RESEARCH PROPOSAL

Agreement Among Three Methods of Intraoperative Core Temperature Monitoring:

Nasopharyngeal Probe, TaiDoc TD-1261 Infrared Tympanic Thermometer, and 3M SpotOn™ Skin Sensor

การศึกษาความสอดคล้องระหว่างวิธีการวัดอุณหภูมิแกนกลางของร่างกายระหว่างผ่าตัดสามวิธี:

*โพรบนาโซฟาริงซ์ เทอร์โมมิเตอร์อินฟราเรดแก้วหู **TaiDoc TD-1261** และเซ็นเซอร์ผิวหนัง **3M SpotOn™***

A Prospective Observational Method-Comparison Study

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Executive Summary

Target condition. Inadvertent perioperative hypothermia (IPH), defined as a core body temperature below 36.0°C, affects 20–90% of patients undergoing general anesthesia. By impairing coagulation, suppressing immune defenses, and triggering sympathoadrenal activation, even mild IPH increases the risk of surgical site infection, coagulopathy, morbid cardiac events, and delayed emergence. These consequences are established by landmark randomized trials and underpin professional society mandates for continuous intraoperative core temperature monitoring in all procedures exceeding 30 minutes.

Current knowledge. Three methods are in common intraoperative use. The nasopharyngeal (NP) probe provides continuous, reliable core temperature readings and is the accepted reference standard in intubated patients. The infrared tympanic thermometer (TaiDoc TD-1261) offers rapid, non-invasive intermittent readings; class-equivalent devices report an intraoperative ICC of 0.75 against nasopharyngeal temperature with 93.5% of differences within ±0.5°C. The 3M SpotOn™ zero-heat-flux forehead sensor provides continuous non-invasive estimation with a published bias of approximately 0.07°C against nasopharyngeal temperature, within the ±0.5°C clinical acceptability threshold.

Gap of knowledge. No study has simultaneously evaluated all three methods in a single cohort using repeated-measures Bland–Altman analysis. The TaiDoc TD-1261, the device routinely used at Srinagarind Hospital, has no published intraoperative validation against nasopharyngeal temperature. Existing evidence originates predominantly from European centers and may not generalize to Thai patients or local practice conditions.

Rationale. When clinicians substitute one monitoring method for another without knowledge of inter-method bias, systematic differences may go undetected, risking under-recognition of hypothermia or unnecessary warming escalation. This prospective observational study will quantify the simultaneous agreement among all three methods in 92 adult patients at Srinagarind Hospital, and Queen Sirikit Heart Center of the Northeast, using repeated-measures Bland–Altman analysis (acceptability criterion ±0.5°C), providing the first institution-specific evidence to guide safe method selection in Thai perioperative practice and the first published intraoperative validation of the TaiDoc TD-1261.

1. Project head and affiliation

Project head:

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2. Rationale and Background

Inadvertent perioperative hypothermia (IPH), defined as a core body temperature below 36.0°C during the perioperative period, is the most commonly encountered thermoregulatory complication in anesthetic practice, with a reported incidence ranging from 20% to 90% of patients undergoing elective surgery.[1,2]

General anesthesia profoundly impairs thermoregulatory control. Volatile and intravenous anesthetic agents inhibit hypothalamic thermoregulation in a dose-dependent fashion, reducing the vasoconstriction threshold from approximately 37°C to approximately 34.5°C and widening the interthreshold range — the temperature range within which no autonomic defense is activated — from the normal 0.2°C to as much as 4°C.[3,4]

Consequently, unwarmed anesthetized patients become hypothermic, typically by 1–2°C, following a characteristic three-phase pattern. During the first 30–60 minutes after induction, core temperature falls rapidly by 1.0–1.5°C as anesthetic-induced peripheral vasodilation transfers body heat from the warm central compartment to cooler peripheral tissues (redistribution hypothermia). This is followed by a slower linear decline in which heat loss to the environment exceeds metabolic heat production, and finally a plateau when residual thermoregulatory vasoconstriction limits further heat loss or when heat loss equilibrates with production.[3,5]

The clinical consequences of IPH are extensive and well-documented across multiple high-quality randomized trials and systematic reviews:

- Coagulopathy and increased blood loss: Hypothermia impairs coagulation factor enzyme activity and reversibly inhibits platelet activation, leading to a clinical bleeding diathesis. A systematic review and meta-analysis by Rajagopalan et al. (2008) demonstrated that even mild hypothermia (< 1°C below normothermia) increases intraoperative blood loss

by approximately 16% and raises the relative risk of requiring a blood transfusion by approximately 22%.[6]

- Surgical site infection: Perioperative hypothermia promotes wound infection through two mechanisms — thermoregulatory cutaneous vasoconstriction reduces subcutaneous oxygen tension and impairs neutrophil oxidative killing, while hypothermia also directly suppresses immune function. In a landmark randomized controlled trial by Kurz, Sessler, and Lenhardt (1996), patients undergoing colorectal resection assigned to hypothermia (mean core temperature 34.7°C) had a wound infection rate of 19% compared with 6% in the normothermic group (P = 0.009), and their hospitalization was prolonged by 2.6 days.[7]
- Adverse cardiac events: In a randomized trial of 300 high-risk patients undergoing major non-cardiac surgery, Frank et al. (1997) demonstrated that patients with intraoperative hypothermia (mean temperature 35.4°C) had a 4.5-fold higher incidence of morbid cardiac events (6.3% vs. 1.4%; P = 0.02) and a higher rate of ventricular tachycardia compared with normothermic controls. Hypothermia was an independent predictor of adverse cardiac outcomes on multivariate analysis (relative risk 2.2; 95% CI 1.1–4.7).[8]
- Impaired drug metabolism: Hypothermia reduces hepatic enzyme activity and decreases renal clearance, prolonging the duration of action of neuromuscular blocking agents, volatile anesthetics, and intravenous opioids, thereby extending emergence time and post-anesthetic care unit stay.[2,9]
- Postoperative shivering: As anesthetic effect wanes, residual hypothermia triggers shivering, which may increase oxygen consumption by 40–300% and causes significant patient discomfort, adrenergic activation, tachycardia, and hypertension.[2,9]

These findings have led professional bodies including the American Society of Anesthesiologists, the European Society of Anesthesiology and Intensive Care, and the National Institute for Health and Care Excellence (NICE) to mandate continuous intraoperative core temperature monitoring and active warming for all surgical procedures exceeding 30 minutes.[2,9]

To monitor temperature effectively and trigger timely warming interventions, anesthesiologists require a monitoring modality that is accurate, continuous, minimally invasive, and practical across a wide range of surgical contexts. Three monitoring methods are in common clinical use at Srinagarind Hospital, Queen Sirikit Heart Center of the Northeast, and comparable institutions throughout Thailand:

- **Nasopharyngeal temperature probe (NP probe):** inserted through one nostril to the posterior nasopharynx, adjacent to branches of the internal carotid artery. When positioned correctly at the level of the soft palate, it provides continuous, reliable core temperature readings closely reflecting hypothalamic temperature.[10,11]
- **TaiDoc TD-1261 infrared tympanic thermometer (TM thermometer):** the TaiDoc TD-1261 infrared tympanic thermometer (TaiDoc Technology Corp., New Taipei City, Taiwan) detects infrared radiation emitted by the tympanic membrane and surrounding ear canal tissue without direct membrane contact. Because the tympanic membrane shares its arterial blood supply with the hypothalamus via the internal carotid artery, it theoretically reflects core (brain) temperature. The device is non-invasive, rapid (result in approximately 1–3 seconds), and requires only a fresh disposable probe cover for each

measurement. It supports Bluetooth data output for direct logging. However, accuracy depends on correct probe positioning and the angle of insertion; because the ear canal is not straight, the infrared sensor may not align directly with the tympanic membrane, causing it to sample canal wall rather than membrane radiation and consequently underestimate core temperature. Measurements are therefore intermittent (taken at each scheduled time point) rather than continuous.[10]

- **3M SpotOn™ Temperature Monitoring System (3M Health Care, St. Paul, MN, USA):** a non-invasive forehead skin sensor employing zero-heat-flux (ZHF) thermometry. The device uses a servo-controlled heater integrated with a thermal flux transducer to eliminate heat flow between two separated thermocouples, thereby estimating deep tissue (core) temperature from the skin surface. Applied as a disposable adhesive patch to the lateral forehead, it enables continuous non-invasive core temperature estimation without requiring positioning that is dependent on surgical access.[12]

Iden et al. (2015) reported that SpotOn temperatures were nearly identical to simultaneous nasopharyngeal temperatures in 83 surgical patients, with a Bland–Altman bias of 0.07°C (SD 0.21°C; limits of agreement −0.34 to 0.48°C),[12] meeting the widely accepted clinical interchangeability threshold of ±0.5°C proposed by Sessler (2008).[4]

Despite the increasing adoption of the 3M SpotOn™ sensor in Thailand and the continued parallel use of nasopharyngeal and tympanic probes, the three-way agreement among these specific methods has not been formally evaluated in a Thai surgical population. Published comparisons predominantly originate from European and East Asian centers with potentially different patient demographics, ambient operating theater conditions, and warming practice environments.[12,13,14] Moreover, the majority of existing studies compare only two methods simultaneously, and few address the three-way comparison of NP, TM, and SpotOn under standardized conditions. If clinicians alternate or substitute among these methods based on availability or patient anatomy, an uncharacterized systematic bias could lead to under-recognition of hypothermia or unnecessary warming escalation. This study therefore aims to fill this evidence gap by rigorously quantifying the measurement agreement among all three methods using appropriate repeated-measures Bland–Altman analysis.

3. Literature Review

3.1 Core Temperature Measurement: Principles and Sites

Core body temperature refers to the temperature of the central, vessel-rich organ group — brain, heart, lungs, and abdominal viscera — and is maintained within a narrow interthreshold range of approximately 36.8–37.2°C in awake, thermoregulating individuals.[3] The pulmonary artery catheter thermistor is universally accepted as the gold standard for core temperature measurement, though its invasiveness restricts its use to patients requiring hemodynamic monitoring.[4,10]

Cork, Vaughan, and Humphrey (1983) established foundational data on the comparative accuracy of seven intraoperative monitoring sites, demonstrating that nasopharyngeal, esophageal, and bladder sites provided the best combination of accuracy and precision for clinical use.[10] Sessler (2008) reinforced that clinically acceptable accuracy requires a combined site and thermometer inaccuracy not exceeding 0.5°C, as this represents the minimum temperature difference shown to be associated with hypothermia-related complications.[4]

3.2 Nasopharyngeal Temperature Monitoring

The nasopharyngeal mucosa is supplied by branches of the internal carotid artery, and a correctly positioned probe provides temperature readings closely reflecting hypothalamic (brain) temperature.[10,11] Limitations include a risk of epistaxis, the necessity of tracheal intubation, and potential artifact from high fresh gas flows past uncuffed tubes. Despite these caveats, the nasopharyngeal probe remains the most frequently employed reference standard in intraoperative temperature method comparison studies.[15]

3.3 Tympanic Membrane Temperature Monitoring

The tympanic membrane receives its blood supply from the internal carotid artery, making it theoretically an excellent proxy for hypothalamic temperature.[10] When properly sealed within the external auditory canal, wire-based thermistor probes achieve accuracy comparable to nasopharyngeal and esophageal measurements; however, such probes carry risks of tympanic membrane perforation and canal trauma that have led to their declining availability. Infrared tympanic thermometers — including the TaiDoc TD-1261 used in this study — offer a non-invasive alternative by detecting infrared radiation emitted from the tympanic membrane and surrounding canal tissue without direct contact. Their accuracy, however, is influenced by probe insertion angle, pinna retraction technique, cerumen accumulation, and canal cooling from the ambient environment. Because most IR tympanic devices reach only a few millimeters into the

aural canal, the sensor may not face the tympanic membrane directly, instead capturing canal wall radiation and thereby underestimating core temperature. Sessler (2008) noted that infrared tympanic systems, as normally directed into the aural canal, are insufficiently accurate for continuous intraoperative use compared with thermistor-based contact probes. Despite these concerns, a prospective study by Chen et al. (2022) comparing the Braun ThermoScan PRO 4000 — a device of the same class and certified to the same EN 12470-5 / ASTM E1965-98 standards as the TD-1261 — against simultaneous nasopharyngeal temperature in 56 anesthetized patients reported an ICC of 0.75 intraoperatively, with 93.5% of differences falling within ±0.5°C of the nasopharyngeal reference and an AUROC of 0.95 for detecting intraoperative hypothermia. Notably, no published intraoperative study has yet validated the TaiDoc TD-1261 specifically; the present study will therefore provide the first evidence on this device's agreement with nasopharyngeal temperature during surgery.[4,10]

3.4 Zero-Heat-Flux Technology: The 3M SpotOn™ Sensor

The zero-heat-flux principle for non-invasive core temperature estimation was developed theoretically in the 1960s–70s and refined commercially for clinical use in the 2010s. The 3M SpotOn™ sensor implements this principle as a disposable adhesive patch applied to the lateral forehead, connected to the Bair Hugger™ warming system control unit.[12]

Iden et al. (2015) reported a bias of only 0.07°C (SD 0.21) between SpotOn and nasopharyngeal temperature in 83 adult surgical patients, with both methods fulfilling the 0.5°C clinical acceptability criterion.[12] Morettini et al. (2020; the ESOSPOT study) evaluated 99 patients undergoing major surgery, finding a Bland–Altman bias of 0.005°C (limits of agreement −0.49 to +0.50°C) and a concordance correlation coefficient of 0.89 compared with esophageal temperature.[16] In the pediatric surgical population, Sang et al. (2022) found a bias of −0.07°C with 98.9% of measurements falling within 0.5°C of the esophageal reference.[14]

In comparisons specifically against tympanic temperature, Wang et al. (2025) enrolled 130 patients undergoing major surgery and compared ZHF forehead monitoring against infrared tympanic temperature using Bland–Altman analysis with a random-effects model, reporting acceptable agreement overall.[13] Despite this accumulating evidence, no published study has formally characterized the three-way agreement among NP, TM, and SpotOn simultaneously in a single study population, nor has any study been conducted in a Southeast Asian population at a tertiary center in Thailand.

4. Justification

When clinicians substitute one monitoring method for another without knowledge of inter-method bias, systematic differences may go undetected, risking under-recognition of hypothermia or unnecessary warming escalation. This prospective observational study will quantify the simultaneous agreement among all three methods in 92 adult patients at Srinagarind Hospital, and Queen Sirikit Heart Center of the Northeast, using repeated-measures Bland–Altman analysis (acceptability criterion ±0.5°C), providing the first institution-specific evidence to guide safe method selection in Thai perioperative practice and the first published intraoperative validation of the TaiDoc TD-1261.

5. Research Objectives

5.1 Primary Objective

To assess the agreement between the TaiDoc TD-1261 infrared tympanic thermometer and the nasopharyngeal probe for intraoperative core temperature monitoring, and between the 3M SpotOn™ skin sensor and the nasopharyngeal probe, using repeated-measures Bland–Altman analysis in adult patients undergoing elective surgery under general anesthesia at Srinagarind Hospital and Queen Sirikit Heart Center of the Northeast, Khon Kaen University.

5.2 Secondary Objectives

1. To determine the systematic bias (mean difference) of the TaiDoc TD-1261 infrared tympanic thermometer relative to the nasopharyngeal probe across the observed temperature range.
2. To determine the systematic bias (mean difference) of the 3M SpotOn™ sensor relative to the nasopharyngeal probe across the observed temperature range.
3. To evaluate whether proportional bias exists for each comparison.
4. To assess sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the TaiDoc TD-1261 infrared tympanic thermometer and 3M SpotOn™ sensor for detecting intraoperative hypothermia (NP temperature < 36.0°C).
5. To compare the intraclass correlation coefficient (ICC) between each test method and the nasopharyngeal probe.
6. To identify clinical covariates that may influence the magnitude of disagreement between methods, including BMI, age, sex, ASA physical status, surgical duration, anesthetic technique, use of active warming, and ambient OR temperature.

6. Outcome Measures

6.1 Primary Outcome

The limits of agreement (LoA) between each test method (TM thermometer and SpotOn™) and the NP probe from repeated-measures Bland–Altman analysis. Pre-specified clinical acceptability criterion: methods will be considered clinically interchangeable if the LoA are

contained within ±0.5°C,[13] with both 95% CI limits of the upper and lower LoA falling within this range.

6.2 Secondary Outcomes

- Bias (mean difference in °C) between each test method and the NP probe with 95% CI.
- Presence or absence of proportional bias, assessed by regression of the difference on the mean.
- Sensitivity and specificity (with 95% CIs) and ROC curve analysis for hypothermia detection.
- Intraclass correlation coefficient (ICC) for each method pair.
- Percentage of paired measurements within ±0.5°C of the reference value.
- Subgroup analysis of LoA stratified by temperature range (normothermia vs. hypothermia < 36.0°C).
- Association between clinical covariates and absolute method difference (mixed-effects regression).
- Incidence of device-related complications: epistaxis (NP), aural discomfort or canal injury (TM thermometer), adhesive skin reaction (SpotOn™).

7. Study Design and Methods

7.1 Study Design

Prospective, single-center, triple-method observational agreement study. All three thermometry modalities will be applied simultaneously in each participant. The nasopharyngeal probe serves as the reference standard. No intervention is assigned; temperature monitoring is purely observational and additional to standard perioperative care.

7.2 Setting

Main operating theaters, Srinagarind Hospital, and Queen Sirikit Heart Center of the Northeast, Khon Kaen University, Khon Kaen, Thailand.

7.3 Eligibility Criteria

Inclusion Criteria

- Adult patients aged 18 years and above.
- We will include 3 independent groups of patients receiving general anesthesia with tracheal intubation:
  - Group 1: Cardiac surgery
  - Group 2: Thoracic surgery
  - Group 3: General surgery, including neurosurgery
- Expected surgical duration ≥ 60 minutes.
- ASA Physical Status Classification I–III.
- Able to provide written informed consent.

Exclusion Criteria

- Prior nasal surgery, nasal polyps, deviated nasal septum, or significant epistaxis history precluding safe NP probe insertion.
- Otitis media, tympanic membrane perforation, significant cerumen impaction, or external auditory canal deformity that would prevent reliable infrared tympanic temperature measurement.
- Facial or forehead skin lesions, burns, or known adhesive hypersensitivity at the planned SpotOn™ application site, craniotomy, and head and neck surgery
- Baseline core temperature < 35.0°C or > 38.5°C at preoperative assessment.
- Planned use of neuraxial anesthesia as the primary or adjunct technique.
- Emergency procedures, pregnancy, or procedures involving deliberate hypothermia or cardiopulmonary bypass.

Withdrawal of participant criteria: N/A
Early termination of study criteria: N/A

7.4 Monitoring Protocol

Following induction of general anesthesia and tracheal intubation, all three temperature monitoring devices will be placed by trained study personnel. The NP probe will be inserted to the posterior nasopharynx at 10–12 cm from the anterior nares. At each scheduled time point, TM temperature will be measured with the TaiDoc TD-1261 infrared tympanic thermometer (TaiDoc Technology Corp., New Taipei City, Taiwan) using a standardized technique: the nurse or research assistant gently retracts the pinna posterosuperiorly to straighten the external auditory canal, inserts the probe with a fresh disposable probe cover until a canal seal is achieved, then activates the device until the confirmation beep sounds. Two consecutive readings will be taken from the same ear (right ear preferred; left ear if the right is inaccessible), and the mean of the two values will be recorded to the nearest 0.1°C. All personnel performing TM measurements will complete a standardized training session before the study begins to ensure technique consistency. The 3M SpotOn™ sensor will be applied to the lateral forehead per manufacturer instructions, with a minimum 10-minute equilibration period before the first recording. Simultaneous readings from all three sensors will be documented at 15-minute intervals from 15 minutes after induction until the end of surgery, with NP and SpotOn™ values recorded at the same moment as TM measurement. Standard forced-air warming will be maintained per institutional protocol.

8. Sample Size Calculation

Sample size was calculated using the method proposed by Lu et al. (2016) for Bland–Altman agreement studies,[17] as implemented in MedCalc statistical software (version 22.0). This

approach formally incorporates Type I and Type II error control. Parameters were derived from Iden et al. (2015)[12] for NP vs. SpotOn™ and from Wan et al. (2022)[18] for the NP vs. TM comparison (Braun ThermoScan PRO 4000, same device class as the TD-1261).

8.1 Parameters for Calculation

Parameter	NP vs. TM	NP vs. SpotOn™
Expected bias (mean difference)	0.20 °C	0.10 °C
Expected SD of differences	0.30 °C	0.22 °C
Pre-specified acceptable LoA (Δ)	±0.50 °C	±0.50 °C
Type I error (α, two-sided)	0.05	0.05
Statistical power (1−β)	80%	80%
Required subjects (Lu method)	78	70

The governing comparison (NP vs. TM) requires 78 subjects. Accounting for a 10% dropout rate, the required enrollment is:

n = 78 ÷ (1 − 0.1) = 87, rounding up to 90 patients per each independent group
The total number of subjects in this study is 270.

With an expected mean of 4–6 time-point readings per patient, the effective number of paired observations is estimated at 360–540 per method pair, providing excellent precision for the Bland–Altman LoA estimates and their 95% confidence intervals.

9. Statistical Analysis

9.1 Primary Analysis: Repeated-Measures Bland–Altman

Because multiple measurements are obtained from each patient across time, we will apply the repeated-measures extension of Bland–Altman analysis as described by Myles and Cui (2007).[19] Variance of differences will be decomposed into between-subject (σ^2_B) and within-subject (σ^2_W) components. The total SD of differences is calculated as $SD_{total} = \sqrt{(\sigma^2_B + \sigma^2_W)}$, and 95% LoA are computed as: Bias ± 1.96 × SD_{total}. The 95% CIs for bias and LoA will be reported[19,20], and agreement will be visualized using Bland–Altman difference plots with LOWESS trend curves.

9.2 Assessment of Proportional Bias

Proportional bias will be assessed by (1) visual inspection of the Bland–Altman plot; (2) linear regression of the difference on the mean with cluster-robust standard errors; and (3) Pitman's test of correlation between the sum and difference of paired values.

9.3 Diagnostic Performance for Hypothermia Detection

Using NP temperature < 36.0°C as the reference, sensitivity, specificity, PPV, and NPV of each test method will be calculated. AUROC will be estimated and compared between TM and SpotOn™ using DeLong's method. Optimal cut-off temperatures will be identified using the Youden index.

9.4 Intraclass Correlation Coefficient (ICC)

ICC will be calculated using a two-way mixed-effects model for absolute agreement. An ICC ≥ 0.90 will be considered excellent, 0.75–0.89 good, 0.50–0.74 moderate, and < 0.50 poor.

9.5 Covariates Analysis

A multivariable linear regression model with patient-level random intercepts (mixed-effects) will be constructed separately for each method pair to identify predictors of the absolute method difference. Candidate covariates: age, sex, BMI, ASA status, surgical duration, anesthetic technique, active warming use, ambient OR temperature, and baseline core temperature.

9.6 Subgroup Analyzes

Pre-specified subgroup analyses: LoA stratified by temperature range (hypothermia < 36.0°C vs. normothermia) and by surgical duration (≤ 90 min vs. > 90 min). These are exploratory.

9.7 Software and Significance

All analyses: R version ≥ 4.3 (packages lme4, nlme, pROC, blandPower) and MedCalc version 22.0. Statistical significance: two-sided $\alpha = 0.05$ throughout.

10. Ethical Considerations

This study will be conducted in accordance with the Declaration of Helsinki (2013 revision) and ICH E6(R2) Good Clinical Practice guidelines. Ethical approval will be sought from the Khon Kaen University Ethics Committee for Human Research (KKUEC) prior to enrolllment. Written informed consent will be obtained from all participants in Thai. Participation is voluntary and withdrawal will not affect care. All study personnel will be trained in safe device placement. Any device-related complication will be managed immediately and reported to the Ethics Committee. Data will be anonymized and stored on a password-protected institutional server.

11. Action plan

11.1 Duration of project

11.2 Time frame

	Process	Time frame (Month)																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Literature reviews	→	→																
2	Invitation research		→	→	→	→	→												
3	Ethical clearance					→	→	→	→										
4	Implementation & Data collection								→	→	→	→	→	→	→	→	→		
5	Data analysis															→	→		
6	Conclusion and writing																→	→	→

12. References

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13. Budget

รายการ	**งบประมาณ**
A หมวดค่าใช้จ่ายเกี่ยวกับบุคคล	
รวม	
B หมวดค่าใช้จ่ายในการดำเนินงานวิจัย 1. ค่าอุปกรณ์ในการวิจัย SpotOn™ sensor 270 ชิ้นๆ ละ 650 บาท 2. ค่าอุปกรณ์ disposable probe for TM monitor 270 ชิ้นๆ ละ 100 บาท 3. ค่าที่พัก 4. ค่าเตรียมคู่มือ แบบสอบถาม	175,500 27,000 - -
รวม	202,500
C หมวดค่าใช้จ่ายในการบริหารงานทั่วไป - ค่าโทรศัพท์ ค่าแสตมป์ ค่าถ่ายเอกสาร ค่าใช้จ่ายเบ็ดเตล็ด หมึกปริ๊นเตอร์และอื่นๆ	1,000
D หมวดค่าใช้จ่ายในการจัดพิมพ์รายงาน	1,000
รวมค่าใช้จ่ายทั้งหมด	203,500

I hereby certify that the above information is truthful, and the person filling in the information clearly understand every piece of the information given.

Signature……

(Professor Sirirat Tribuddharat, Ph.D.)

Project Head

This protocol has been approved by the affiliated organization.

Signature ……

(Associate Professor Panarat Ratanasuwan)

Head of Department of Anesthesiology