





- A STARTER TOOLKIT

For the College of Anaesthesiologists (CoA) and Malaysian Society of Anaesthesiologists (MSA) Climate-Conscious, Evidence-Based, Health-Centred Anaesthetic Practice

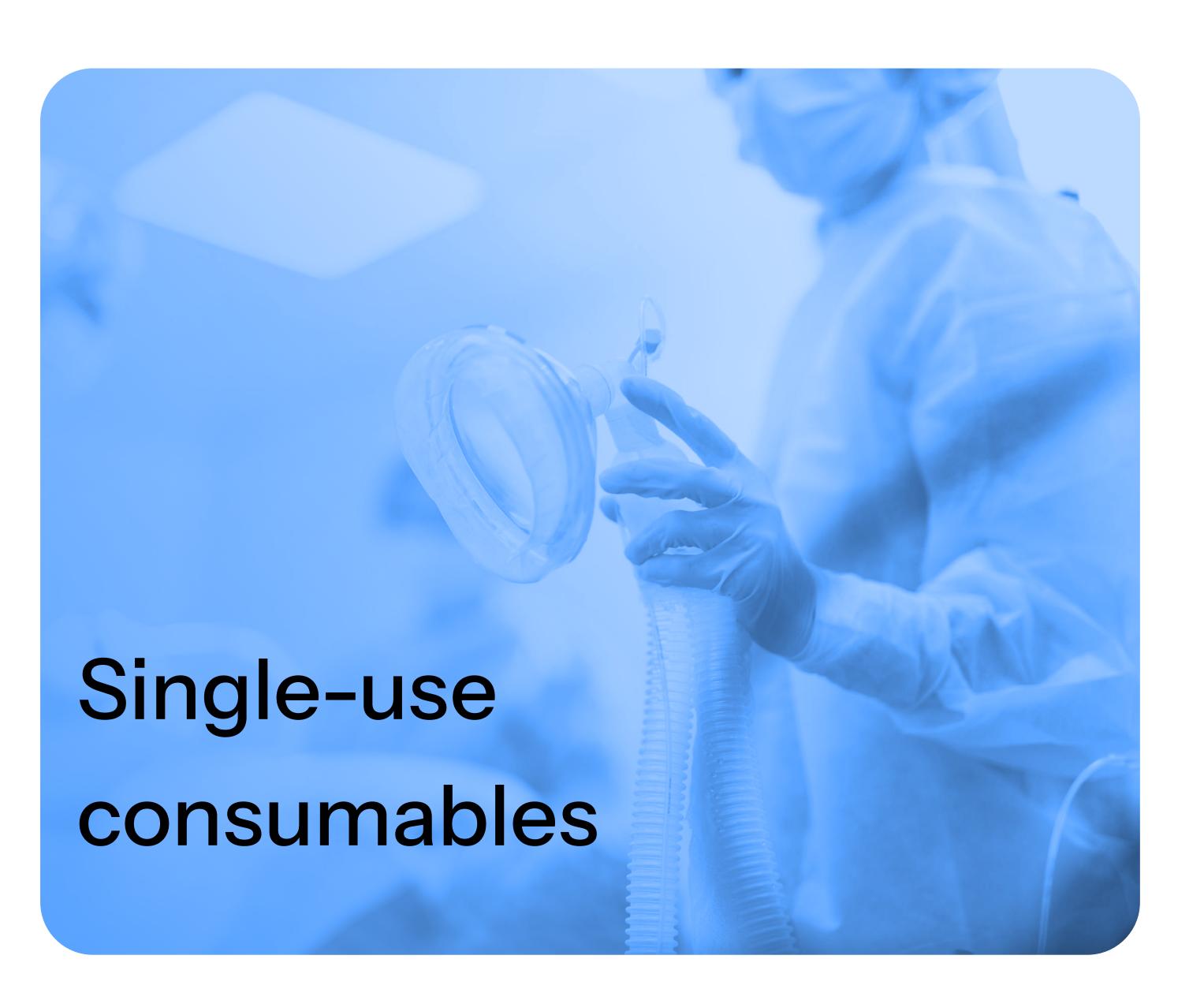
INTRODUCTION

Climate change is the greatest global health threat of the 21st century, and healthcare significantly contributes to environmental degradation.

Anaesthesia has a disproportionately high environmental impact due to:



Volatile anaesthetic agents with high global warming potentials (GWPs)



Toolkit purpose:

Provide practical, evidencebased guidance for sustainable anaesthesia in Malaysia Balance environmental responsibility with patient safety and clinical efficacy

ROLE OF ANAESTHESIOLOGIST

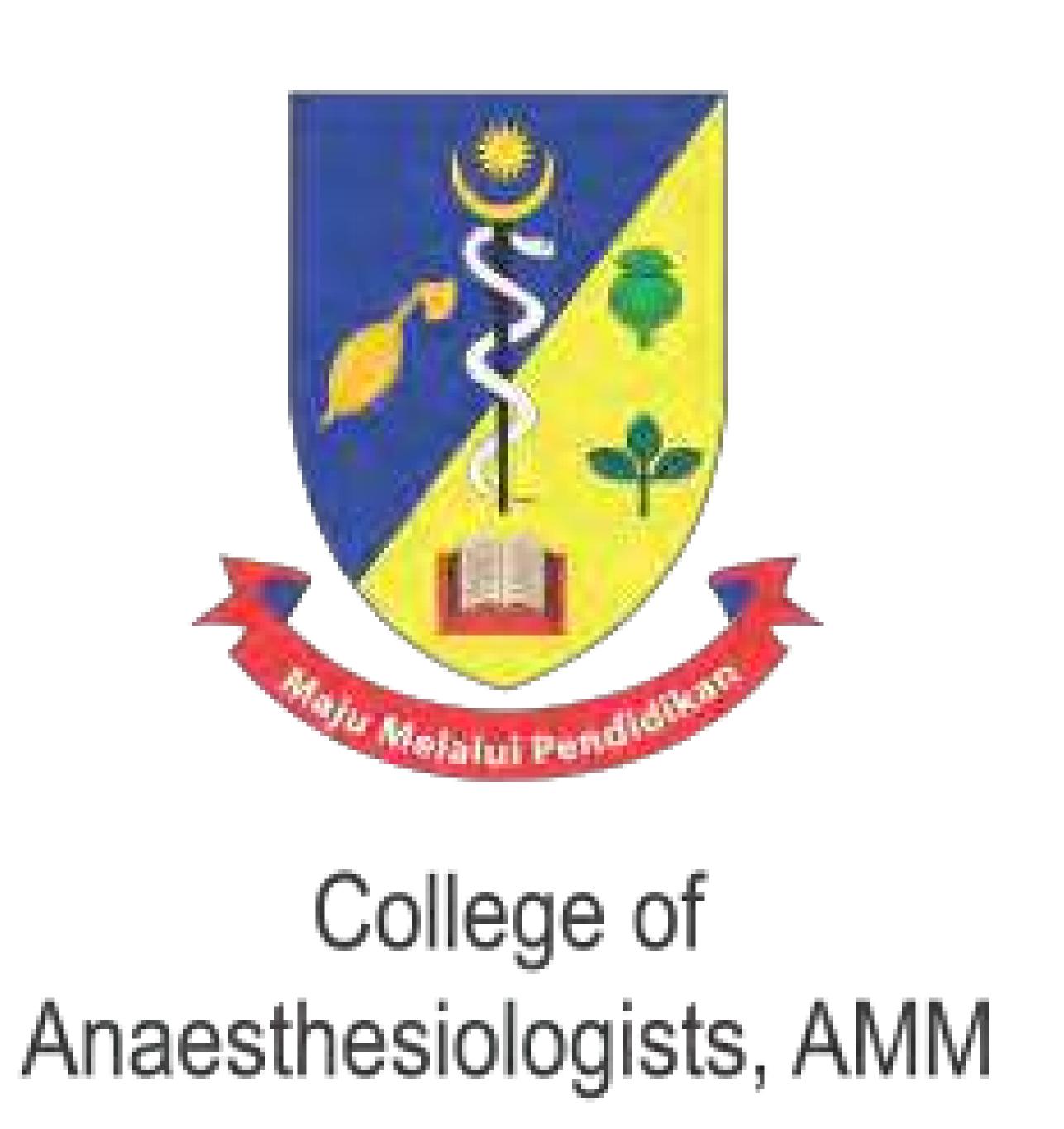
Anaesthesiologists are central figures in perioperative care and uniquely placed to champion sustainability.

The World Federation of Societies of Anaesthesiologists has underscored this responsibility through <u>three core directives</u>:











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KEY RECOMMENDATIONS & STRATEGIES

Scope 1: Direct Emission

Practice Low-flow anaesthesia (≤1L/min)

Lower flow reduces volatile agent consumption, costs, and emissions. 1,2 It is safe with modern CO₂ absorbers and reduces unnecessary environmental release.

Limit use of Desflurane

(specific cases only)

Potential (GWP) data:
Desflurane (2540), long atmospheric lifetime.
We recommend the use of Desflurane only for specific indications.
Examples include but not limited to the patients with morbid obesity, elderly patients, patients undergoing long surgeries and neuro-surgeries 3-6

Limit use of Nitrous Oxide(N₂O) (labour analgesia only)

N₂O: Ozone depleter ^{7,8}, small volume but high

impact

Total Intravenous Anaesthesia (TIVA) / Regional Anaesthesia

preferred

TIVA/Propofol: Life cycle assessment shows lower footprint, —even accounting for the manufacturing and disposal of syringes and IV sets. 9-11

Use Depth of Anaesthesia (DoA) monitoring

DoA monitoring reduces agent use, and may lead to reduction of Green House Gas (GHG) emissions. 11

Use leak-free closed-circuit with scavenging

Leak prevention essential for occupational safety.
A leak-free anaesthesia machine is essential for the effective practice of low-flow anaesthesia. 12-14

Scope 2: Indirect Emission From The Energy Used

Minimise energy consumption



Power off out of hours

Heat, Ventilation and Air-Conditioning (HVAC) Systems:

Ensure systems are powered down when not in use.

Anaesthetic Gas
Scavenging System
(AGSS):

Anaesthesia Machines:

Power down postprocedure, which can save approximately 50 kWh per day per machine.

Ventilators/
ICU Monitors:

Activate eco-mode during

Utilise centralised monitoring to minimise the need for redundant devices:

- Introduce 'shutdown' and 'power on' checklists.
- Install occupancy sensors and automate 'set-back' modes

Transition towards sustainable energy generation

Shifting to renewables significantly decreases life-cycle emissions of all hospital operations.

• Encourage solar

Prevention of energy loss

- Encourage window/ natural light sources to reduce electrical lighting.
- Ontimisation of





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KEY RECOMMENDATIONS & STRATEGIES

Scope 3: Indirect Emission from the Supply Chain

Application of 6R, EM concepts^{13-16,17}

Reduce

- Minimise nonessential single-use items.
- Prepare medications only when needed to reduce waste.
- Use medication ampoules fully whenever possible.
- Shorten ICU and hospital stays to lessen resource use and environmental impact.

Reuse

Where appropriate, substitute single-use items with reusable alternatives, provided they meet all relevant safety and hygiene standards.

Recycle

- Segregate waste streams in operating theatres and ICUs.
- Collaborate with hospital administration and local authorities to improve recycling infrastructure and ensure compliance.

Rethink

- Prioritise
 procurement from
 suppliers with
 strong
 environmental
 commitments.
- Redesign supply kits to eliminate nonessential.

Repair

- Implement internal protocols for timely equipment maintenance and repair.
- Ensure supplier
 agreements include
 full post-sale
 support and
 guaranteed spare
 parts.

Research

- Conduct and support local audits and life cycle assessments of anaesthesia-related products and practices.
- Publish and share findings.

Education¹⁶ & Culture Change

- Integrate sustainability into anaesthesia training and continuing education programs.
- Raise awareness among staff about the environmental impact of clinical choices and empower them to advocate for greener practices.
- Celebrate and share successes (e.g., Green Anaesthesia Day) to foster a culture of environmental responsibility.

Monitor and Audit

- Regularly track supply use, waste generation, and recycling rates in the OT and ICU.
- Benchmark against national and international standards and set measurable sustainability targets.
- Use audit data to drive continuous improvement and inform procurement and clinical practice changes.

Encourage sustainable waste management¹⁸⁻²¹



Optimise use of waste containers²²



Reduce leftover and unutilised disposable



Ensure safe pharmaceutical waste



Promote paperless practices

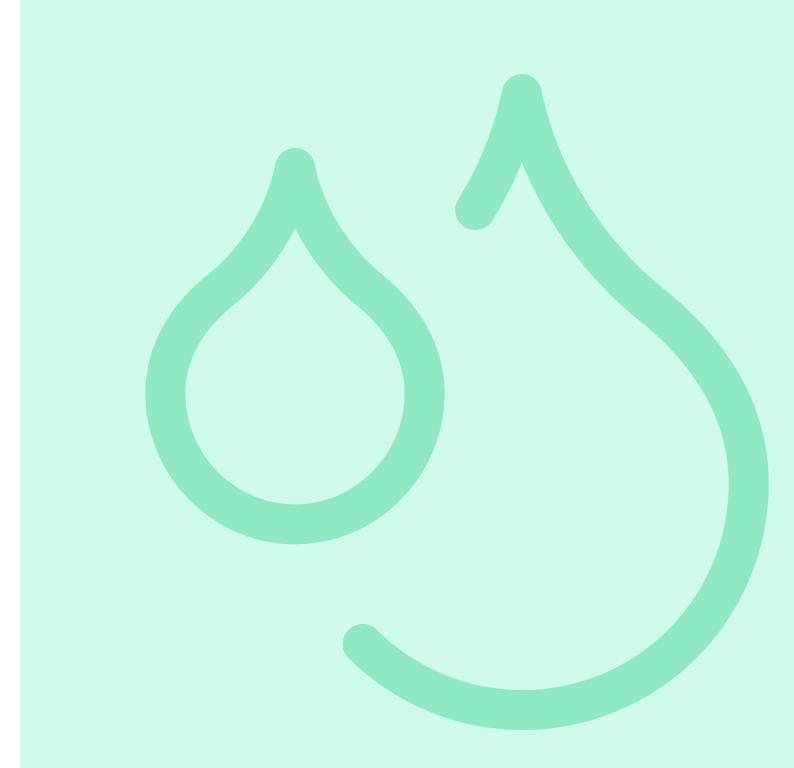




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KEY RECOMMENDATIONS & STRATEGIES

Wellbeing & Self-care of Anaesthesia Care Provider



Create awareness of physical health risks due to heat

Anaesthesia providers are vulnerable to extreme weather, heat, air pollution, and resource strain.^{27,28} Strengthening workforce resilience is essential to sustainable healthcare. This can be done by:

Integrate climate-related health risks into staff wellness programmes.

Monitor and identify high-heat areas in the hospital.

Examples include but not limited to wards, on-call rooms, and older facilities with limited climate control.

Promote hydration and rest

- Encourage regular hydration. Aim for 150-250 mL fluid intake every 20-30 minutes in hot or humid environments.
- Implement peer support systems ('buddy checks') to identify early signs of heat strain, particularly among junior and auxiliary staff.
- Use designated cooling zones (e.g. air-conditioned rooms, shaded areas) equitably across all staff groups.



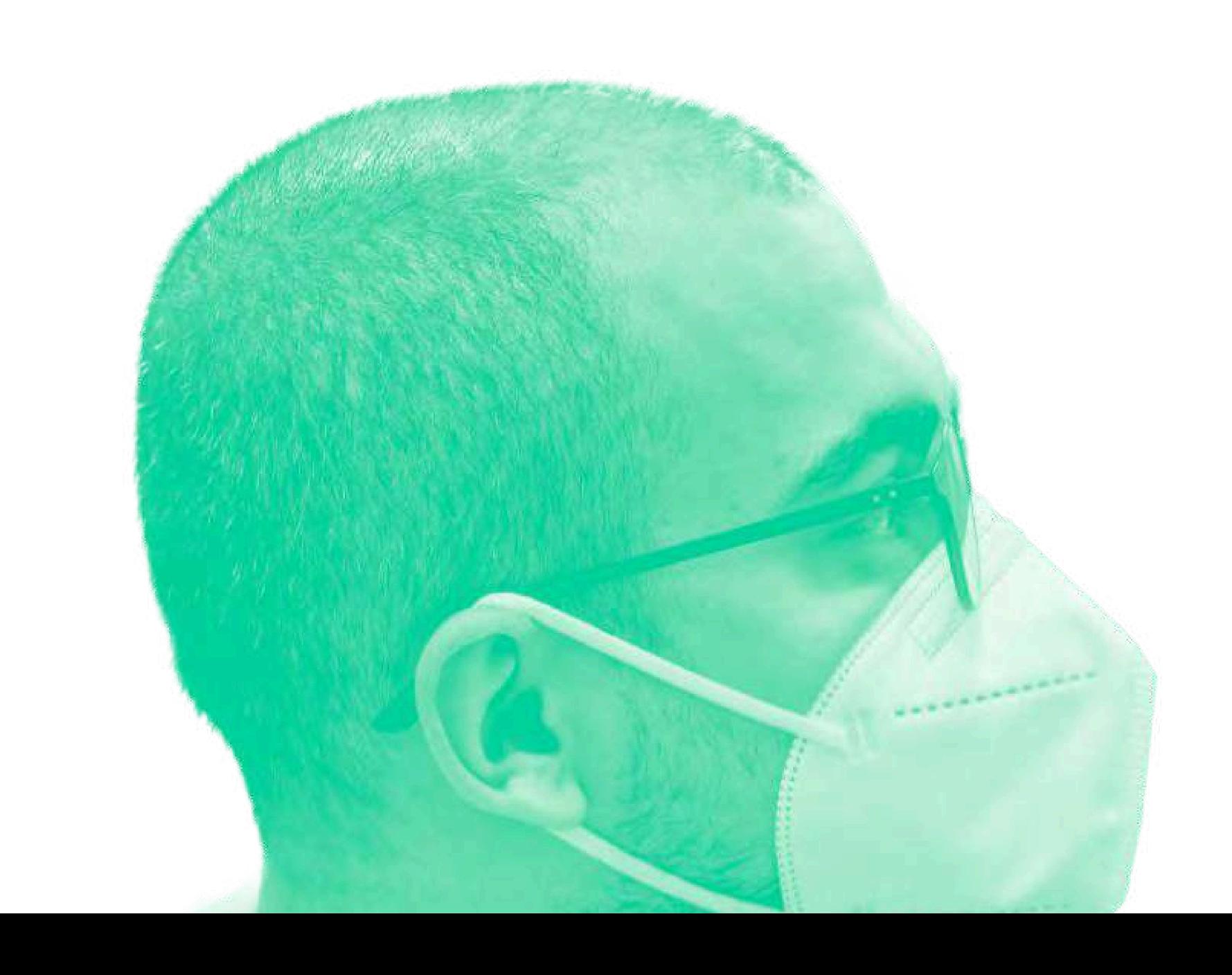
Empower mental health and heat resilience^{27,28}

- Address climate-related stressors such as heat fatigue, haze, and disaster response within staff wellbeing programmes.
- Provide basic psychological first aid training for frontline staff and team leaders following climaterelated events (e.g. floods, heat emergencies).
- Enable peer support and debriefing to help staff cope with climate-induced stress, including resource strain and community displacement.



Address occupational & systemic challenges²⁸

- Advocate for system-level upgrades to create safer, greener, and more resilient workplaces.
- Encourage cardiovascular fitness and regular aerobic exercise to enhance physiological heat tolerance.









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