PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (see an example) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below. Some articles will have been accepted based in part or entirely on reviews undertaken for other BMJ Group journals. These will be reproduced where possible.

ARTICLE DETAILS

TITLE (PROVISIONAL)	Heat illness surveillance in schoolboys participating in physical education class in tropical climate: an analytical prospective descriptive study
AUTHORS	Somboonwong, Juraiporn ; Sanguanrungsirikul, Sompol; Pitayanon, Chatchatchai

VERSION 1 - REVIEW

REVIEWER	Pipat Cherdrungsi, Associate Professor Department of Physiology, Faculty of Science Mahidol University Rama 6 Road Bangkok 10400 Thailand
REVIEW RETURNED	I declare I have no competing interests

THE STUDY	This study aimed to observe any occurrence of heat illness in children exercising outdoors in physical education class under hot and humid climate. I have some concerns which the authors need to address. In INTRODUCTION: - The background information about the incidence of heat illness in primary school aged children in any countries or global regions should be mentioned. - The authors claimed that the measurement of ear temperature is not a good approximation of deep body (i.e., rectal) temperature. The relationship between the ear and the rectal temperature should be calibrated before its use. In METHODS: On page 7 line 37: - What is the heat-stress index? What does it indicate? Is the calculation of the index standard? The authors should state any references for this. In addition, there are no results on the heat-stress index shown in this study. It is suggested to show these index values in the RESULTS. On page 7, lines 44-53 (4th paragraph): - A reference for determination of exercise intensity in term of MET has been quoted. Anyway, the authors should explain how to judge or assess the children activities in the field which might be an irregular combination of various types of activities. On page 8, 1st paragraph: - Determinations of many cardiovascular and thermoregulatory parameters immediately after exercise to assess the response of these parameters to exercise are inappropriate. This is because the

	intensity of exercise activities in these children is neither constant throughout the exercise period nor maximum at the end of exercise. So, data from this measurement may not reflex what the authors expected. The most intense exercise may already occur long before the measurement was conducted. In addition, the term immediate is actually not really be immediate since measurement of some parameters were taken at 5th minute after exercise. On page 8, 3rd paragraph under " Occurrence of heat-illness": - The signs and symptoms of heat-illness were mentioned but the authors used no criteria for identification the type and classification the degree of the illness. On page 9, the part "analysis": - The authors presented many data as means ± standard deviation. This could make the result data inadequate for interpretation since the peak changes in environmental condition and its physiological responses are obscured. - Besides the t-test, other statistical methods used for data analysis should include Analysis of covariance to determine the contribution of some measured factors on the genesis of heat illness.
RESULTS & CONCLUSIONS	About the RESULTS; On page 12, in Table 2: - All the physiological responses are presented only in % change. What are the absolute values of these parameters? - What are the highest and the lowest ambient temperature and humidity during the exercise period? How long are these levels of the ambient condition prolonged in each semester ? - What is the peak ear temperature and cardiovascular responses to the peak ambient temperature and humidity? - What is the sweat rate of the overweight subjects? - The parameters that the authors used to indicate hydration state of the subjects are inadequate. Calculation of water or fluid balance should provide a more valid indicator. On page 14, in Table 3: - What criteria are used to define "overweight"? - How to classify the exercise intensity in this study? - The classification of hydration status by consuming or not consuming water is rather weak. Why not the amount of water consumed and the calculation of water balance? About the DISCUSSION: On page 15, paragraph 3 &4 – page16, paragraph1: - Many references the authors quoted are invalid for discussion on exercise under heat stress since most of them concerned with heat injury in athletes and/or high aerobic fitness subjects whereas the young children in this study are not. - Refer to page 13, last paragraph. The authors report that overweight children had higher risk of heat illness because of their high body temperature response to exercise. However, no subjects experienced heat-related illness. This means that even mild sign of heat illness such as mild heat edema in hands or feet or skin rash could not be observed. It needs discussion for this point.
GENERAL COMMENTS	General Recommendation/ Comment: - Any immediate medical attention for children health and safety should be provided. This is important if heat injury occurs. - The subjects in this study were not the school athletes; so during their physical education class they were not under pressure to exercise but only recreational aim; hence, they were not at risk of

	overexertion.

REVIEWER	Wade Sinclair Lecturer Institute of Sport and Exercise Science James Cook University AUSTRALIA I declare that I have no competing interests.
REVIEW RETURNED	08-Feb-2012

THE STUDY	I am seeking clarification with regards to a methodological issues including the latency of the heart rate assessments in the study. I suspect the time taken for the heart rate samples to be collected in the study will contribute to the study's limitations. See more detailed report attached
RESULTS & CONCLUSIONS	I feel the authors have tried to identify causative mechanisms for heat-related illnesses in a cohort that did not experience any incidence. I do however, acknowledge that this may be interpretive and have therefore sought clarifications, see more detailed report attached
GENERAL COMMENTS	The manuscript entitled “Physiological responses and heat illness surveillance in primary schoolboys during outdoor exercise in physical education class under hot and humid climate: an analytical prospective descriptive study” examines the incidence of heat-related illness risk factors in schoolboys participating in physical education classes in a tropical climate. The manuscript is both adequately written for the most part and appropriate for the Journal. While the study presented is both interesting and warranted, there are a number of clarifications needed throughout the manuscript as well as a revision of the statistical analyses conducted on the data. **Title** The title is too long – a more succinct title would be appropriate **Abstract** Page 2, line 30 – suggest replacing “ear temperature” with “tympanic temperature” – more descriptive of the temperature actually assessed Page 2, line 36 – Results section: suggest the presentation of findings in an order that reflects importance; for example, the environmental temperatures are only descriptive and could therefore be presented last Page 2, line 45 – combine sweat rate, ear temperature and dehydration results for fluency

	Page 3, line 5 – suggest an alternative for “tendency” such as “increased risk” as no incidence of HI was recorded throughout the study **Article summary** Page 4, line 10 – suggest an alternative for “imposed” Page 4, lines 23-28 – please revise the second key message for English translation and grammar Page 4, line 32 – change “in the Southeast Asia...” to “from Southeast Asia...”; also Page 15, line 23 Page 4, line 55 – suggest an alternative for “making about” Limitation – timing of the pulse rate assessment? **Introduction** Please provide references at the end of each sentence on the following lines from page 5: 10, 16, 52 and 54 as well as page 6 line 7; page 16, lines 36, 41; page 17, lines 34, 52; page 18, line 12 Page 5, line 18 – suggest an alternative for “ensues” Page 5, line 30 – Are there any results from Southeast Asian countries? Page 5, line 50 – suggest briefly expanding on the increased risk being associated with exposure and behaviour as this comprises the foundation for the study **Methods** Page 6, line 36 – Change “The study population of this study was...” to “Participants were...” Page 6, line 50 – include a comment that as the students did not participate in the exercise, they were excluded from the study Page 7, line 25 – suggest moving methodological sections to reflect importance within the study. For example, climatic conditions could be featured last as these are purely descriptive of the conditions. This order should also reflect the presentation of results in the Abstract Page 7, line 39 – reference for WBGT equation Page 7, line 50 – the use of adult METs (Ainsworth et al 2000) may underestimate energy expenditure in children (see Ridley and Olds,

	MSSE, 2008). Please include a justification for using the adult compendium of physical activity into the manuscript. Page 8, line 5 – please clarify “immediately after exercise...” – does this represent at the end of the class or immediately upon completion of the respective activities. Also clarify how participants were assessed – how many were done “immediately” or were they assesses individually, one-by-one. Pulse rate would significantly drop if assessment was too long after exercise, especially if only progressing through the assessments one-by-one when the class finished all at the same time. Please clarify. **Analysis** Page 9, line 21 – change “up-paired t-test.” to “Independent samples T-test.” Page 9, line 17 – why were differences between first and second semesters investigated? Please clarify in the manuscript **Results** Please present results as per Abstract and Methods – most significant variable to descriptive only variables Page 9, line 30 – remove “were...” Page 9, line 37 – please provide a reference for the “normal standard” height and weight used. Was this scale relevant to Thai boys? Many such scales are vastly outdated, perhaps BMI presents a more acceptable method of distinguishing between normal and over-weight. Please revise Table 1 – please present results in semester cohorts as per Table 2 for consistency and to rule out any potential differences being due to physical characteristic differences Table 2 – please include METs Page 13, lines 14-18 – sentence is confusing – suggest removing “categorized” Page 13, line 25 – perhaps a correlation would also be insightful for relative risk for increase in body temperature? Page 13, line 25 – please change “body temperature” to “ear temperature” as it is only an estimation of body temperature based on the tympanic temperature Page 13, line 28 – change “subjects...” to “students...” or participants. Also in Table 3 and elsewhere throughout the

	manuscript (e.g. pg 15, ln 34) Table 3 – suggest revision of table title as the present one suggests the listed variables were causative of the students' ear temperature exceeding 38°C however there is insufficient evidence to make that claim **Discussion** Page 15, line 7 – please provide references for "life-long health and well-being." Page 15, line 50 – the claim of children being at more risk in the afternoon classes in the first semester should be able to be supported/refuted by your data. Please include this comparison – first semester morning to afternoon session, in this discussion Page 16, line 5 – "heart rate" is used instead of "pulse rate" – please note that these can refer to different measures and therefore cannot be used interchangeably. Suggest using heart rate throughout the manuscript instead of pulse rate. Page 16, line 25 – lower pulse rates could also be the result of the timing of the assessment post-exercise? A significant limitation of the study Page 17, line 23 – refer to Table 3 for these results Page 18, line 16 – please discuss differences in sweat rate between semester one and two here Page 18, line 43 – revise the term "tendency for heat illness" as no student in the study experienced any HI symptoms and therefore they may be at "an increased risk" Page 18, line 45 – is the ongoing assessment of children's core temperature during classes realistic? Perhaps frequent drink breaks, modified play-to-rest ratio or inclusion of more shaded or ventilated areas would be more appropriate recommendations? Final paragraph needs a conclusive statement **General comments** The manuscript suggest to identify causative mechanisms for heat-related illness in Thai schoolboys however in the absence of any incidence of heat-related illness perhaps the authors could present the findings of the study as purely descriptive. The data obtained is indeed interesting and relevant to the current literature. I also suggest that the authors have their manuscript revised by a native English speaking colleague to assist with fluency and misinterpreted

	translations.

VERSION 1 – AUTHOR RESPONSE

I would like to thank the reviewers for their kind and useful comments. If my manuscript ia accepted for publication, I would like to apply for discount of processing charge to 350 US dollars as I requested before.

Now I have my manuscript edited by a native English speaking colleague. The manuscript is also revised in light of the reviewer's comments as follows:

REVIEWER 1

Title
The title is changed to "Heat illness surveillance in schoolboys participating in physical education class in tropical climate: an analytical prospective descriptive study".

Abstract
- Replace "ear temperature" with "tympanic temperature" as suggested.
- In results section, the presentation of findings is rearranged, starting with exercise duration & intensity, then tympanic temperature, cardiovascular responses, sweat and dehydration rates, and climatic conditions.
- Replace "tendency" with "increased risk" as suggested.

Article summary
- Replace "imposed" with "affected".
- Revise the second key message to "Such information could have important implications for design of an optimal program as well as prevention of heat illness in physical education classes under hot and humid environment."
- Change "in the Southeast Asia" to "from Southeast Asia"
- Include "timing of the heart rate assessment" as one of the limitation of the study.

Introduction
- References are provided.
- Replace "extreme result ensues….." with "a cascade of events occur, ultimately resulting in…"
- Results from Southeast Asia are included.
- Information regarding exposure and behaviour is added.

Methods
- I agree with you that the use of adult METs may underestimate energy expenditure in children. Therefore, the compendium of energy expenditures for youth given by Ridley et al (2008) is used as suggested and the exercise intensity of playing sports is corrected to be 2.6-8.8 METs.
- Details of how participants were assessed are now clarified in the manuscript. Cardiovascular parameters including blood pressure and heart rate were measured at the beginning and immediately

upon completion of the respective activities In each exercise period, 3 to 6 students were assessed for these parameters by 3 examiners; 3 students immediately post-exercise and the rest one after the other. The time taken for heart rate samples to be collected was not more than 2 minutes.
- Others are done as suggested.

Analysis
- Differences between first and second semesters were investigated because it was during rainy and winter seasons, respectively.

Results
- Assessment of body weight status was determined by using Thai national growth chart. As BMI references for Thai children are not available, weight for height reference has been used. Overweight is defined as a weight for height of +1.5 S.D. to +2 S.D., corresponding to BMI of 17.99 to 22.42 for the height ranging from 107 to 160 cm. A reference is provided.
- The outcome measure in this study is the number of the students who reached the cut-off-point ear temperature of 38 degree celcius, which is qualitative value. Therefore, we did not use a correlation to determine relative risk.
- Table 1-3 are revised as suggested. The title of Table 3 is changed to “Conditions found in 20 students whose body temperature exceeded 38°C or above during outdoor exercise in physical education class”.

Discussion
- The claim of children being at more risk in the afternoon classes in the first semester is deleted. Instead, we add “Therefore, the high values of heat stress index, especially in the afternoon of the first semester, seem to pose a risk in having heat-related illnesses to the students when exercising outdoors. However, this study demonstrated no significant differences in any variables post-exercise except for sweat rate which was higher in the afternoon than in the late morning during the first semester.”
- The comparison between first morning and afternoon sessions is also discussed.
- Differences in sweat rate between semester one and two is discussed.
- In the final paragraph, your suggested recommendations are included along with a conclusive statement.

REVIEWER 2

Introduction
- Results from Southeast Asia are now included. However, reports in children have not been published.
- As stated references in the manuscript, comparative studies in children indicate that ear and rectal temperature have strong correlation with the pooled mean difference of 0.29°C. Actually, the relationship between the ear and the rectal temperatures was calibrated before its use in this study. Calibration of the instrument was done by comparing with rectal core temperature measurements in 5 male volunteers, aged 16-17 years, by using a Biopac MP100 system with SKT100C transducer module, and a thermistor probe (TSD102A, Biopac Systems Inc.) with 1.7 mm of diameter. The software for calibrated and collecting data was AcqKnowLedge version 3.8. The tympanic measurements showed a range of 0.1-0.2◦C lower than the rectal temperature. We now add this information in the manuscript.

Methods
- The wet bulb globe temperature (WBGT) index was used to evaluate environmental heat stress and was calculated using the following formula: wet bulb globe temperature x 0.7 + black globe

temperature x 0.2 + dry bulb temperature x 0.1. The reference for this formula is now stated. Heat stress index values (WBGT) have already been shown in the RESULTS section.
- The intensity of each physical activity which started with skill practice, followed by playing sports, was determined as Metabolic Equivalent of Task (MET) value using the compendium of energy expenditures for youth given by Ridley et al (2008).
- Determination of the thermoregulatory and cardiovascular responses was done at the beginning and immediately upon completion of the respective activities. In each exercise period, 3 to 6 students were assessed for these parameters by 3 examiners; 3 students immediately post-exercise and the rest one after the other. The time taken for heart rate samples to be collected was not more than 2 minutes. However, this is considered to be one of the limitations of the study. Ear temperature was measured WITHIN 5 minutes, not at 5th minute after the completion of exercise. According to Bergeron et al (2007), the ear temperature is stable within 5 minutes after the completion of exercise.
- As suggested, the signs and symptoms of heat illness have been categorized according to severity: 1) heat edema; 2) heat rash; 3) heat cramps; 4) heat syncope; and 5) heat exhaustion.
- Because there are a large numbers of participants in this study, we presented data as mean ± SD and analyzed data by using t-test like most of the field-based studies.

Results
- The absolutes values of the cardiovascular parameters are now included in Table 2.
- The highest and lowest ambient temperatures and humidity were 28.20-39.77°C and 36.04-73.87% (already shown in Table 2).
- The maximal heat stress level was found during an afternoon session of semester 1 (WBGT of 33.85 and relative humidity of 48.50%), where 5 students (5th graders) were observed while playing handball. The peak responses post-exercise during this class were as follows: ear temperature of 37.1◦C, and percent changes in systolic and diastolic blood pressure and heart rate of 56.98, 84.75 and 13.89%, respectively.
- The sweat rate of overweight students throughout the year was 437.97 ± 179.27 mL/h. It was significantly ($P<0.05$) higher in semester 1 (494.05 ± 208.50 mL/h, n=60) than in semester 2 (388.49 ± 131.66 mL/h, n=68). This data is now included in the manuscript.
- Criteria used to defined overweight are mentioned above.
- Classification of exercise intensity is mentioned above.
- In Table 3, “hydration status” is changed to “water consumption” as suggested.

Discussion
- References quoted were done in children who were not athletes or of high aerobic fitness.
- It has been discussed that students with high body temperature response to exercise, if exercising for a longer period of time, may have a tendency to develop heat exhaustion which can lead to heat stroke.
- We agree with you that immediate medical attention should be provided for student’s health and safety. This recommendation is added in the manuscript.

The changes to the manuscript are highlighted by using colored text. Once again, reviewers’ comments and suggestions are truly appreciated

VERSION 2 – REVIEW

REVIEWER	Wade Sinclair Lecturer Institute of Sport and Exercise Science James Cook University Australia
REVIEW RETURNED	17-Apr-2012

GENERAL COMMENTS	I commend the authors on the extensive changes made to this revised manuscript particularly the clarifications in the methodology.

REVIEWER	Pipat Cherdrungsi Associate Professor Department of physiology Faculty of Science Mahidol University Rama 6 Road Bangkok 10400 Thailand
REVIEW RETURNED	21-Apr-2012

THE STUDY	1. The results in Table 2 reveal a wide range of almost all measured physical and physiological parameters. The minimum and maximum pre-exercise values of both systolic (SP) and diastolic (DP) arterial blood pressure of normal subjects aged ~ 5-12 yrs were rather too low (i.e., 56 for SP and 30 for DP) and too high (i.e., 159 for SP and 109 for DP). This should not be due to the climatic condition. We wonder whether the cuff size used in this study appropriate for these primary schoolboys. In addition, we also question that the very high max values of pre-exercise SP and DP may not be the values of the subjects at rest. The same question can also be applied to the max value of pre-exercise heart rate. 2. The exercise intensity of playing sports (Table 2) varied from very low level of 2.6 MET to 8.8 MET. This max value of the METs is equivalent to very heavy exercise in adults. However, the authors gave no information on (a) the duration of exercise at such the high exercise intensity, (b) what was the climatic condition at that moment of exercise, and (c) which students performed such the heavy exercise/ sports. In addition, the way and criteria used to determine the MET level of irregular exercise activity in the field in this study could make the determination be quite subjective and hence not accurate. 3. On page 13 of the revised manuscript, last paragraph: the authors stated that there were 20 students (about 4 % of total) had ear temperature exceeded 38 °C. They also tried to show that overweight students had a higher risk of an increase in body temperature compared to normal-weight students. However, data in Table 3 are inadequate to support their judgment. The authors should perform statistical correlation analysis or analysis of covariance to determine the possible contributing factors of hyperthermia in the overweight students. Data on duration of exercise and the age of the subjects could also be put into the analysis.
RESULTS & CONCLUSIONS	1. Considering the climatic condition in Table 2, the value of WBGT varies from 23.7 °C to 33.8 °C. The max WBGT level suggests that some students were exposed to the zone of very high heat stress. Actually, at this high heat stress, it has been recommended to cancel all athletic activities. The authors did not explain how the students in this study could withstand such the heat stress with

	exercise. The information about the level of exercise /sport s intensity the students had under this high climatic stress is needed. 2. On page 13 of the revised manuscript, paragraph 1: the authors reported that five students were exposed to the max WBGT of 33.8 °C with a R.H. of 48.5 %. The peak post-exercise ear temperature under this climatic condition was only 37.1 °C which is the level of normal body temperature at rest. The authors did not give explanation on this. 3. Actually, it is known that body core temperature of 38 °C is quite common in many active children and adults exercising at moderate intensity or under emotion under normal climatic condition. Furthermore, hard exercise can raise the core temperature up to 40 °C. The rise in ear temperature to 38.7 °C in exercising children in this study may or may not be greatly influenced by the climatic surrounding. 4. No information about airflow at the outdoor area where physical activity was taking place. In addition, in this study it was unknown whether there was shadow of surrounding buildings or large trees that can reduce the development of hyperthermia in the students during playing sports. 5. No any signs and symptoms of heat illness, even a mild degree, could be observed even in the 20 students who exhibited hyperthermia of 38.7 °C. The authors had no explanation on this. The information from literature can illustrate quite clearly about the factors contributing to the development of heat illness in children. Unfortunately, the data presented in this study were inadequate to serve the study objectives.
GENERAL COMMENTS	The authors should concentrate on the 20 boys whose body temperature exceeded 38 C and reinvestigate the relationship of this body temp with those relevant physical and other physiological parameters as well as any degree of signs and symptoms of heat illness. in addition, the intensity of exercise or sports activity should be standardized.

VERSION 2 – AUTHOR RESPONSE

Manuscript ID bmjopen-2011-000741.R1 entitled "Heat illness surveillance in schoolboys participating in physical education class in tropical climate: an analytical prospective descriptive study"
Dear Editor,
With regard to the review from reviewer Cherdrungsi: I would like to address the concerns point-by-point as follows:
1. “The results in Table 2 reveal a wide range of almost all measured physical and physiological parameters. The minimum and maximum pre-exercise values of both systolic (SP) and diastolic (DP) arterial blood pressure of normal subjects aged ~ 5-12 yrs were rather too low (i.e., 56 for SP and 30 for DP) and too high (i.e., 159 for SP and 109 for DP). This should not be due to the climatic condition. We wonder whether the cuff size used in this study appropriate for these primary schoolboys. In addition, we also question that the very high max values of pre-exercise SP and DP may not be the values of the subjects at rest. The same question can also be applied to the max value of pre-exercise heart rate.”

Blood pressure monitor used in this study was pediatric special, with XS child, S child, and Medium adult cuffs

• XS cuff: 5" - 8" (13 cm - 20 cm)
• S cuff: 7" - 10" (17 cm - 26 cm)
• Med.cuff: 9" - 13" (24 cm - 32 cm)

However, such XS cuff may be too large for some small children (BW 15-16 kg), probably resulting in lower blood pressure than the actual values.

Prior to the beginning of the physical education class, the children had only 5 minutes to take a rest before measuring blood pressure and heart rate. Because it is not of absolute resting values, we call "pre-exercise blood pressure and heart rate". This may contribute to the high max values of pre-exercise blood pressure and heart rate.

2. "The exercise intensity of playing sports (Table 2) varied from very low level of 2.6 MET to 8.8 MET. This max value of the METs is equivalent to very heavy exercise in adults. However, the authors gave no information on (a) the duration of exercise at such the high exercise intensity, (b) what was the climatic condition at that moment of exercise, and (c) which students performed such the heavy exercise/ sports. In addition, the way and criteria used to determine the MET level of irregular exercise activity in the field in this study could make the determination be quite subjective and hence not accurate."

At the high exercise intensity of 8.8 MET,
a) duration of playing sports was 11.43 ± 5.23 min and the total duration of exercise was 32.34 ± 5.20 min.
b) climatic condition: WBGT was 28.35 ± 2.01ºC
c) Sports with such high intensity included chair-ball (n= 45; 1st graders=24, 2nd graders=21), soccer (n=110; 1st graders=30, 2nd graders=41, 3rd graders=22, 4th graders=9 and 6th graders=8) and mini-rugby football (n=1, 3rd grader).
This information is now included in the revised manuscript.
To determine MET level, the Compendium of Energy Expenditures for Youth was used. This tool is accepted for use in scoring physical activity and energy expenditure values to observational data as obtained from such real-life situation in this study (please see the reference in Ridley et al, 2008).

3. "On page 13 of the revised manuscript, last paragraph: the authors stated that there were 20 students (about 4 % of total) had ear temperature exceeded 38°C. They also tried to show that overweight students had a higher risk of an increase in body temperature compared to normal-weight students. However, data in Table 3 are inadequate to support their judgment. The authors should perform statistical correlation analysis or analysis of covariance to determine the possible contributing factors of hyperthermia in the overweight students. Data on duration of exercise and the age of the subjects could also be put into the analysis."

We accept that data in Table 3 may be inadequate to support the judgment on the risk of heat illness. However, we did not state that all of these conditions found
in these 20 students, except for "overweight" are the risks.
To our knowledge, relative risk is used frequently in the statistical analysis of binary outcomes where the outcome of interest has relatively low probability. Relative risk is a ratio of the probability of the event occurring in the exposed group versus a non-exposed group. Relative risk is used in randomized controlled trials and cohort studies. Analysis of covariance (ANCOVA) is a general linear model to present a model appropriate for looking at group effects on a continuous outcome when some other continuous explanatory variable also has an effect on the outcome.
We use the cut-off point level at ear temperature of 38ºC and categorize the conditions found in 20 students into binary data, e.g., overweight/normal weight, consume water/not consume water, etc. Therefore, relative risk is appropriate for analyzing such qualitative data in this cohort study in order to determine the probability of developing hyperthermia in overweight students versus normal weight students.

To put the data on duration of exercise and the age of the subjects into analysis is a good recommendation.

4. “Considering the climatic condition in Table 2, the value of WBGT varies from 23.7°C to 33.8 °C. The max WBGT level suggests that some students were exposed to the zone of very high heat stress. Actually, at this high heat stress, it has been recommended to cancel all athletic activities. The authors did not explain how the students in this study could withstand such the heat stress with exercise. The information about the level of exercise /sport s intensity the students had under this high climatic stress is needed.”
Under the max WBGT of 33.8 °C, five students played handball, of which the exercise intensity was 8 MET. The sweat rate was 642.37±193.33 mL/h and fluid intake was 198.20±7.68 mL. These students showed adequate thermoregulatory response by effective heat loss through sweating, thus, when coupled with fluid consumption, making them withstand such the heat stress with exercise. This information and explanation is now included in the revised manuscript.

5. “On page 13 of the revised manuscript, paragraph 1: the authors reported that five students were exposed to the max WBGT of 33.8° C with a R.H. of 48.5 %. The peak post-exercise ear temperature under this climatic condition was only 37.1°C which is the level of normal body temperature at rest. The authors did not give explanation on this.”

As mentioned in ITEM 4, these students showed adequate thermoregulatory response by effective heat loss mechanism through sweating along with fluid consumption, making them withstand such the heat stress with exercise and maintain their temperatures.

6. “Actually, it is known that body core temperature of 38°C in exercising children in this study may or may not be greatly influenced by the climatic surrounding.°C. The rise in ear temperature to 38.7 °C is quite common in many active children and adults exercising at moderate intensity or under emotion under normal climatic condition. Furthermore, hard exercise can raise the core temperature up to 40 °C.”
In children or adults performing strenuous exercise in the environmental temperature of 25°C or above, their core temperatures can elevate by approximately 1 °C. However, in athletes or trained persons, the body can tolerate more heat stress than untrained persons because of relatively more effective heat loss.

7. “No information about airflow at the outdoor area where physical activity was taking place. In addition, in this study it was unknown whether there was shadow of surrounding buildings or large trees that can reduce the development of hyperthermia in the students during playing sports.”

WBGT is a composite temperature widely used to estimate the effect of temperature, humidity and solar radiation on humans. We did not determine air flow at the outdoor area. There was no shadow of the surrounding buildings or large trees while the students were playing sports outdoors.

8. “No any signs and symptoms of heat illness, even a mild degree, could be observed even in the 20 students who exhibited hyperthermia of 38.7 ° C. The authors had no explanation on this. The information from literature can illustrate quite clearly about the factors contributing to the development of heat illness in children. Unfortunately, the data presented in this study were inadequate to serve the study objectives.

The authors should concentrate on the 20 boys whose body temperature exceeded 38 C and reinvestigate the relationship of this body temp with those relevant physical and other physiological parameters as well as any degree of signs and symptoms of heat illness. in addition, the intensity of

exercise or sports activity should be standardized."

The objective of this study was to perform surveillance of heat illness, i.e., to determine whether the students are susceptible to tropical climatic conditions like Thailand while exercising outdoors in physical education class. Therefore, cardiovascular and thermoregulatory responses as well as the occurrence of heat-related illness were examined. The research design was an observational descriptive study conducted in 457 primary schoolboys under real-life situation. This study must be approved not only by the Institutional Review Board, but also the principal of the school, the physical educational teachers and, most importantly, the parents. It will be ideal if the teachers prepare a systematic and similar program in every physical education class, and researchers can measure blood pressure, heart rate and ear temperature in every student at the same time while not disturbing their usual class activities. In case of such ideal research design, the data obtained can be analyzed by using correlation analysis or analysis of covariance as suggested by reviewer. However, such ideal research design may not be accepted by the principal of the school, the physical educational teachers. Therefore, there are some limitations to conduct the study. The most practical and standard way is to assess: 1) climatic conditions by using WBGT as standard criteria, 2) exercise intensity as qualitative data by using the Compendium of Energy Expenditures for Youth, 3) body weight, body temperature, blood pressure and heart rate by using standardized instruments.

Additional information and explanation are now included in the revised manuscript by using green colored text. Last but not least, I would like to thank the reviewers for their valuable comments and suggestions.

Regards,

Dr. Somboonwong