	• CO2	• CO2	• CO2 • Energy	• CO2 • Energy • Water • Chemicals	• Landfill waste • CO2 • Recycling & generation of energy
Reusable Endoscopes (current standard)	1 endoscope needed for 2000 Endoscopies	↑	↑	↑	↑↑	↑↑↑	↑
Single-use Endoscopes (if used for procedures performed)	2000 endoscopes needed for 2000 procedures	↑↑↑	↑↑↑	↑↑↑	↑↑	-	↑↑↑
Conclusion		• Single-use endoscopy with greater need for natural resources • Oil for non-recycled plastic as major material. • Minerals for electronic components.	• Single-use endoscopes with greater carbon footprint	• Single-use endoscopes probably with greater carbon footprint • Current manufacturing plants in Asia and South America*	• Single use and reusable endoscopes with probably similar environmental impact	• Reusable endoscopes with greater environmental impact • CO2 related to endoscope repair and servicing, heating and cooling of space • Per reprocessing cycle†: 91 L *clean water*, 0.33kWh *energy* needs, and 1L *chemicals* (alcohol, detergents, disinfectants)	• Single-use endoscopes generate more waste (net increased waste per endoscope 1.0 kg) • Recycling program: *Recycling* of metal and electronic components • Incineration of plastic components = *Energy* production at *CO2* cost • Packaging material and transport to send for disposal management (one site in the US)

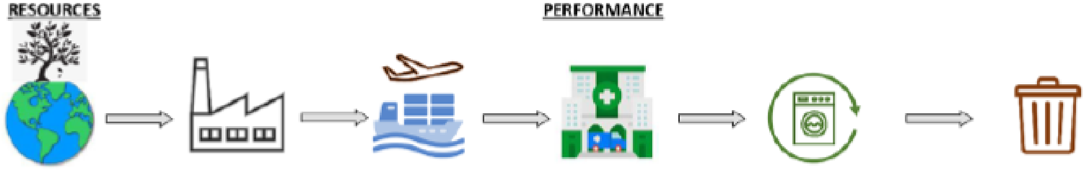


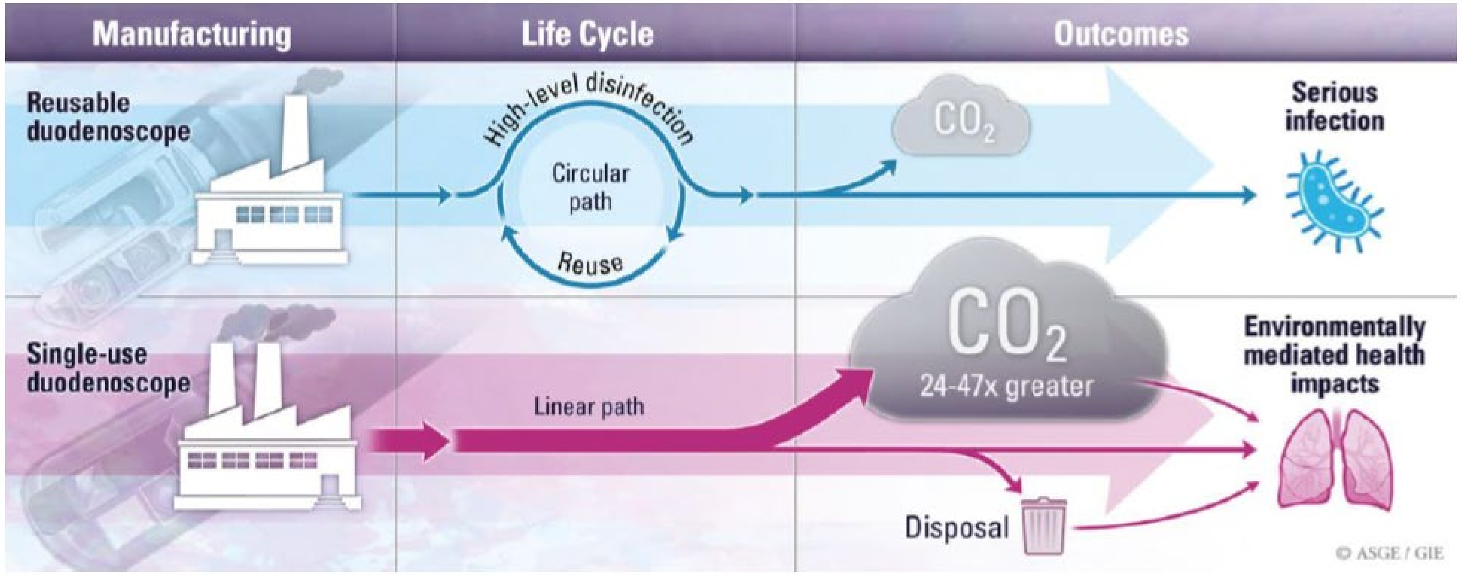
Figure 4 Life cycle of an endoscope from manufacturing to disposal. Up-arrows indicate a possible harmful impact on the environment. *Boston Scientific and Ambu. †Data obtained from Olympus endoscope washing machines. One cycle cleans two gastroscopes or colonoscopes and one duodenoscope.

Environmental and health outcomes of single-use versus reusable duodenoscopes

Nguyen Nhat Thu Le, BA,[1] Lyndon V. Hernandez, MD, MPH,[2] Nimish Vakil, MD,[3] Nalini Guda, MD,[3] Casey Patnode, MD, MPH,[1] Olivier Jolliet, PhD[1,4]

Ann Arbor, Michigan; Milwaukee, Summit, Madison, Wisconsin, USA

GRAPHICAL ABSTRACT



PROCESS AND SYSTEMS

Does telemedicine reduce the carbon footprint of healthcare? A systematic review

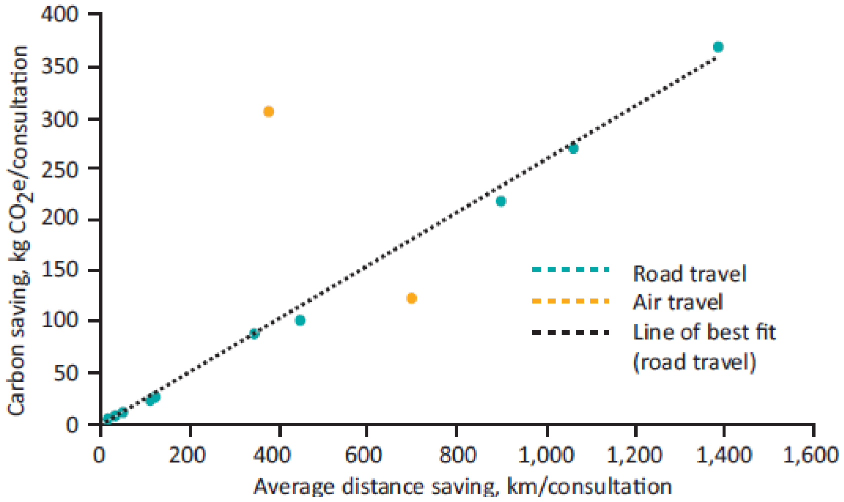


Fig 2. Carbon footprint against travel distance savings of telemedicine interventions.

Table 1. Distance and carbon savings of telemedicine studies

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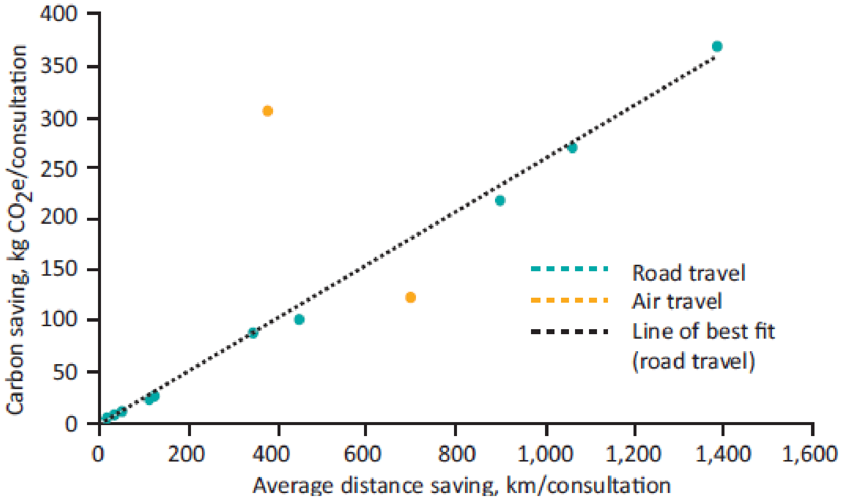
LCA = life cycle assessment.

Future Healthcare Journal 2021 Vol 8, No 1: e85–91 REVIEW

PROCESS AND SYSTEMS Does telemedicine reduce the carbon footprint of healthcare? A systematic review



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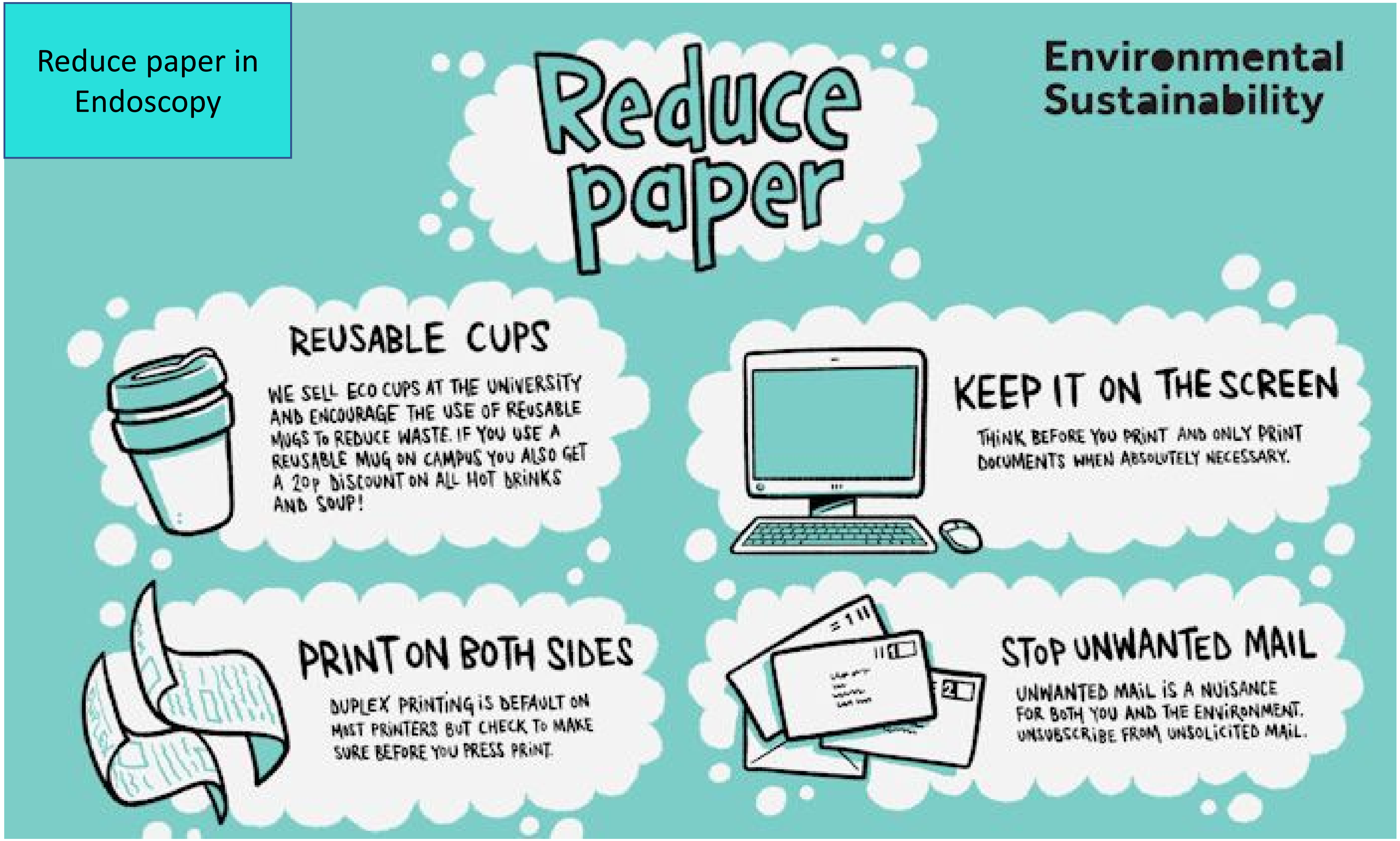
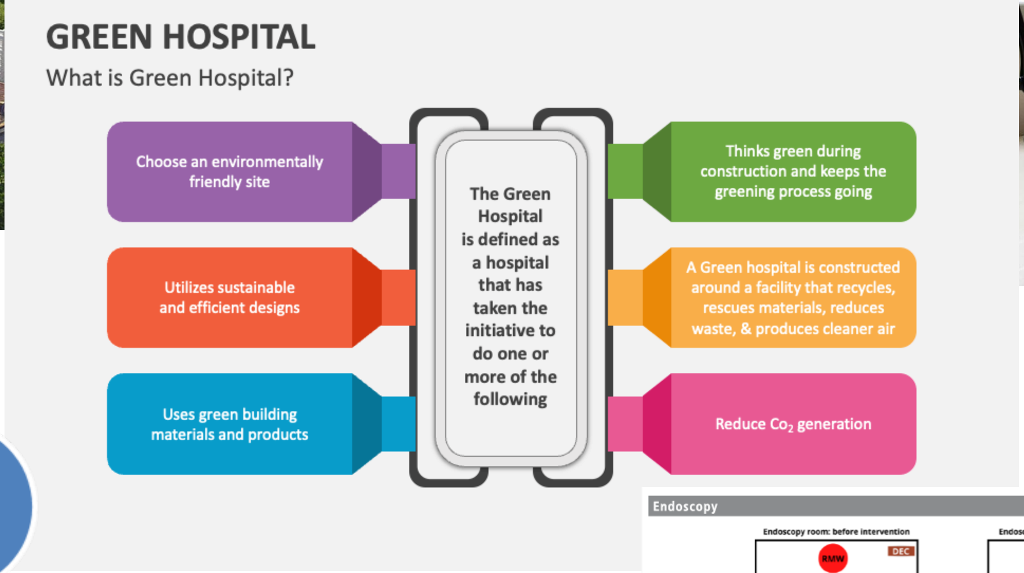
Reduce paper in Endoscopy





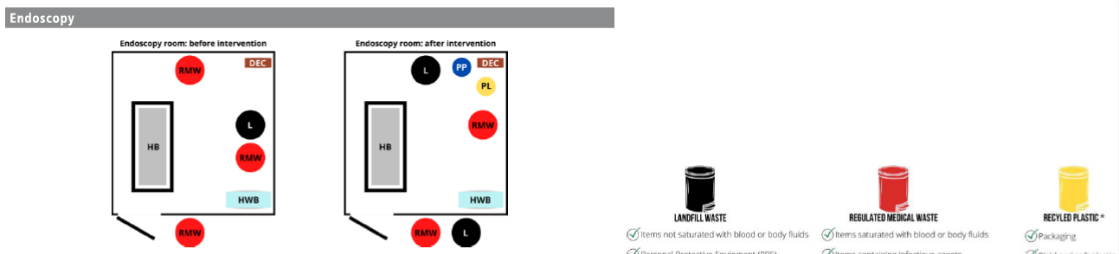
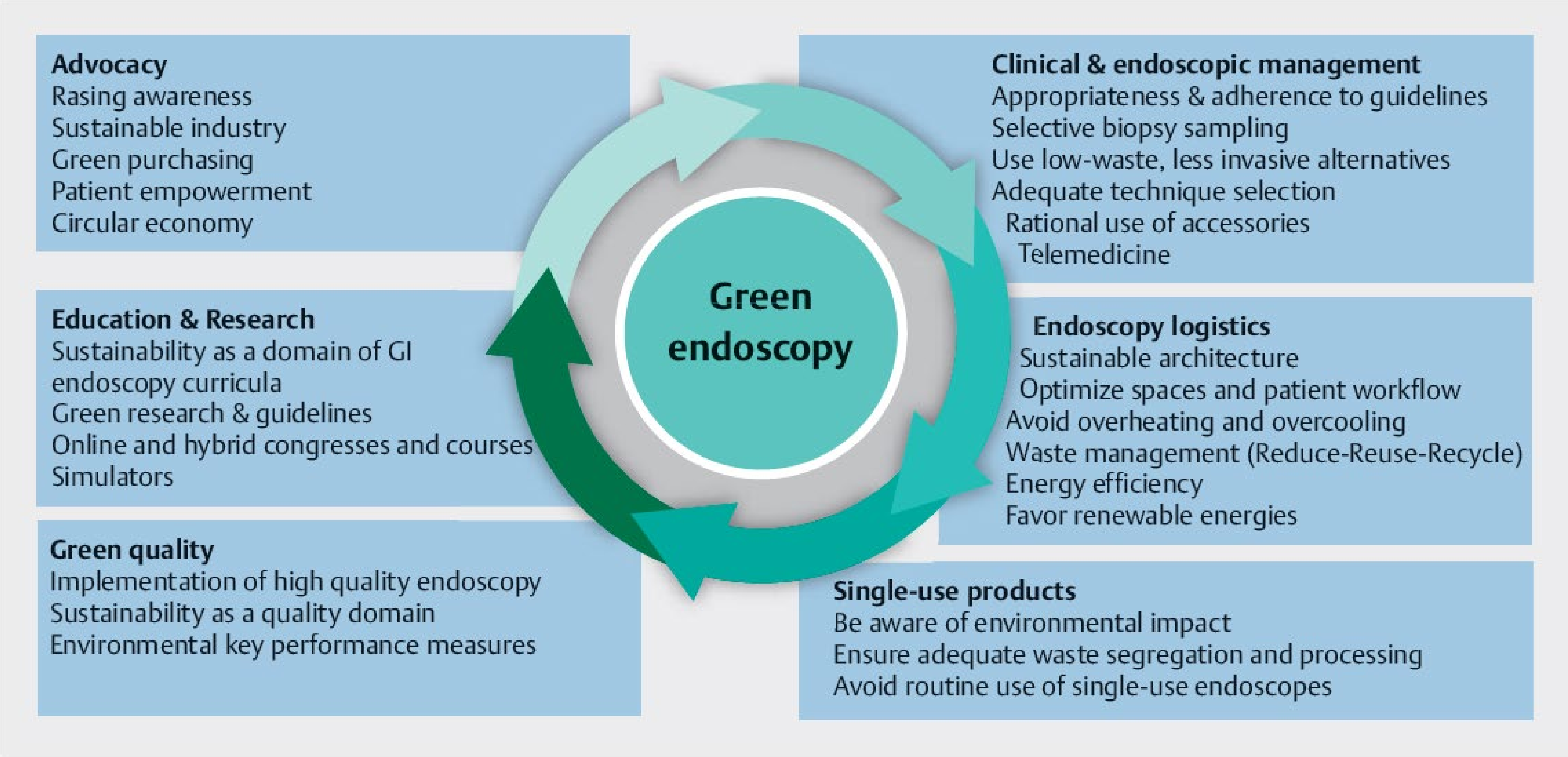


Figure 1 Placement and relocation of bins within endoscopy rooms: before and after intervention. DEC, disposal endoscopic cabinet; HB, hospital bed; HWB, hand washbasin; L, landfill waste; PL, plastic waste; PP, paper waste; RMW, regulated medical waste.

Targeted intervention to achieve waste reduction in gastrointestinal endoscopy

João A Cunha Neves [1,2], Joana Roseira [1,2], Patrícia Queirós [1,2], Helena Tavares Sousa [1,2], Gianluca Pellino [3,4], Miguel F Cunha [2,5]



▶ **Fig. 2** The path towards sustainable endoscopy.

Our Vision:	Digestive health care for all that aligns with planetary health.
Our Mission:	The participating GI societies commit to promote and support sustainable digestive health care for all.
	Clinical setting: Devise and foster sustainable clinical practices to reduce waste and carbon emissions.
	Education: Raise awareness and share sustainability practices with society members and patients regarding the interaction between climate change, digestive health, and healthcare services.
	Research: Raise and allocate resources to support research at the intersection of the environment, climate change, and digestive health.
	Society efforts: Achieve environmentally and organizationally sustainable activities across all society mission areas.
	Intersociety efforts: Collaborate with national and international GI and hepatology societies to advocate for and support implementation of sustainable practices.
	Industry: Engage with GI- and hepatology-focused industry and pharmaceutical partners to develop environmentally friendly products rooted in sustainable economy principles.
	Advocacy: Advocate for policies that promote environmentally sustainable GI practices.

Figure 2. Vision, mission, and strategic goals.

Gastroenterology 2022;163:1695–1701

AGA SECTION

GI Multisociety Strategic Plan on Environmental Sustainability

Heiko Pohl,[1,2] Rabia de Latour,[3] Adrian Reuben,[4] Nitin K. Ahuja,[5] Swapna Gayam,[6] Rohit Kohli,[7] Deepak Agrawal,[8] and M. Bishr Omary[9]

Quantifying the climate benefits of a virtual versus an in-person format for an international conference

Jacqueline R. Lewy[1], Casey D. Patnode[1], Philip J. Landrigan[2,3], Joseph C. Kolars[1*] and Brent C. Williams[1]

The conversion of the 2021 Consortium of Universities for Global Health (CUGH) conference, planned in-person for Houston, TX USA to an all-virtual format

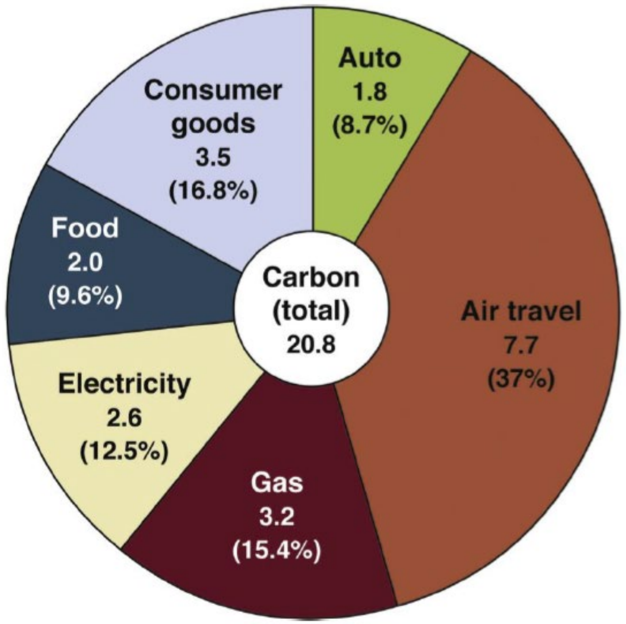
Table 1 Number of attendees utilizing air travel

Miles per round trip	Number of attendees	Emissions averted ($MtCO_2$)
≤ 1000	57	8.94
1001–2000	291	110.21
2001–3000	639	360.04
3001–4000	306	232.52
4001–5000	17	17.85
5001–6000	5	5.85
6001–7000	7	10.02
7001–8000	14	24.16
8001–9000	0	0
9001–10,000	30	68.46
> 10,000	389	1598.23

Table 2 Number of attendees traveling by vehicle

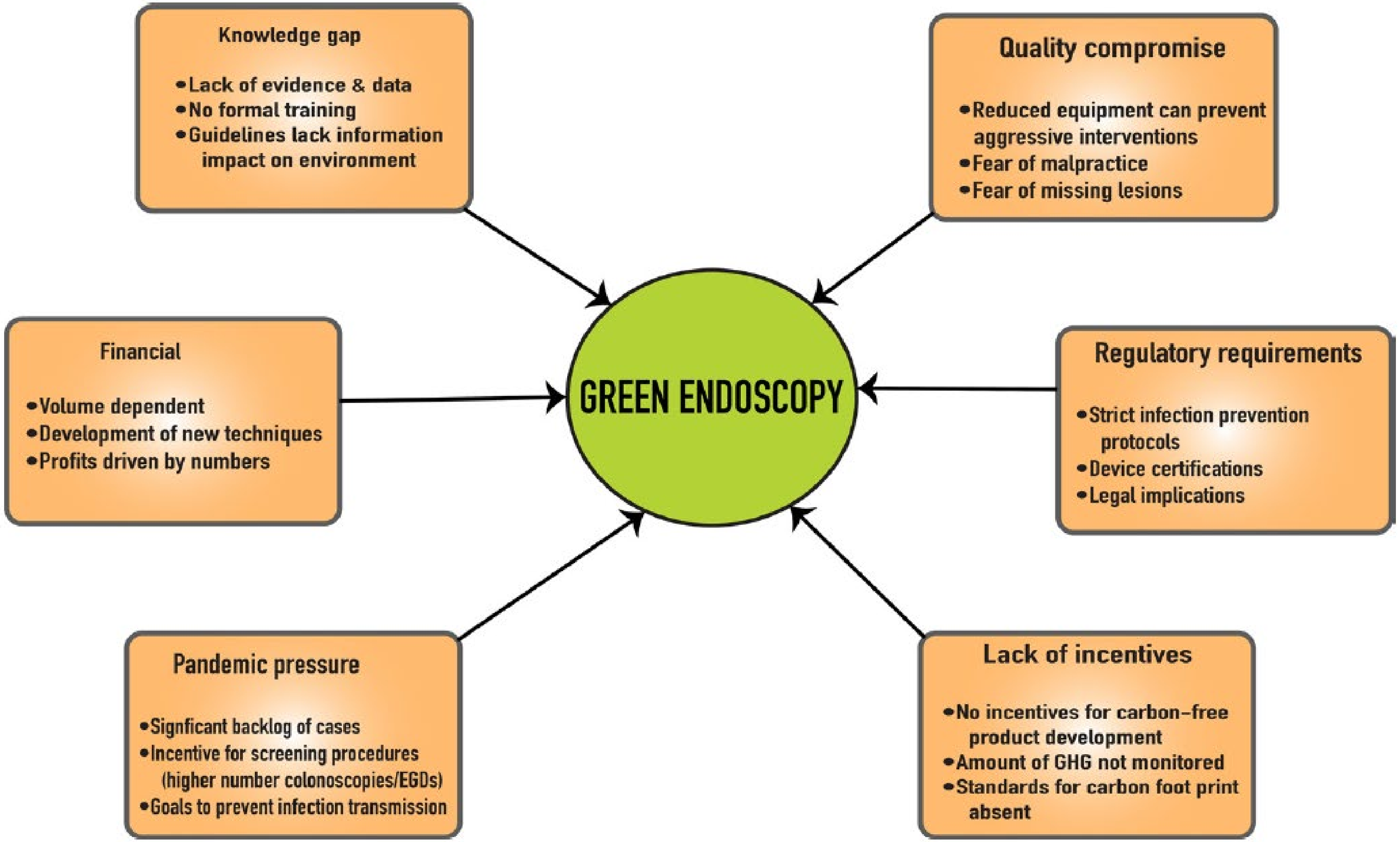
Miles per round trip	Number of attendees	Emissions averted ($MtCO_2$)
≤ 100	74	0.12
101–300	32	1.61
301–600	48	6.07

Travel component	Carbon emissions averted ($MtCO_2$)
Flights to/from IAH	2436.14
Driving to/from Houston	7.68
Total	**2443.82**



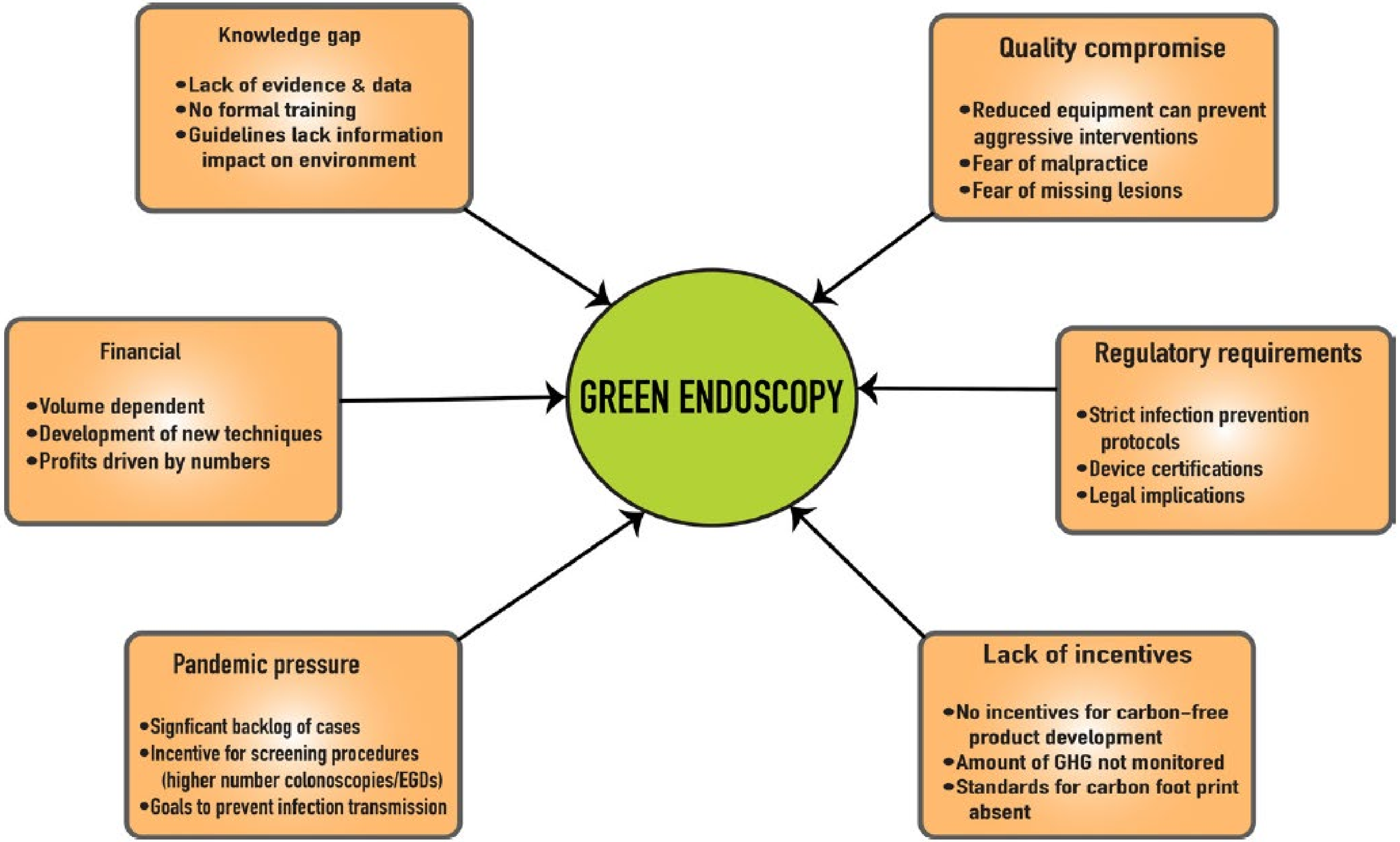
Lewy *et al. Environmental Health* (2022) 21:71
https://doi.org/10.1186/s12940-022-00883-7

Barriers to green endoscopy



Barriers to green endoscopy. EGD, oesophagogastroduodenoscopy; GHG, greenhouse gas.

Barriers to green endoscopy



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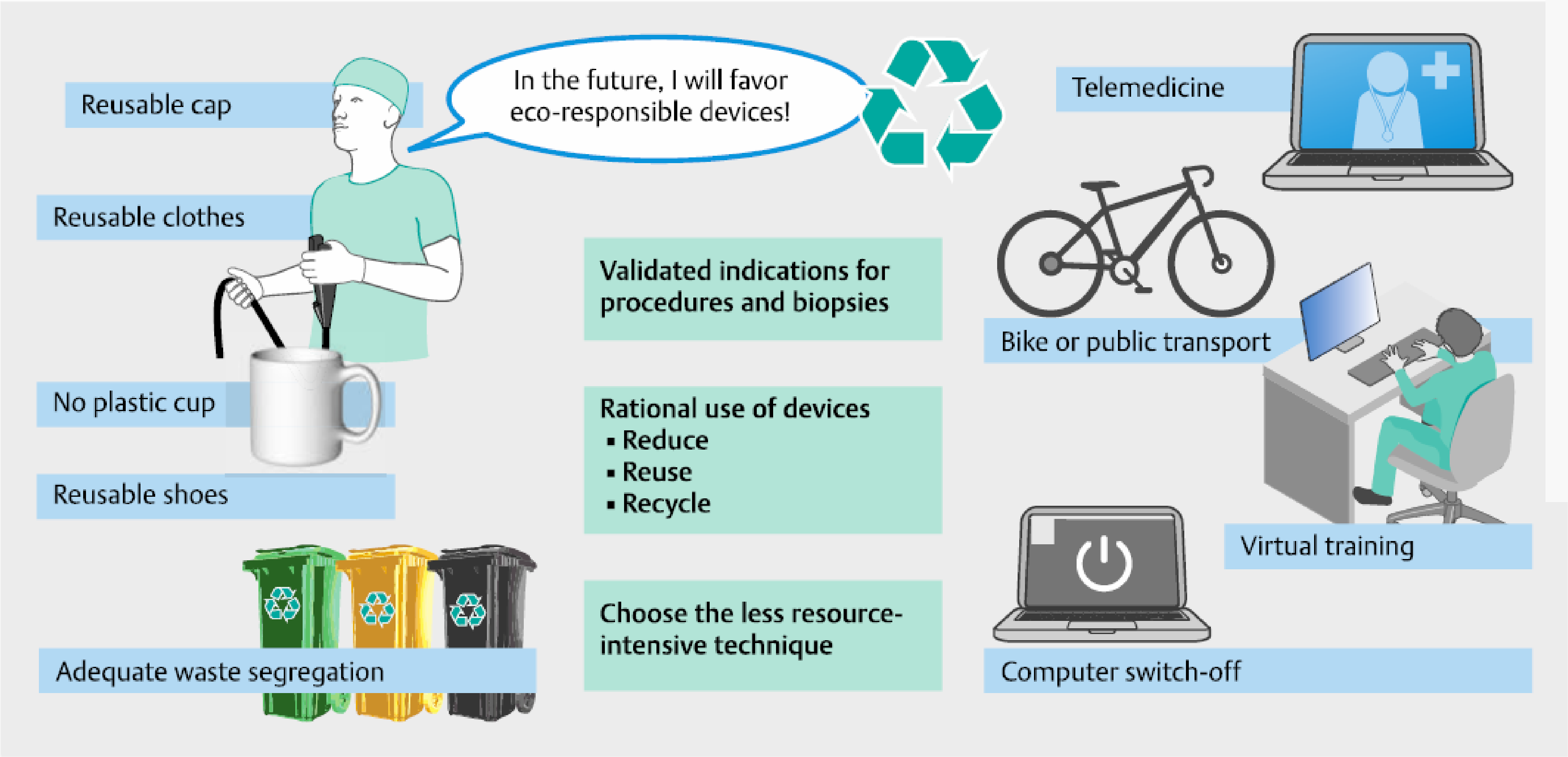
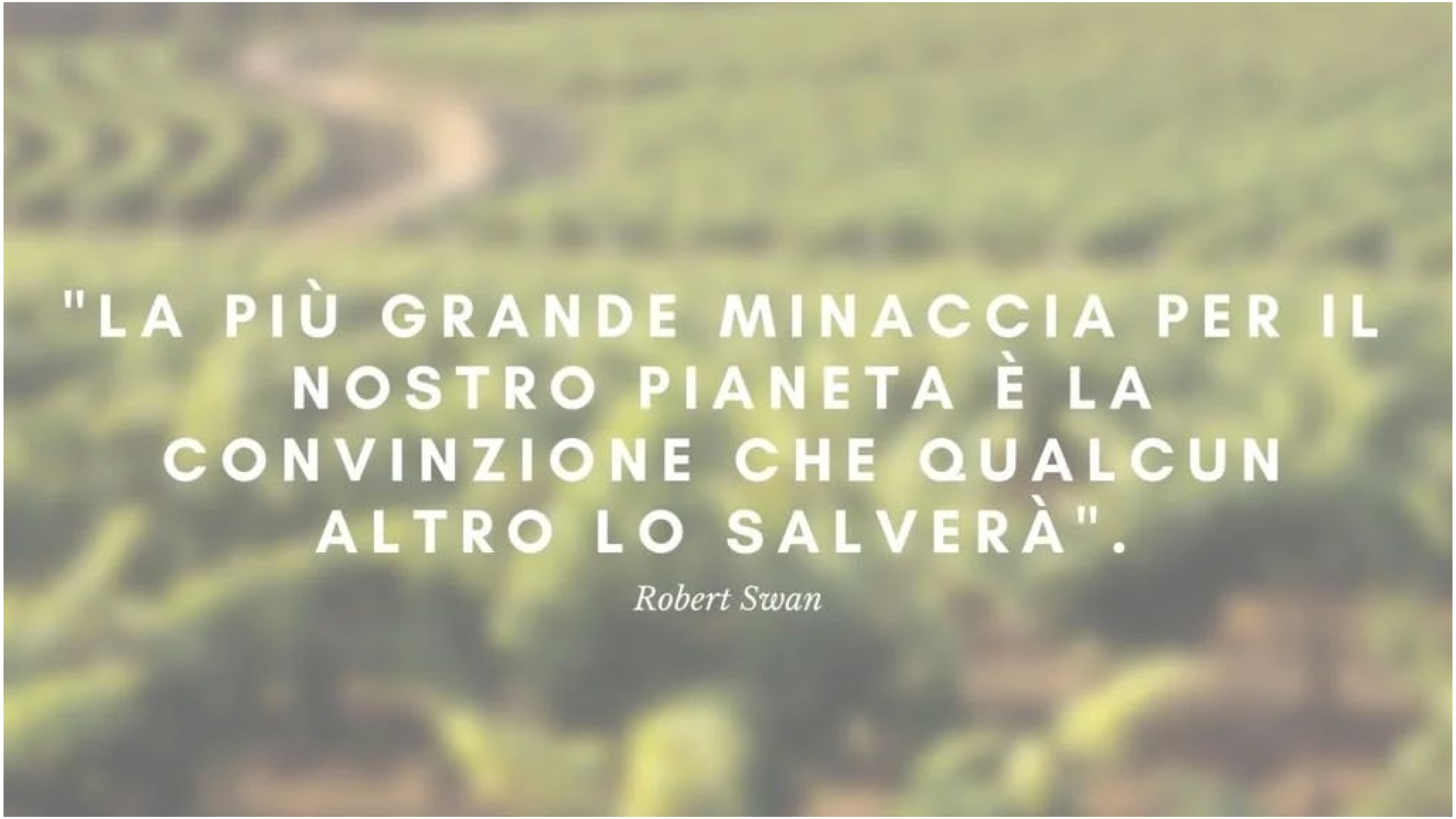
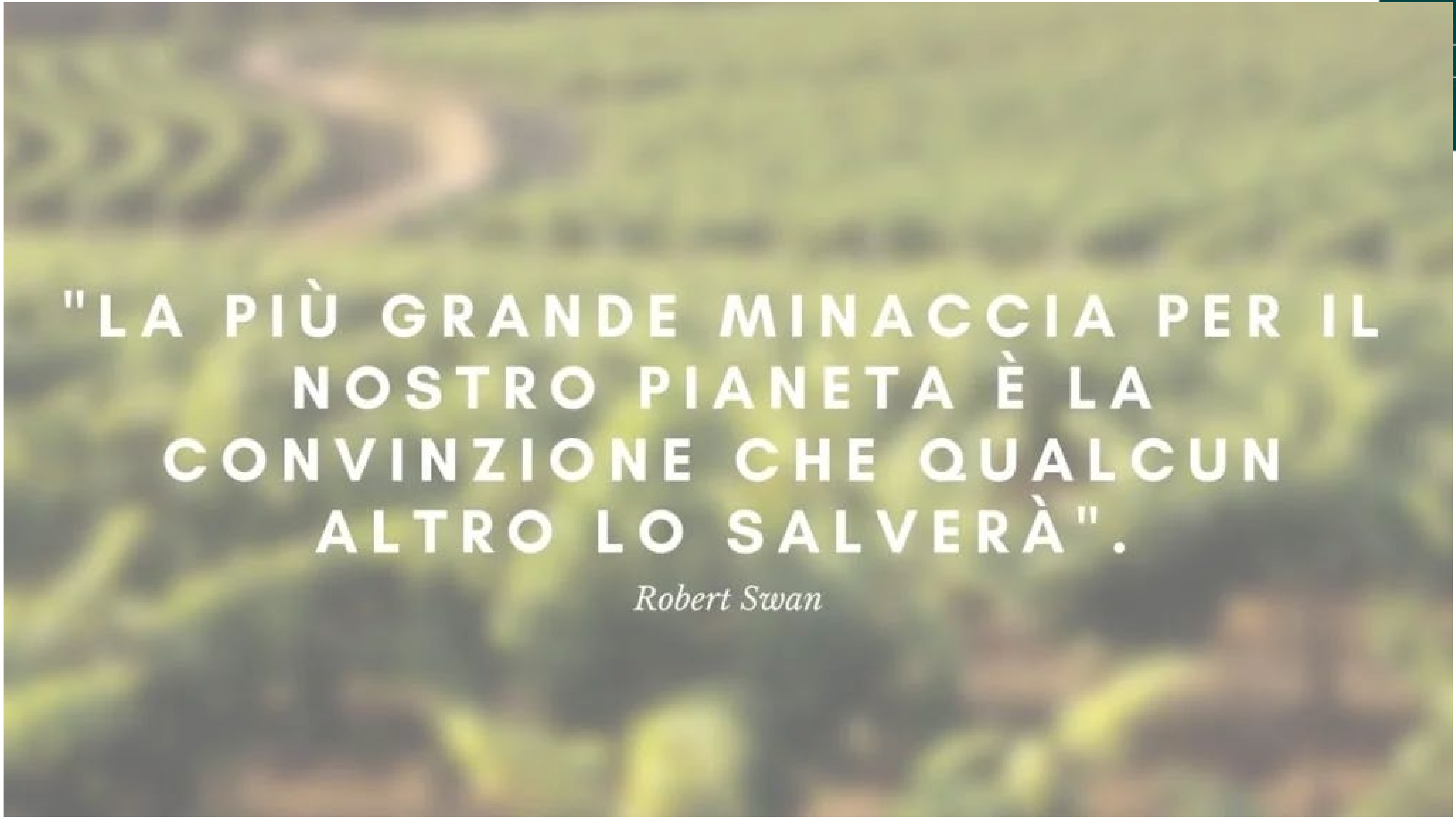


▶ **Fig. 3** The "eco-endoscopist."


"LA PIÙ GRANDE MINACCIA PER IL NOSTRO PIANETA È LA CONVINZIONE CHE QUALCUN ALTRO LO SALVERÀ".
Robert Swan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BERGAMO
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Piazza della Repubblica, 6

TOP TEN Slides

1

Carbon footprint of heath care activities

- Health care activities 1-5% of human enviromental impact
- 4.4% of greenhouse gas emission worldwide
- Increase of GHG emission by a third in the last two decades
- USA+EU+China account for more than half of all emissions

- 8.5% in USA
- 7% in Australia,
- 5% in Canada
- 3% in England

2

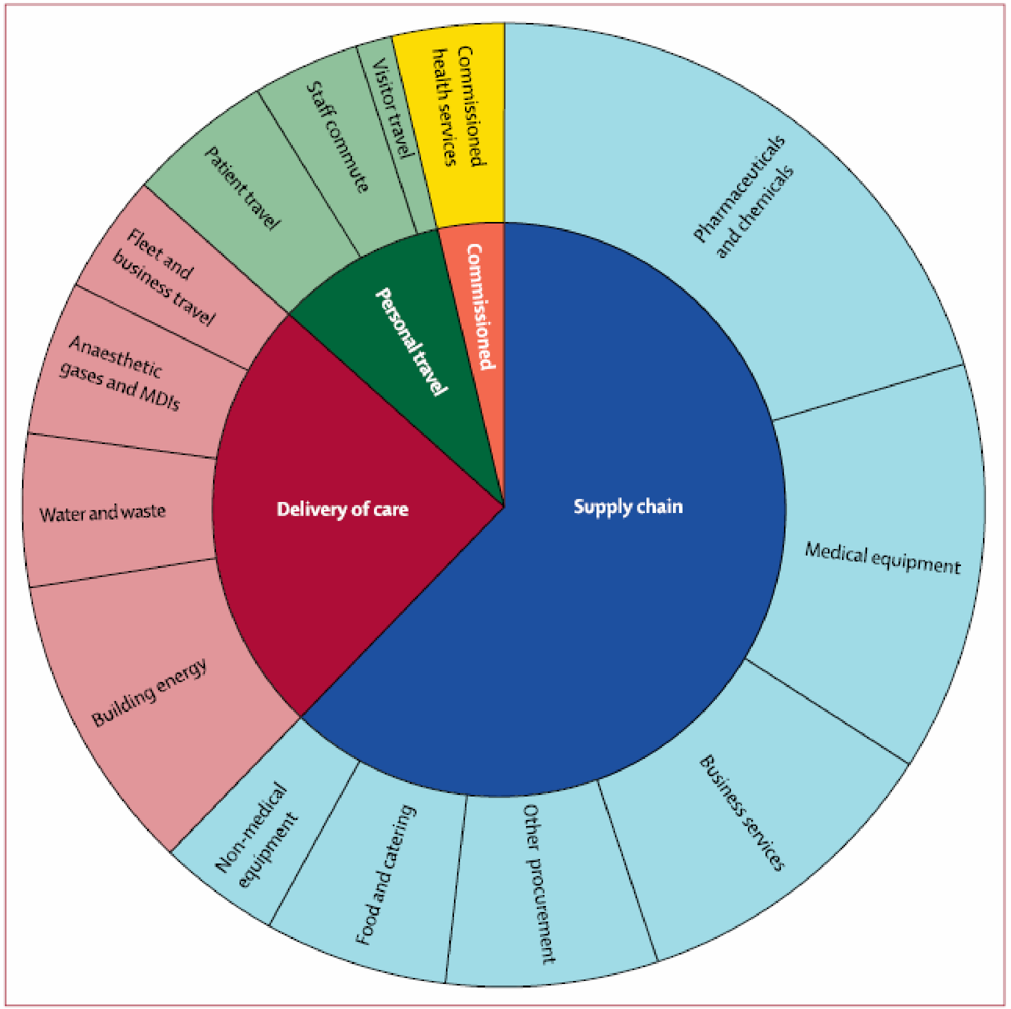

Figure 4: **Contribution of different sectors to the greenhouse gas emissions of the NHS England, 2019**
Data available in appendix 1 (p 39). MDI=metered dose inhaler. NHS=National Health Service.

Table 1
Main components of a hospital's carbon footprint [4].

Hospital carbon footprint
Electricity
Heating and cooling
Staff travel and products transportation
Equipment and supplies production and disposal

Emission generation in healthcare could be:

- direct (eg, use of anaesthesia gases)
- indirect (energy consumption)
- supply chain related

3

GI endoscopy: the third highest generator of hazardous waste in heath care facilities

1. Anaesthetics (5.96 kg day^{-1} bed^{-1}),
2. Paediatric and intensive care (3.37 kg day^{-1} bed^{-1})
3. Gastroenterology-digestive endoscopy (3.09 kg day^{-1} bed^{-1})

Vaccari M, et al . Costs associated with the management of waste from healthcare facilities: an analysis at national and site level. Waste Manage Res 2018;36:39–47.

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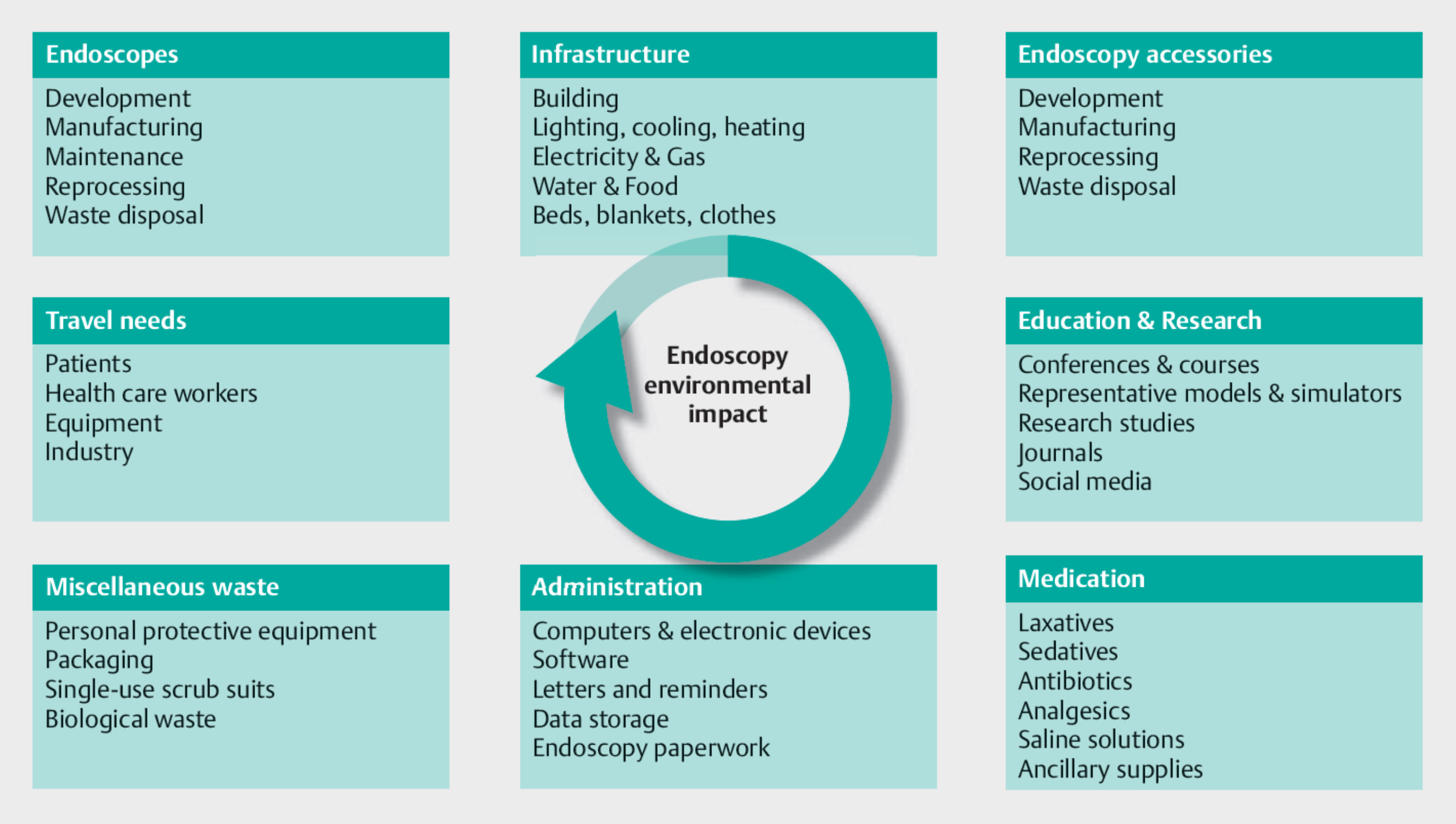
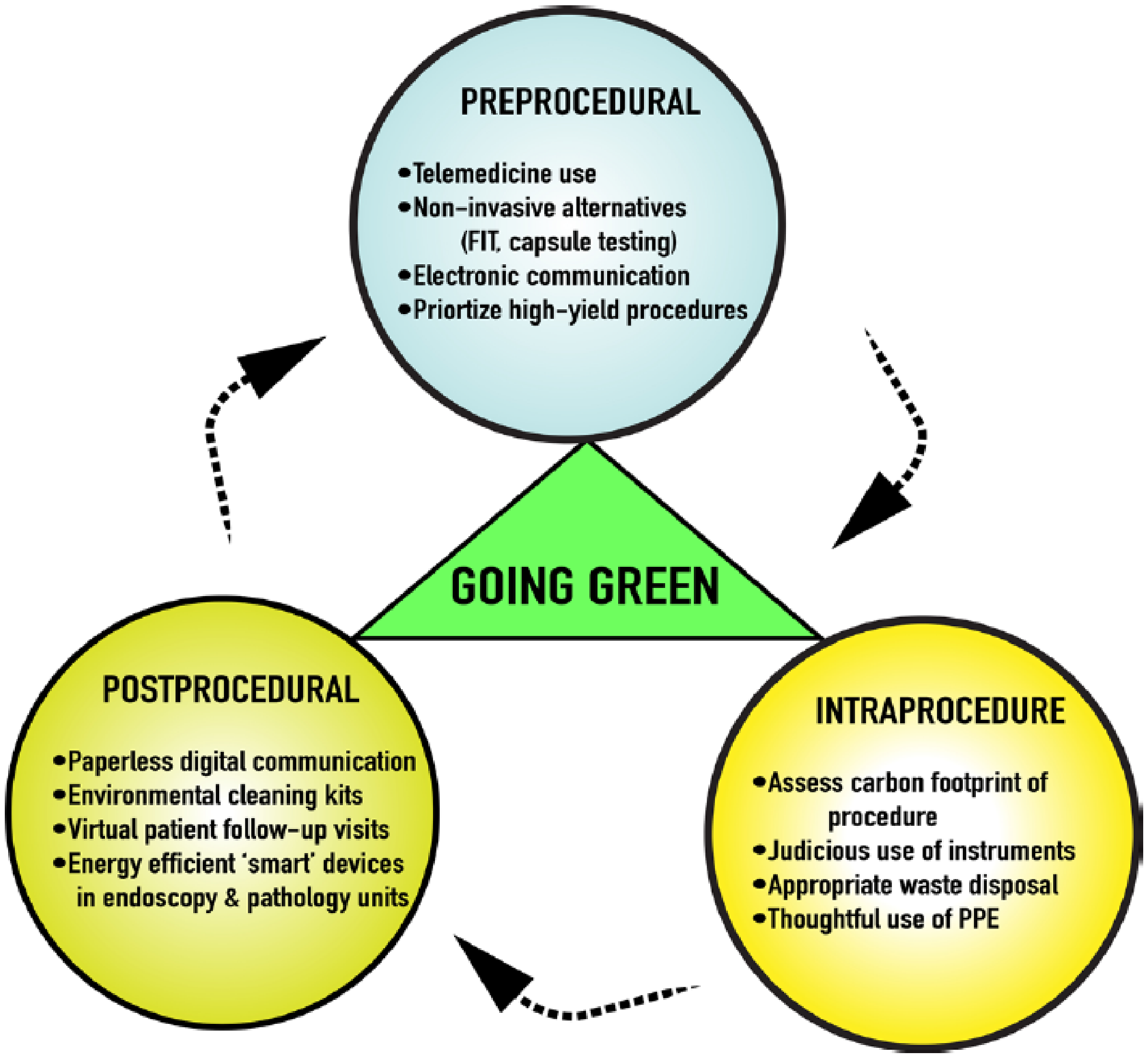


▶ **Fig. 1** The environmental impact of gastrointestinal (GI) endoscopy.

4


PREPROCEDURAL
•Telemedicine use
•Non-invasive alternatives
(FIT, capsule testing)
•Electronic communication
•Priortize high-yield procedures
GOING GREEN
POSTPROCEDURAL
•Paperless digital communication
•Environmental cleaning kits
•Virtual patient follow-up visits
•Energy efficient 'smart' devices
in endoscopy & pathology units
INTRAPROCEDURE
•Assess carbon footprint of
procedure
•Judicious use of instruments
•Appropriate waste disposal
•Thoughtful use of PPE

5

Adherence to guidelines ensuring the appropriateness of the indication for GI endoscopy is vital to optimizing use of resources

20-30% inappropriate use of upper and lower GI endoscopy

ESGE-ESGENA consider that reducing the current rate of unnecessary GI endoscopic procedures is key to that end and should be prioritized by GI endoscopy services and health care systems. This is probably the most effective action to mitigate the GHG emissions of GI endoscopy.

Endoscopy services should regularly assess appropriateness of endoscopy and take action in case of inappropriate procedures

Up to 80% reduction in surveillance endoscopy following guidelines

6

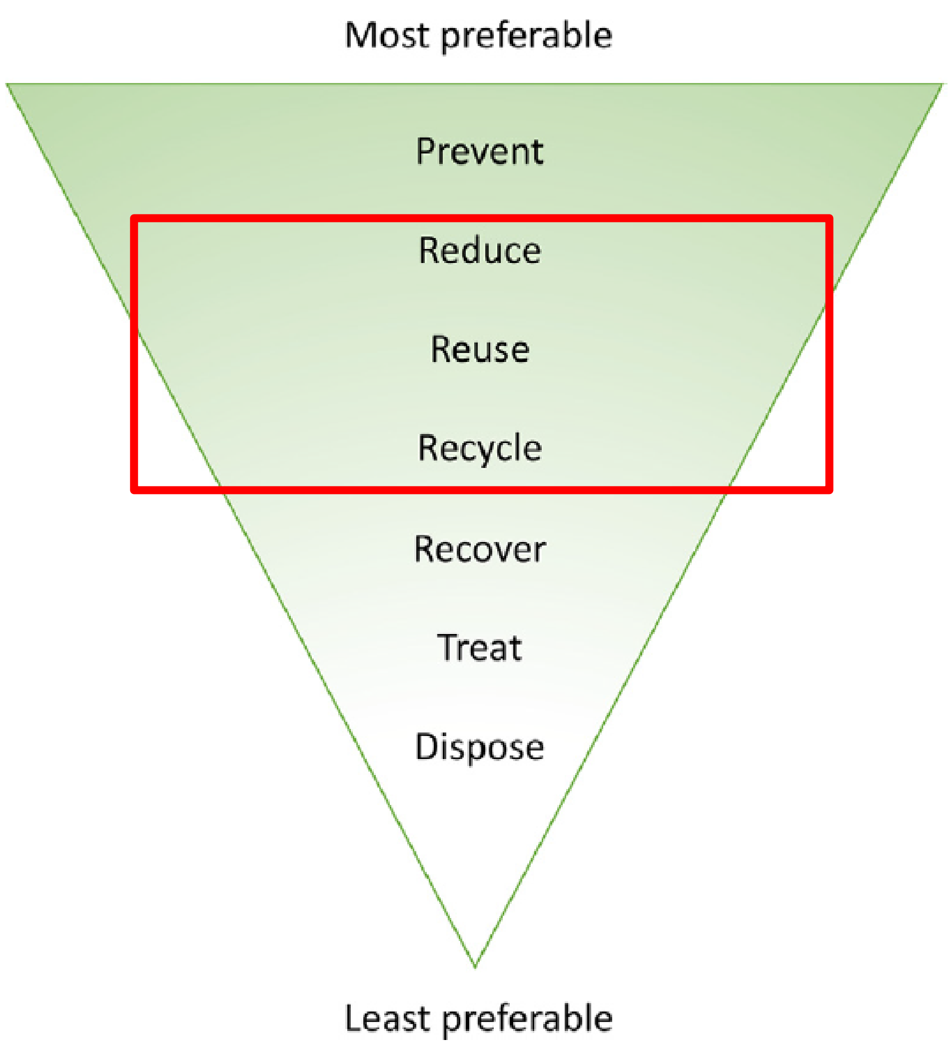
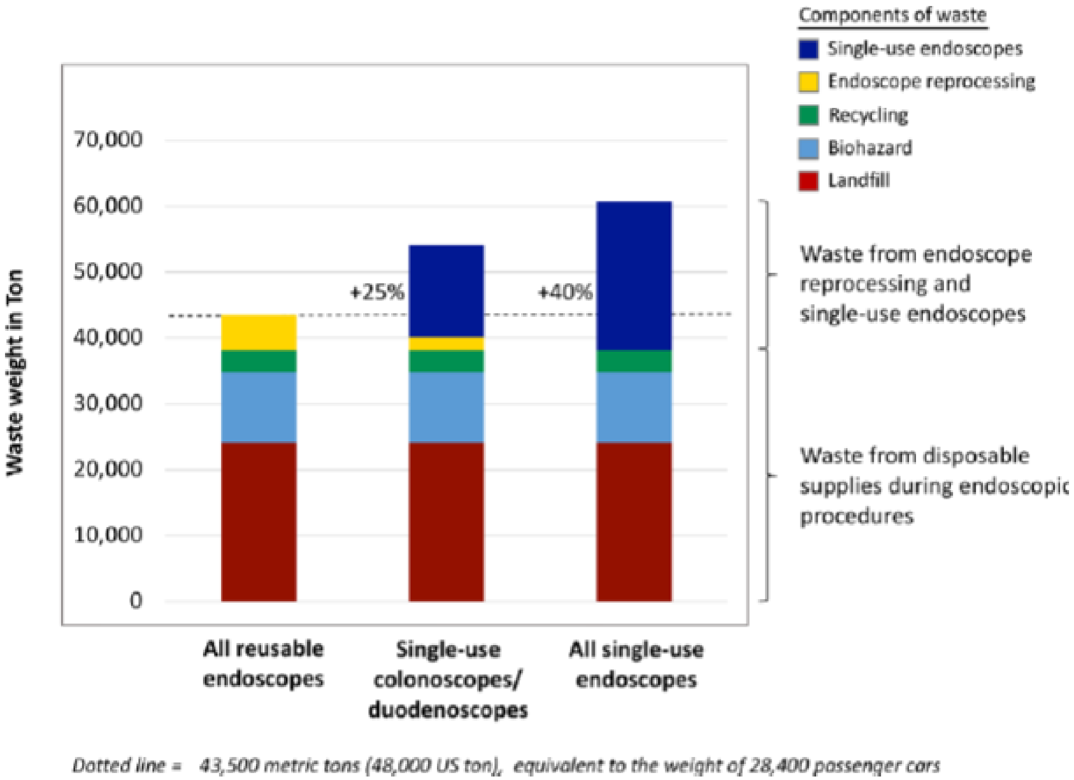


Fig. 2. The waste-management hierarchy according to the Wordl Health Organization (WHO).

7



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8

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PROCESS AND SYSTEMS

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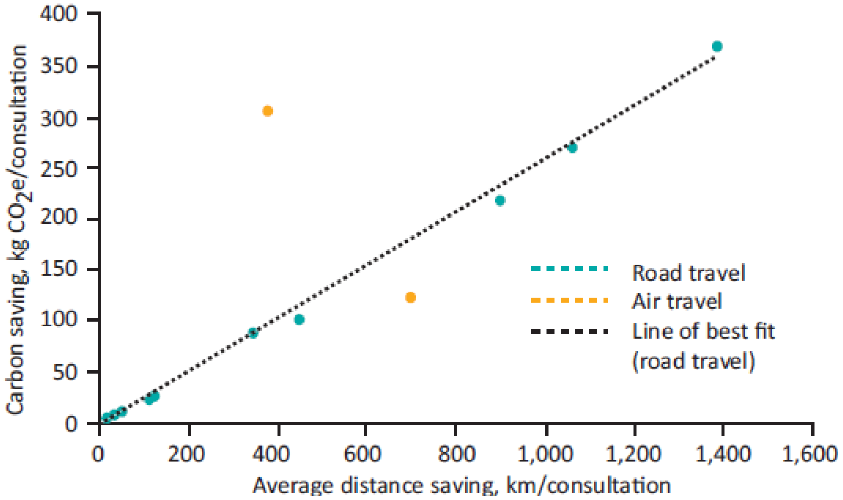

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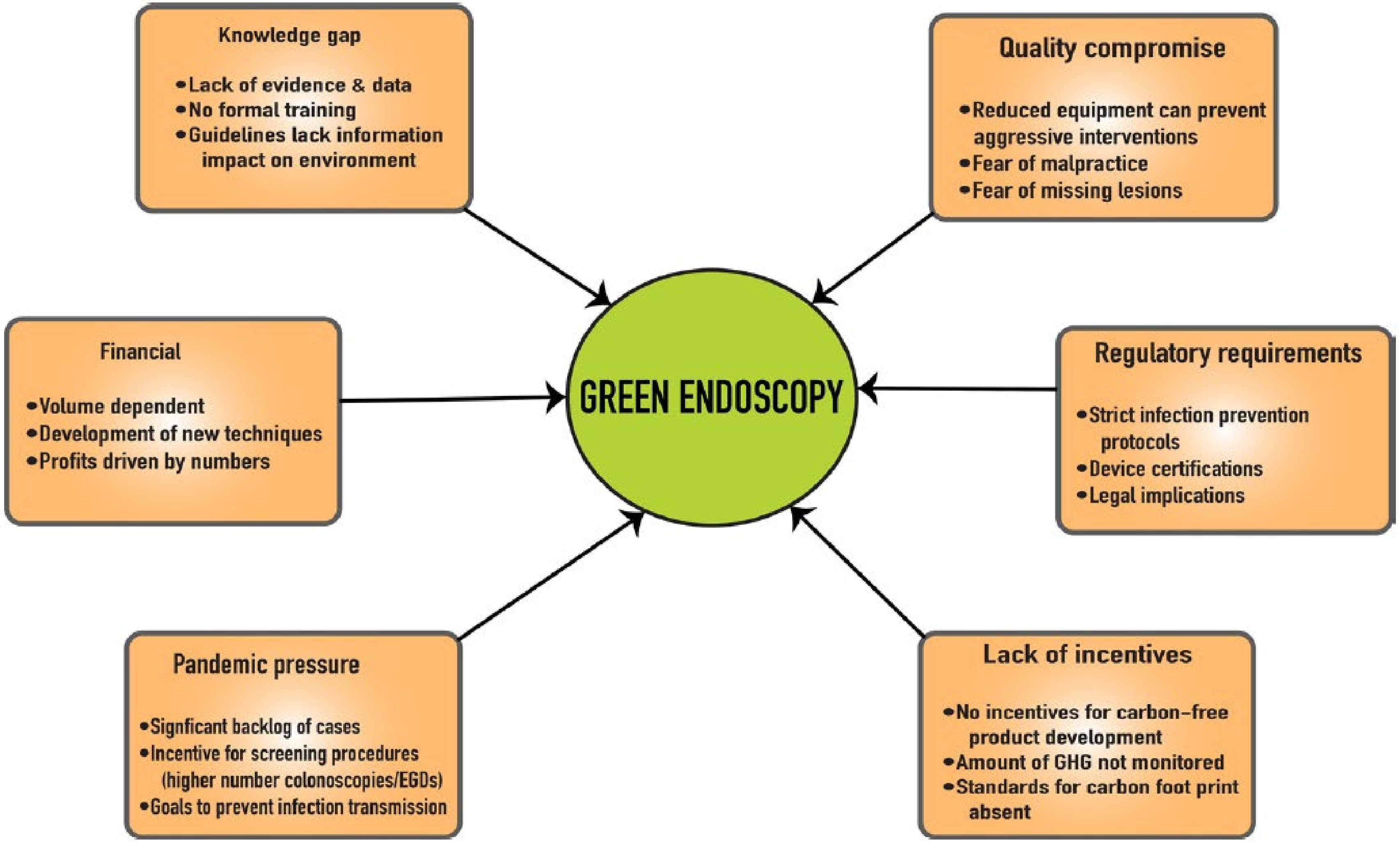
LCA = life cycle assessment.

9

Barriers to green endoscopy



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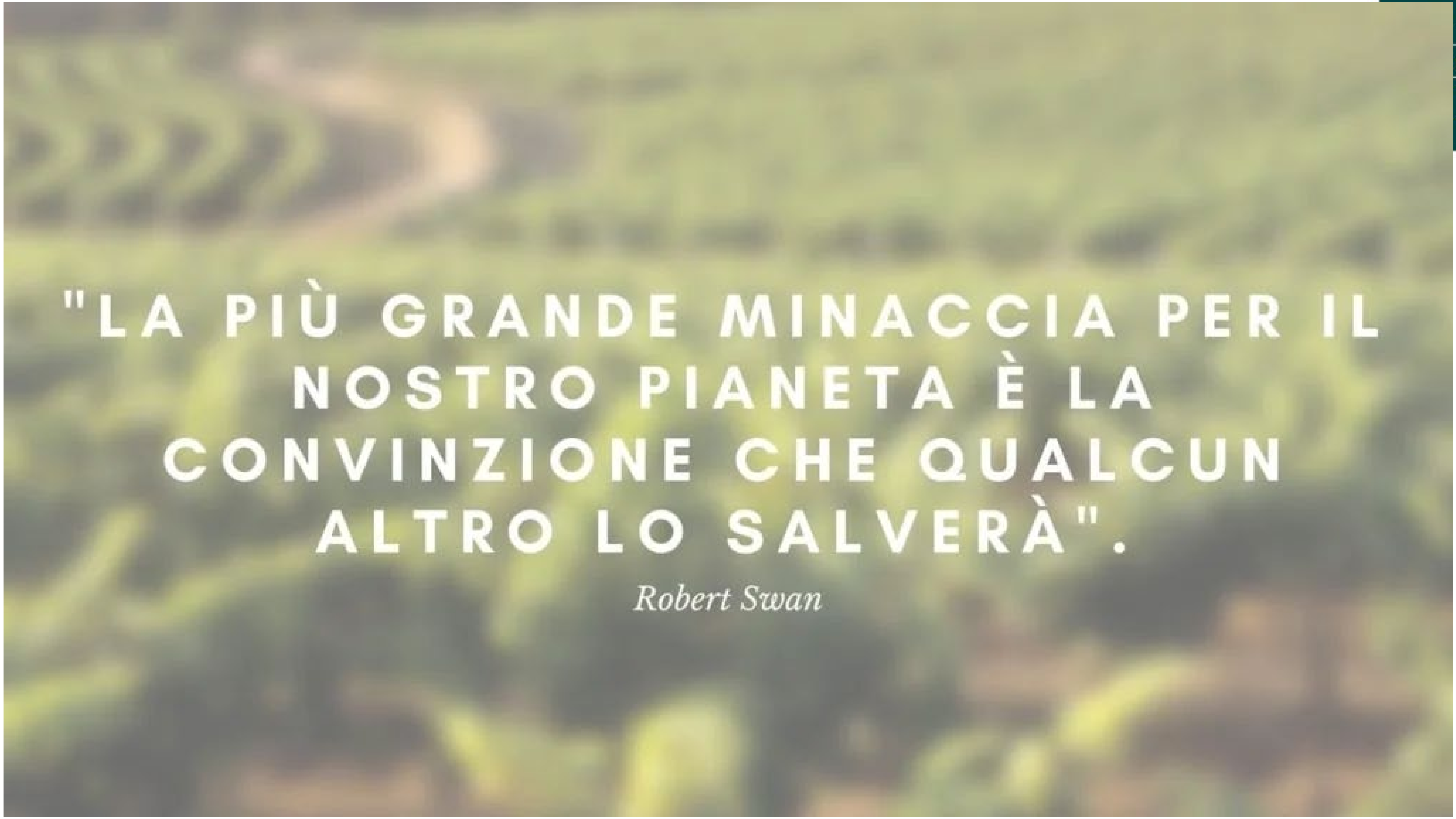
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