Thermogard XP®

Intravascular Temperature Management System

ZOLL®

Value Procurement Insights

for high-quality targeted temperature management

High-Quality TTM:
Speed, precision, and efficiency — when it matters most

Sudden out-of-hospital cardiac arrest (OHCA) is the third leading cause of death in Europe.[1] Every year approximately 275,000 cases of cardiac arrest occur outside of a hospital setting in Europe,[1] of which about 8% survive. Approximately 200,000 cardiac arrests occur each year in hospitals, and 22% of those patients survive.[2] Of those patients who do survive, many are discharged with severe cognitive impairment, leading to a lifetime of debilitation, multiple readmissions, and expensive aftercare.

Recovery after cardiac arrest

Timely restoration of blood flow after the onset of cardiac arrest (CA) is critical to survival, and studies show that mild therapeutic hypothermia, also referred to as induced hypothermia (IH) or targeted temperature management (TTM), reduces inflammation and other harmful processes that occur immediately following reperfusion.[3]

In addition, reduced time from the onset of arrest or initiation of therapeutic reduction of core body temperature to achieving moderate hypothermia is associated with significantly better outcomes.[4,5] In patients resuscitated from CA, decreasing the time to target temperature appears to be associated with better survival rates.

High-quality targeted temperature management (HQ TTM), which includes fever control, therapeutic hypothermia (TH), and warming, has been shown to improve outcomes, reduce complications, and deliver a beneficial economic impact on society and hospitals.[6-11]
Major medical societies recommend targeted temperature management as the standard of care for patients after cardiac arrest.[12-14]

- American Heart Association (AHA)
- European Resuscitation Council (ERC)
- European Society of Intensive Care Medicine (ESICM)
- International Liaison Committee on Resuscitation (ILCOR)

Why Intravascular Temperature Management?

Intravascular temperature management has shown significantly better neurological outcomes compared to surface cooling methods in patients after cardiac arrest.[6]

Clinical Parameters	Intravascular	Surface
Reaching Target Temperature	100% reached target temperature[15]	29% of patients did not reach target temperature.[16]
Target Temperature Maintained (± 0.2°C)	Superior: 97% of time in range[8]	Poor: 49% of time in range[8]
Time to Target Temperature	Rapid: 45 minutes	Slow: 240 minutes[17]
Target Temperature Overshoot (<32°C)	0%[15]	34%[17]
Time from Event to Start of Cooling	65 minutes[18]	60 minutes[18]
Shivering	4% rate of shivering.[9] May require less sedation and lower doses of paralytics.[19]	85% rate of shivering.[20] May require higher doses of paralytics.[19]
Nursing Time	Minimal: Set temperature and device adjusts automatically. Enables more focus on other aspects of patient care.[21]	Extensive: requires management of temperature overshoot/undershoot,[22] pads, and shivering
Patient Eligibility Patients with spinal injuries Patients with skin issues Patients on multiple vasopressors Conscious patients	 Yes Yes Yes Yes	 No[23] No[23] No[23] No[23]
Patient Access	Unhindered	Limited: at least 40%[23] of the patient is covered with pads and tubing
Adverse Events	Risk of DVT is no greater than a standard CVC[18]	Potential for skin injuries[24-26]
Central Venous Catheter (CVC) Requirement	Integrated: CVC integral to ZOLL catheter design	Additional: Separate CVC required[21]

IVTM IMPROVES PATIENT OUTCOMES

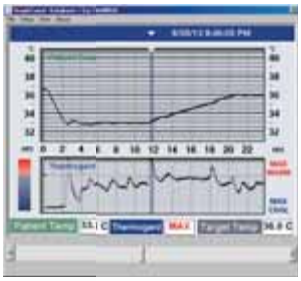
The Thermogard XP® System

Easy-to-read monitor:

- Large display of patient temperature
- Color presentation of cooling or warming activity

Total control: Mode, target temperature, and rate setting

Full patient data: Track patient and system data and electronically transfer to the patient's file



Two temperature inputs: For measuring patient temperature

Heating and cooling catheter

Standard central venous catheter (CVC) infusion lumens

IVTM catheters feature:

- Triple-lumen central venous catheter (CVC) functions, including medication delivery, blood draw, and central venous pressure monitoring
- Catheter kits, which include accessories needed for placement
- Hydrophilic coating with heparin
- Radiopaque body, tip, and marker band to ensure proper placement in the vessel

All IVTM catheters are MRI-compatible

Insertion sites:

- Internal jugular (IJ)
- Subclavian (S)
- Femoral (F)

UPPER-BODY CATHETERS		
Catheter Name	**Solex 7™**	**Cool Line®**
Dwell Time	7 Days	7 Days
Cooling Power (Watts) with TGXP	144	74
Warming Power (Watts) with TGXP	38	21
Insertion Site	Subclavian Internal Jugular	Subclavian Internal Jugular
Outer Diameter (OD) at Insertion Site	9.3 F	9.3 F
Length	20 cm	22 cm

LOWER-BODY CATHETERS			
Catheter Name	**Quattro®**	**Icy®**	**Cool Line®**
Dwell Time	4 Days	4 Days	7 Days
Cooling Power (Watts) with TGXP	173	139	74
Warming Power (Watts) with TGXP	48	38	21
Insertion Site	Femoral	Femoral	Femoral
Outer Diameter (OD) at Insertion Site	9.3 F	9.3 F	9.3 F
Length	45 cm	38 cm	22 cm

With ZOLL's intravascular temperature management technology, customers are purchasing more than just a device:

ZOLL's team of **clinical application specialists** trains customers on the device and its usage as well as on the latest clinical data.

ZOLL's **Technical Service** team helps protect your investment by providing best-in-class service programs that support long lifecycles for your high-quality temperature management system, and the most up-to-date software.

ZOLL's **Data Analytics** helps improve patient outcomes through data-driven results. You need to see your results in order to measure performance. Download raw data from Thermogard XP with no risk to patient identifiers. Our clinical consultants will review and interpret each case with you to support you in optimizing patient flow.

By investing in **continuous product improvements**, ZOLL enables its customers to follow new trends with existing devices. We continuously work on updating our heat exchange catheter portfolio for even better performance in existing and new indications. ZOLL's patented intravascular temperature management technology is not used only for TTM in patients with brain damage after acute ischemic encephalopathy, but also in clinical trials for ischemic stroke[27] and acute myocardial infarction.[28]

Adding value to your patient care

Thermogard XP® reaches and maintains target temperature within ± 0.2°C 100% of the time.[6,8–11,15,29]

WHO BENEFITS FROM IVTM?

The patient: Improves chance of full recovery of heart and brain

Patients treated with IVTM have a better chance of neurological survival,[6] less need for sedation and relaxation,[30] and can be mobilized earlier due to CVC as TTM treatment.

IVTM can be used on patients with fragile skin or skin damage, diabetics, and patients with steroid history.[31]

Interventional cardiologist: Better tools = better outcomes

With early access to the cardiac arrest patient, the interventionist provides PCI and induces TTM. They actively affect patient survival by starting TTM early, while maintaining full patient access for intervention and CPR in the case of re-arrest.[4]

Intensivist: Provides precise therapy control

IVTM enables the intensivist to precisely manage induction and maintenance of TTM and controlled, slow rewarming followed by fever prevention.

All ZOLL heat exchange catheters double as a 3-lumen CVC and provide additional control for vasopressor drug usage.

Intensive care nurse: Manage patients, not machines

Using IVTM for targeted temperature management:

- enables nurses to auto-control patient temperature precisely
- provides nurses unhindered patient access for treatment and care
- supports nurses' ability to mobilize patients early
- offers nurses an up to 74% reduced TTM-related nursing time and liberates them to other important work[7]

Biomedical technicians: Standardized care, top-notch tech support

IVTM allows biomeds to standardize TTM for different indications throughout various departments in the hospital.

ZOLL's ExpertCare Technical Service provides first-hand technical support as well as preventive maintenance and repair as needed.

Infection control: Sterile systems for no-worry infection prevention

Using glycol as heat exchange fluid inside the cooling bath infection control eliminates concerns about water-based heater-cooler devices, which are well-known for contamination.

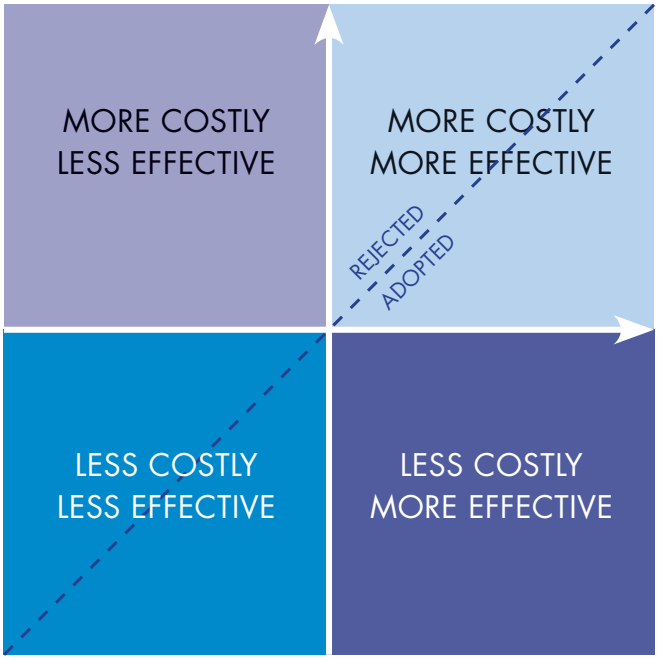
The extended 9-foot Start-Up Kit provides healthcare professionals physical distancing when treating infectious patients.

IVTM is cost-effective[32]

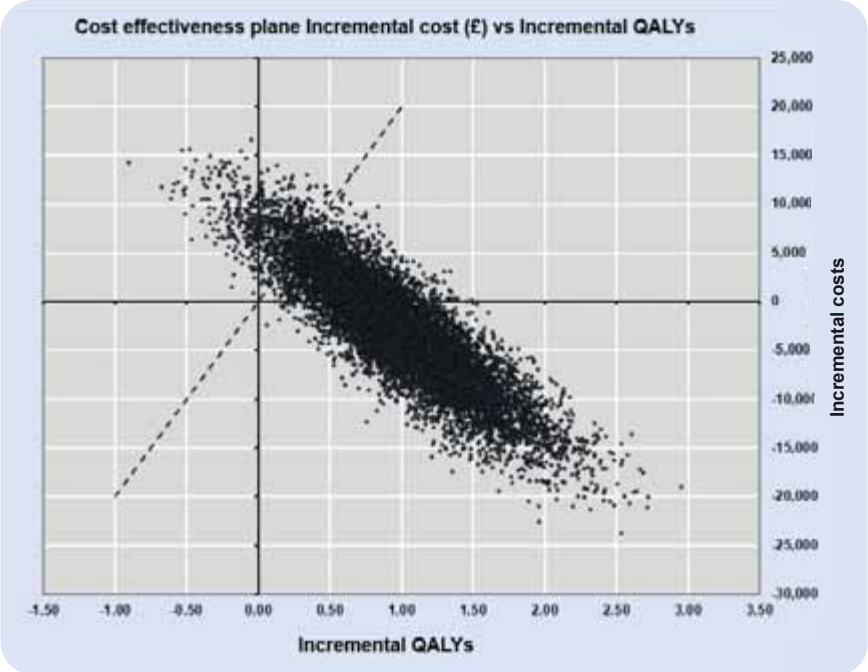
In this study, we found that the IVTM method is likely to be the most cost-effective strategy among current temperature management procedures for post-resuscitation care.[32]

In a simulated cohort of 1,000 patients who require TTM post cardiac arrest, the Thermogard XP resulted in direct cost savings of £2,339 and £2,925 (per patient) when compared with Blanketrol III and Arctic Sun 5000 respectively, and a gain of 0.98 QALYs over the patient lifetime.[32]

Enabling better clinical outcomes and reducing costs



The cost-effectiveness plane



Comparison of Thermogard XP versus Arctic Sun 5000: Intravascular temperature management with Thermogard XP is less costly and more effective compared to surface cooling with Arctic Sun 5000.[32]

Care for People, Care for Earth

ZOLL understands that sustainability is a critical corporate responsibility in the fight against climate change. Accordingly, it is taking an active role in efforts to reduce its corporate carbon footprint (CCF). The CCF value reflects the sum of all climate-relevant emissions associated with a corporation.

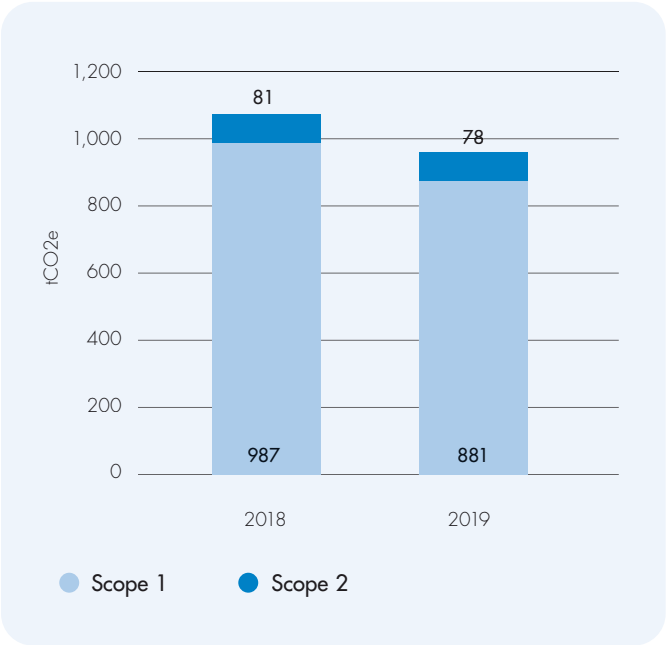
As shown in the figures below, ZOLL succeeded in reducing its CCF in Scope 1 and Scope 2 by 10.2% between 2018 and 2019. This data reflects emissions from five European ZOLL facilities: Austria, Germany, France, Netherland, and UK.

Scope 1

- Heat
- Fuel
- Cooling agents

Scope 2

- Electricity



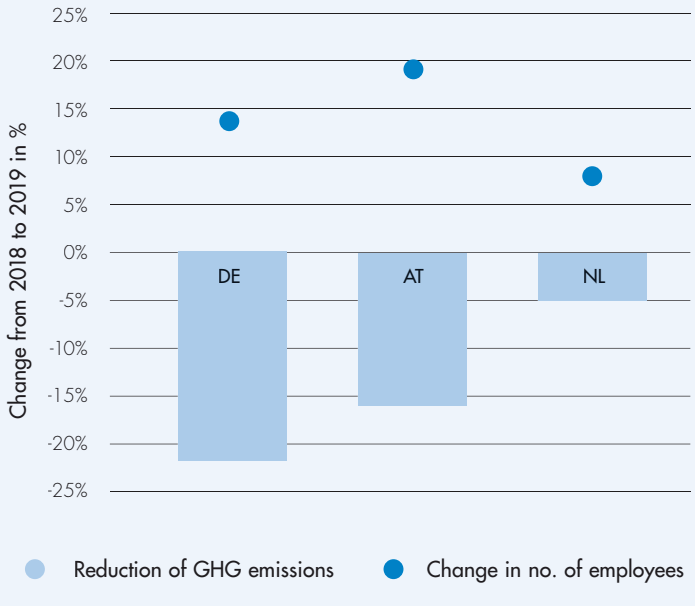
Note: Manufacturing is done in the US and is not included in this analysis.

2018 CCF = Driving a car around the world 81 times
2019 CCF = Driving a car around the world 75 times

The compensation for this CCF are 79,200 trees or 90 ha forest for one year.

Despite an increase in the number of employees, three European ZOLL sites (Germany, Austria, and Netherlands) succeeded in reducing greenhouse gas (GHG) emissions between 2018 and 2019.

- Germany (DE)
- Austria (AT)
- Netherland (NL)



To achieve precise and accurate TTM, two issues are crucial: the use of sedatives/analgesics and the choice of device.[34]

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