# Cost-effectiveness Analysis of non-invasive Targeted Temperature Management therapy vs. conventional cooling methods for patients with return of spontaneous circulation from out-of-hospital cardiac arrest in China

**ISPOR 2023**
**EE456**
Feel free to contact us for any questions via email at whf6296@163.com


**Xuan J[1], Tang Z[2], Weng H[1], Xiao D[1], Chen Z[1]**

1Health Economic Research Institute, School of Pharmaceutical Sciences, Sun Yat-Sen University, Guangzhou, China
2Beijing Chaoyang Hospital, Capital Medical Unversity, Beijing, China
3Department of Clinical Research Management Office, The Third Affiliated Hospital of Guangzhou Medical University, Guangzhou, China


## Background

- In Asia, the incidence of adult out-of-hospital cardiac arrest (OHCA) is estimated at 52.5 cases per 100,000 person-years, of which only 2.2% survive to discharge [1].
- Targeted temperature management (TTM) has been shown to improve neurological prognosis in cardiac arrest(CA) in a number of clinical studies, and both domestic and foreign guidelines recommend TTM for CA patients with return of spontaneous circulation from out-of-hospital cardiac arrest (ROSC-OHCA). [2].
- Compared with conventional care, patients treated with hypothermia after surgery gained an average of 0.66 quality-adjusted life years, with an incremental cost-effectiveness ratio of approximately $47,168 per quality-adjusted life year (QALY) [3].
- Evidence of economic value mainly comes from European and American countries, and there is no relevant study on the economic model of TTM used in ROSC-OHCA patients in Chinese population.

## Objective

Targeted temperature management (TTM) has been shown to improve neurologic outcomes and survival for patients with return of spontaneous circulation from out-of-hospital cardiac arrest (ROSC-OHCA). This study aims to evaluate the cost-effectiveness of a non-invasive TTM with a feedback system (Product: Arctic Sun™) for ROSC-OHCA patients in China.

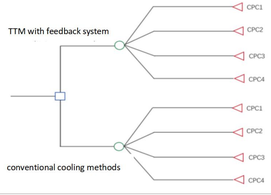
## Methods

A cost-effective analysis model was developed to compare TTM with feedback system against conventional cooling methods from society perspective, over short-term (1 year) and long-term (CPC1-2: 12.5 years, CPC3-4: 8 years) scenarios. Efficacy data were obtained from available literature and local A&E expert survey. Health utility data were abstracted from previous publications. Cost data were collected from the medical service price of each province and the expert survey. One-way and probabilistic sensitivity analysis (PSA) were conducted to assess the robustness of the model.

## Results

**Decision Model**

(1) Model status: It was mainly based on the neurological outcome (Cerebral Performance Category (CPC)):good neurological outcome at level CPC1~CPC2 and poor at level CPC3~CPC4. While CPC5 was considered as the death state and was not included in this study.
(2) Patients: patients with return of spontaneous circulation from out-of-hospital cardiac arrest (ROSC-OHCA).
(3) Intervention measures and control: the Intervention group was target temperature management with feedback system (Product: Arctic Sun™), while the control group was conventional cooling methods (ice blanket, ice cap, etc.).
(4) Research perspective: the whole societal perspective;
(5) Analysis software: Microsoft Excel 2021;
(6)Scenarios:
① short-term scenario: 1 year;
② Long-term scenario: CPC1-2 (12.5 years), CPC3-4 (8 years);
(7) Outcomes:
total and incremental cost of treatment,
total and incremental qualityadjusted life years( QALYs） ,
incremental cost effectiveness (ICER).




## Results

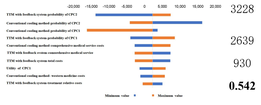
**Base–Case Analysis**

**short-term scenario**

- For the short-term scenario, the TTM with feedback system added 0.089 quality-adjusted life year (QALY) compared against conventional methods, yielded an incremental cost-effectiveness ratio (ICER) of $32,339/QALYs, which was less than three times gross domestic product (GDP) per capita of China in 2021 ($35,832/QALY), indicating that it is cost-effective.

Table1 Short-term Scenario Base–Case Analysis

| item | conventional cooling methods | TTM with feedback system | difference value |
|---|---|---|---|
| **Total costs($)** | 19242 | 22128 | 2886 |
| **Direct medical costs(($))** | 15239 | 18559 | 3319 |
| Intervention & control method costs (service cost+consumable cost) * | 112 | 3688 | 3576 |
| Treatment relative costs | 11378 | 11584 | 206 |
| Adverse event costs | 96 | 59 | −37 |
| **Post-discharge rehabilitation costs(($))** | 3653 | 3228 | −425 |
| **Direct non-medical costs(($))** | 2675 | 2639 | −396 |
| **Indirect costs(($))** | 967 | 930 | −37 |
| Total QALYs | 0.453 | 0.542 | 0.089 |
| ICER(TTM with feedback system vs. Conventional cooling methods),($/QALY) | | 32339 | |



- *

**long-term scenario**

- Under the long-term scenario, TTM is a dominant strategy by cost-saving of $2,032 and gaining effectiveness with 0.979 QALY, compared with conventional methods.

Table2 Long-term Scenario Base–Case Analysis

| item | conventional cooling methods | TTM with feedback system | difference value |
|---|---|---|---|
| **Total costs($)** | 71030 | 68997 | −2032 |
| **Direct medical costs(($))** | 41788 | 42214 | 425 |
| Intervention & control method costs | 112 | 3688 | 3576 |
| Treatment relative costs | 11584 | 11584 | 0 |
| Adverse event costs | 96 | 59 | −37 |
| **Post-discharge rehabilitation costs(($))** | 29997 | 26884 | −3114 |
| **Direct non-medical costs(($))** | 21171 | 18807 | −2363 |
| **Indirect costs(($))** | 8070 | 7976 | −94 |
| Total QALYs | 3.604 | 4.583 | 0.979 |
| ICER(TTM with feedback system vs. Conventional cooling methods),($/QALY) | | dominant | |

**Sensitivity Analysis**

**one-way sensitivity**

- The results of one-way sensitivity showed that the probability of CPC2 of TTM and the probability of CPC2 and CPC1 of the conventional methods had the largest impact on the ICER in both scenarios.

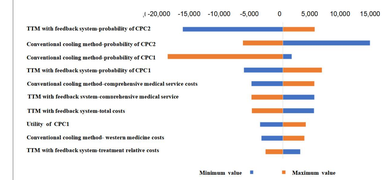



figure1 one-way sensitivity(short-term scenario)

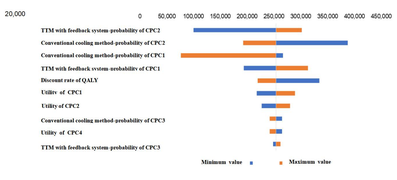



figure2 one-way sensitivity ( long-term scenario)

**probabilistic sensitivity analysis (PSA)**

- PSA estimated 60.16% of TTM to be cost-effective in the short-term scenario, while it would be 100.00% dominant in the long-term scenario, indicating the robustness of the results.

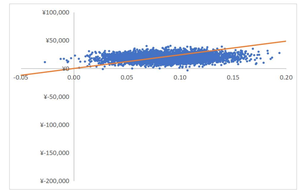



figure3 PSA(short-term scenario)

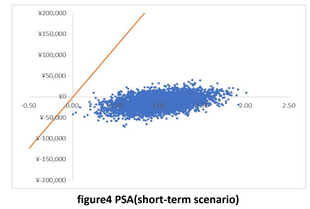



figure4 PSA(short-term scenario)

## Conclusions

The non-invasive targeted temperature management therapy with feedback system provides better neurologic outcomes for ROSC-OHCA patients and is a cost-effective and potentially cost-dominant treatment in China.

## Main reference


[1] Berdowski J, et al. (2010) Global incidences of out-of-hospital cardiac arrest and survival rates: Systematic review of 67 prospective studies. Resuscitation 81 (11): 1479-1487.
[2] Arrich J, Holzer M, Havel C, et al. Hypothermia for neuroprotection in adults after cardiopulmonary resuscitation[J]. 2016,2(2):D4128
[3] Merchant R M, Becker L B, Abella B S, et al. Cost-Effectiveness of Therapeutic Hypothermia After Cardiac Arrest[J]. 2009,2(5):421-428.