US 20160066840A1

(19) United States
(12) Patent Application Publication
RUSSELL

(10) Pub. No.: US 2016/0066840 A1
(43) Pub. Date: Mar. 10, 2016

(54) SYSTEM METHOD AND DEVICE FOR DETERMINING THE RISK OF DEHYDRATION

(71) Applicant: COVIDIEN LP, Mansfield, MA (US)

(72) Inventor: BRIAN KEITH RUSSELL, Annapolis, MD (US)

(21) Appl. No.: 14/944,600

(22) Filed: Nov. 18, 2015

Related U.S. Application Data

(62) Division of application No. 13/154,317, filed on Jun. 6, 2011, now Pat. No. 9,220,444.

(60) Provisional application No. 61/352,293, filed on Jun. 7, 2010.

Publication Classification

(51) Int. Cl.

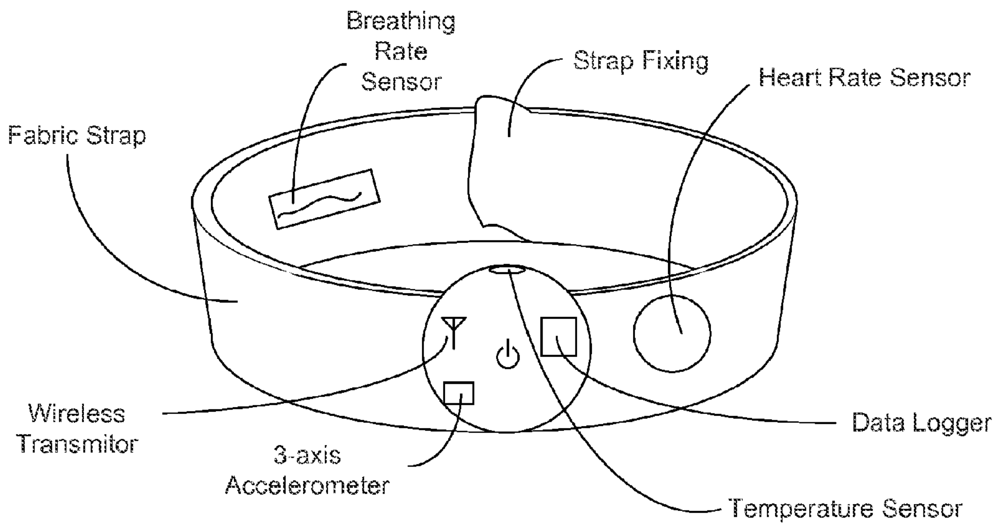
A61B 5/00	(2006.01)
A61B 5/16	(2006.01)
A61B 5/0205	(2006.01)

(52) U.S. Cl.

CPC ***A61B 5/4875*** (2013.01); ***A61B 5/0205*** (2013.01); ***A61B 5/7271*** (2013.01); ***A61B 5/746*** (2013.01); ***A61B 5/742*** (2013.01); ***A61B 5/7405*** (2013.01); ***A61B 5/7475*** (2013.01); ***A61B 5/165*** (2013.01); ***A61B 5/4266*** (2013.01); *A61B 2560/0475* (2013.01)

(57) ABSTRACT

A system, device and method of determining a probability of dehydration of a person is provided. In one embodiment, the method comprises receiving data of a heart rate of the person; receiving data of a posture of the person; determining that a first posture of the person satisfies first posture criteria for a first predetermined time period; determining that the posture of the person satisfies a similarity threshold with a posture envelope; determining a first heart rate for the person while in a first posture; determining a second heart rate for the person while in the second posture; determining a change in heart rate as a difference between the second heart rate and the first heart rate; determining a first probability of dehydration based at least in part on the change in heart rate; and outputting the first probability of dehydration.



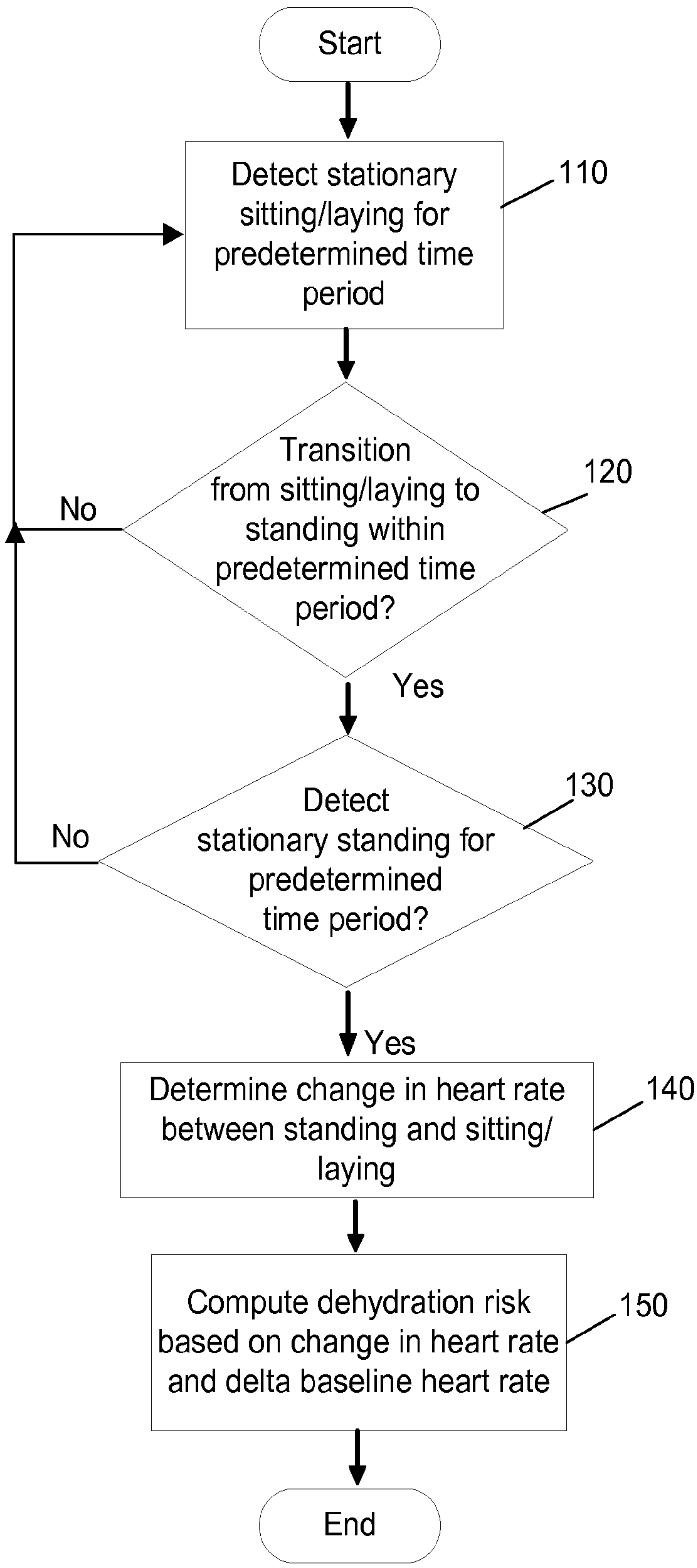

Start
Detect stationary sitting/laying for predetermined time period
110
Transition from sitting/laying to standing within predetermined time period?
120
No
Yes
Detect stationary standing for predetermined time period?
130
No
Yes
Determine change in heart rate between standing and sitting/ laying
140
Compute dehydration risk based on change in heart rate and delta baseline heart rate
150
End

Figure 1

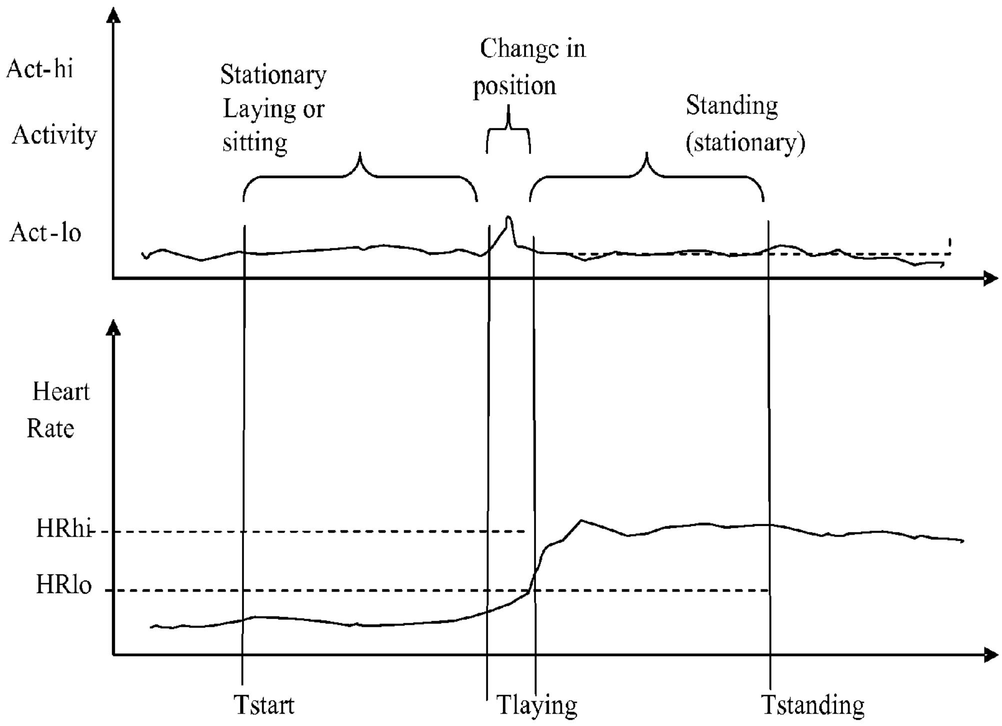

Act-hi
Activity
Act-lo
Stationary
Laying or
sitting
Change in
position
Standing
(stationary)
Heart
Rate
HRhi
HRlo
Tstart
Tlaying
Tstanding

Figure 2

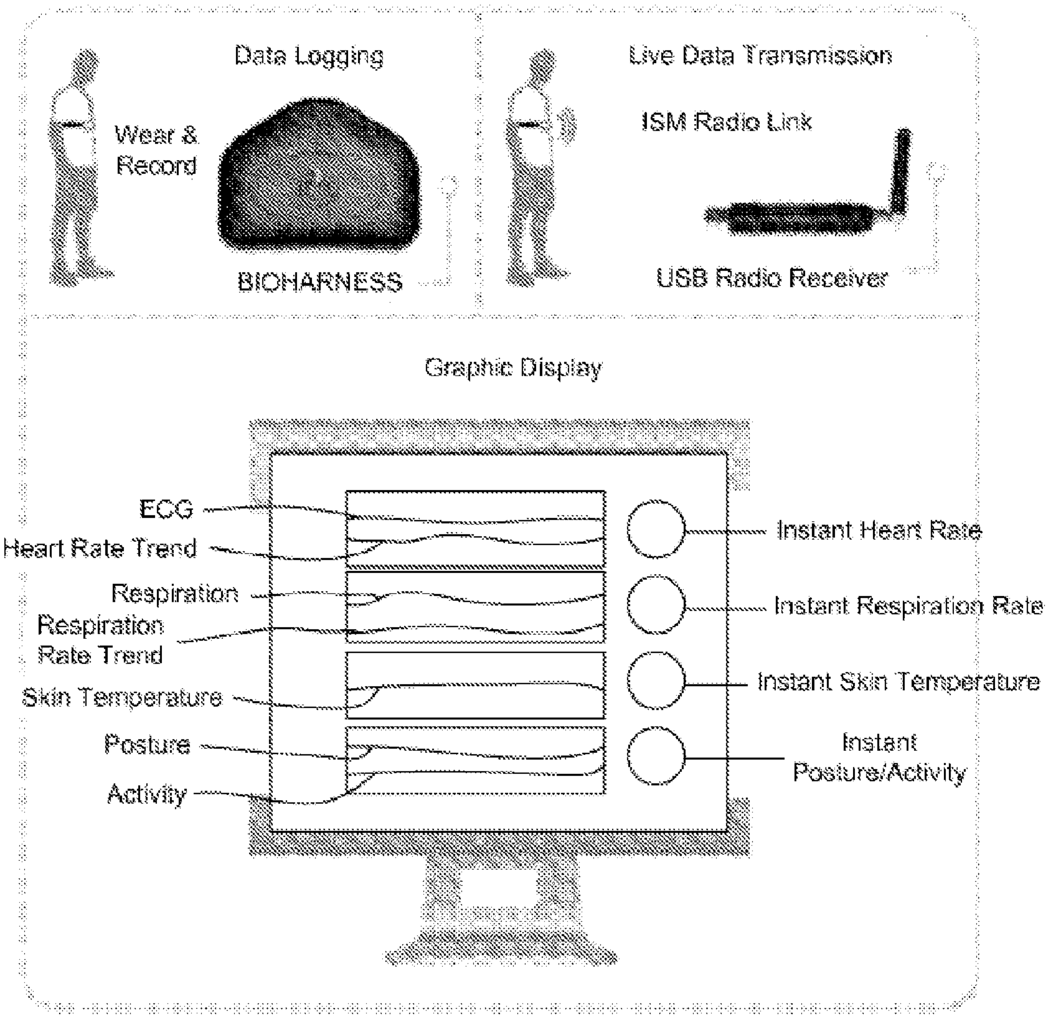

Data Logging
Wear & Record
BIOHARNESS
Live Data Transmission
ISM Radio Link
USB Radio Receiver
Graphic Display
ECG
Heart Rate Trend
Respiration
Respiration Rate Trend
Skin Temperature
Posture
Activity
Instant Heart Rate
Instant Respiration Rate
Instant Skin Temperature
Instant Posture/Activity

Figure 3

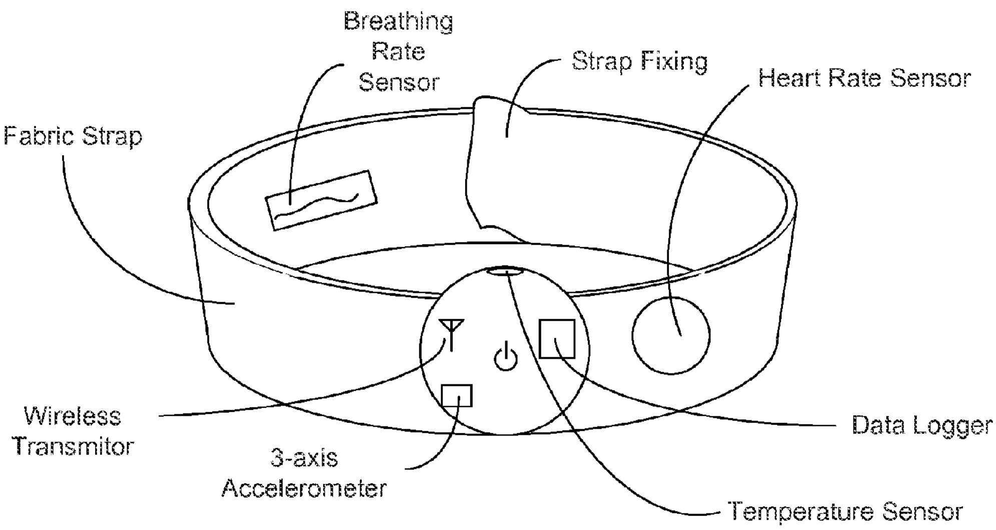

Breathing
Rate
Sensor
Strap Fixing
Heart Rate Sensor
Fabric Strap
Wireless
Transmitor
3-axis
Accelerometer
Data Logger
Temperature Sensor

Figure 4

SYSTEM METHOD AND DEVICE FOR DETERMINING THE RISK OF DEHYDRATION

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of U.S. patent application Ser. No. 13/154,317 filed Jun. 6, 2011, entitled, "System Method and Device for Determining the Risk of Dehydration," which claims priority to U.S. Provisional Application No. 61/352,293, filed Jun. 7, 2010, which are hereby incorporated by reference in their entirety of all purposes.

FIELD OF THE INVENTION

[0002] The present invention generally relates to physiological data processing and more particularly, to a system, method and device for determining the risk of dehydration of a person.

BACKGROUND OF THE INVENTION

[0003] Monitoring vital signs is traditionally done on supine patients at rest. Field based measurements are typically done with a care giver or researcher controlling the person's position (e.g., posture) and degree of movement in order to minimize movement artifacts such as orthostatic changes and effects on the body due to work effort of orientation. Normally tests are performed under various conditions in a clinic manually, using such devices as blood pressure cuffs or using treadmills and stop watches for exertion fitness tests.

[0004] Measuring vital signs over time (in the field) provides more useful information for understanding a person's physiological state. However, body position and activity level are key factors that affect a person's vital signs and hence the interpretation thereof.

[0005] Information of the biomechanical context of a person allows the person's vital signs to be measured and interpreted remotely. Biomechanical sensors include, for example, tri axial accelerometers and gyroscopes which determine the posture and activity level of a person. Biomechanical sensors which form part of, or are time synchronized to, a vital sign monitor afford the opportunity to take measurements that, until now, would not be practical or useful because the person's movement or posture could have a greater effect than the variations sought. In contrast, embodiments of the present invention can determine a normal state of the person under different activity levels and postures and hence determine an abnormal state. In addition, embodiments of the present invention may be used to determine the probability of dehydration when the person is in the field (not in the clinic) and wherein the movement and posture of the person is not directed by the clinician.

[0006] These and other advantages may be provided by one or more embodiments of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention is further described in the detailed description that follows, by reference to the noted drawings by way of non-limiting illustrative embodiments of the invention, in which like reference numerals represent similar parts throughout the drawings. As should be understood, however, the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0008] FIG. **1** is a flow chart of a process, in accordance with an example embodiment of the present invention.

[0009] FIG. **2** is a graphic representation of heart rate and postures, in accordance with an example embodiment of the present invention.

[0010] FIG. **3** depicts a BioHarness that may be used to collect (and process data), in accordance with an example embodiment of the present invention.

[0011] FIG. **4** depicts a BioHarness that may be used to collect (and process data), in accordance with an example embodiment of the present invention.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0012] In the following description, for purposes of explanation and not limitation, specific details are set forth, such as particular networks, communication systems, computers, terminals, devices, components, techniques, sensors, algorithms, data and network protocols, software products and systems, operating systems, development interfaces, hardware, etc. in order to provide a thorough understanding of the present invention.

[0013] However, it will be apparent to one skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. Detailed descriptions of well-known networks, communication systems, sensors, algorithms, computers, terminals, devices, components, techniques, data and network protocols, software products and systems, operating systems, development interfaces, and hardware are omitted so as not to obscure the description.

[0014] A person's physiology changes based on speed of movement, level of activity and posture. Embodiments of the present invention address the issue of automatically testing various physiological states when using sensors for short term and long term (in the field) monitoring of bioelectric signals of a person. When a person is remote, the clinician or coach cannot make a manual assessment of the person's posture or the time at which a certain event occurred. Some embodiments of the present invention provide a method to remotely determine these values by using a combination of biomechanical sensors, physiological sensors and algorithms that process these values over time. This specific example embodiment determines the probability of dehydration based on such values.

[0015] Determining dehydration in a person can be done via chemical means and test protocols such as orthostatic load analysis. The problem with chemical analysis is that for each test stick, such as the Bayer® Q10 test strips, one stick per test is required and people require privacy to produce the urine sample. The problem with a traditional orthostatic tilt test is that a person must be timed manually, using a watch or clock, and the person must be instructed throughout the test and recording heart rate data. These test systems do not lend themselves to multi person remote testing where the clinician or medical person is not present.

[0016] Some embodiments of the present invention use one or more activity sensors and one or more posture sensors along with a heart rate sensor. A single sensor module that uses the same accelerometers may be employed to provide raw data, which is processed by software that separately outputs posture and activity data (e.g., level). When a sequence of postures is detected, the measured heart rates can be used to determine the risk of dehydration.

[0017] The data used by embodiments of the present invention may be collected and processed by a device called the BioHarness, which is commercially available and manufactured by Zephyr Technology of Annapolis, Md. See FIGS. **3** and **4**. The device measures heart rate, breathing rate, temperature, activity and posture, is battery powered and worn as a chest strap. It includes a Bluetooth wireless transceiver and internal memory. The person may wear the device at home and/or at work (as well as in a clinic environment). The data from the biomechanical and physiological sensors (and in some embodiments environmental sensors) is regularly collected and stored in memory. Upon detection of certain physiological data (an acceptable activity and posture envelope), the algorithm processes the stored data to determine the risk of dehydration for the person. The algorithm may be executed by a processor resident in the collection device (e.g., the BioHarness) or a computer that receives the data from the collection device.

[0018] The sensor module and algorithm of this example embodiment determine (automatically) when a person is lying down or sitting for a predetermined duration and when the person is standing for a predetermined duration. If the durations and level of activity are within acceptable limits then the delta (change in) heart rate is used to determine orthostatic loading and hence the degree of hydration. Other personal physiological parameters and environmental parameters and base lines can be used to further increase accuracy of the process.

[0019] One example algorithm for computing the risk of dehydration is described below in conjunction with FIGS. **1** and **2**. The person under test may wear the BioHarness or other collection device(s) to continually (or regularly) monitor the person's heart rate, posture and other physiological data. The person's movement need not be instructed (e.g., movement of the person may simply comprise the movement as he or she performs normal activities) and processing of the data to determine the risk of dehydration may be performed when the sequence of the person's postures satisfies certain parameters. As discussed above, data of the person's posture, activity (whether stationary or not), and heart rate is continually monitored and stored. When the person's posture and activity level satisfy a triggering envelope (FIG. **2**), the stored heart rate data is processed to determine the risk of dehydration. More specifically:

[0020] 1. First, the system detects that the person has been in a stationary sitting or lying down position for at least a first predetermined time period, followed by a transition to a stationary standing position. As discussed, the heart rate is monitored and a variable (HRlo) is set to the peak or average heart rate during the stationary sitting or lying down period. Typically, the first time period will be between one and twenty minutes and may be a configuration set by the operator.

[0021] 2. Next, the system determines whether the transition from stationary sitting or lying down to stationary standing occurred within a second predetermined time period. If the transition does not occur within the second predetermined time period, the process returns to detect sitting or lying down for a first predetermined time period. Typically, the (maximum) second time period is between fifteen and thirty seconds.

[0022] 3. If the system determines that the transition from sitting or lying down to standing occurred within the second predetermined time period, the system determines whether the person was standing for a third predetermined time period. If not the process restarts. Typically, the third time period is between one and twenty minutes.

[0023] 4. If the system determines that the person is stationary standing for the third predetermined time period, a second variable (HRhi) is set to the average measured heart rate during third time period.

[0024] 5. Next, the system calculates the change in heart rate between standing and lying down (or sitting) as delta heart rate computed as HRhi minus HRlo (or HRhi-HRlo).

[0025] 6. Next the system computes the dehydration risk based on the change in heart rate and delta baseline heart rate according to the following equation:

$$\text{Dehydration risk} = K * \frac{(HRhi - HRlo}{\text{Delta\_HR\_baseline}} \qquad \text{Equation A}$$

[0026] Dehydration risk is the chance of dehydration (e.g., in percent). A dehydration risk equal to 100% indicates that there is a 100% risk of dehydration to a point greater than a predetermined percentage (e.g., 3-5%) of the person's body weight. For example a person with no acclimatization and a history of heat related illness for the risk may be 100% and an acclimatized, fully hydrated person with no heat related injury history may be 0.3 (or 30%). The "predetermined percentage of the person's body weight" for which the risk is assessed can be varied by the software application by adjusting the value of K to allow the person to be alerted at his or her (customized) desired risk of dehydration level. For example, one person may wish to know of (or be alerted to) a predetermined risk (e.g., 80% chance) of being dehydrated to 5% of their body weight and use a first value of K is used and if that person wishes to know (or be alerted to) a predetermined risk (e.g., 80%) of being dehydrated to 3% of their body weight, a second value of K would be used.

[0027] Delta heart rate is an increase in heart rate by a given number (typically 20 beats per minute or bpm) between the lying down and standing positions.

[0028] K is a coefficient that is changed per person based on fitness level, age, weight, gender, environment, and/or history. A medically trained person with training may change or select this number. Alternately, the system may receive inputs of various parameters (e.g., the person's age, weight, gender, fitness level, ambient temperature, etc.) and automatically compute K.

[0029] Delta_HR_baseline is the normal heart rate change for that person in a hydrated state, i.e. less than 0.5% of the person's body weight. This number is first calculated based on fitness, age, gender, and/or weight. A baseline test with correct hydration level can be performed for further accuracy. Alternately, the value may be based on crowd sourced data for persons of that group (age, weight, fitness level, level of exercise per week, etc.).

[0030] Data is automatically collected in the collection device that includes activity (via an accelerometer which measures movement in three axes), posture and heart rate. When an acceptable activity and posture envelope is detected (as illustrated by processes **110**, **120**, and **130** of FIG. **1**), this example embodiment of the present invention computes the delta heart rate (HRhi-HRlo) at **140** and then the dehydration risk at **150** in accordance with Equation A above.

[0031] In some instances, the above computed delta heart rate may be used to determine a person's risk of dehydration and/or to improve or confirm the accuracy of Equation A. More specifically, if a person's delta heart rate is above a predetermined threshold (or simply the higher the heart rate) the person's risk of dehydration can be assessed provided any increase in heart rate is not due to panic, sweating, exercise, and/or another factor. To confirm that exercise is not influencing the person's heart rate, the heart rate may be measured only after the person is standing stationary for a predetermined time period or after the person's heart rate stabilizes for a time period (e.g., and no activity is detected). Peripheral temperature and peripheral skin sensors may be used to measure the effects of the sympathetic nervous system (e.g., to ensure the person is not panicked). Similarly, the person's core temperature and whether he is sweating may also be measured (via appropriate chest sensors) to determine whether the person is hot (or overheated) or if they are experiencing vessel dilation—all of which could cause the heart rate to increase and therefore potentially skew any heart rate analysis. In summary, considering a person's age, fitness, weight, and/or other factors, a person's risk of dehydration may be determined based on the above computed delta heart rate (HRhi-HRlo) (which may be multiplied by one or more scaling factors) provided that other factors that might increase a person's heart rate are determined to not be influencing the person's heart rate. Thus, a person's standing (or in some instances, sitting or lying down) heart rate may also be used to assess their risk of dehydration after factoring in a person's age, fitness, weight, and/or other factors, and provided that other factors that might increase a person's heart rate are determined to not be influencing the person's heart rate.

[0032] Algorithms of the present invention can be used while a person is carrying out random events (or exercises) or is performing requested (known) behavior.

[0033] If the dehydration risk is above a predetermined threshold, a notification (an alert) may be transmitted (e.g., wirelessly) to medical personnel and an audible alarm may be sounded to alert the patient.

[0034] The present invention may be embodied, at least in part, as a computer system (one or more co-located or distributed computers) or cluster executing one or more computer programs stored on a tangible medium. The algorithm may be executed (and computer system located) locally to (e.g., attached to or carried by the user) or remotely from the user. The algorithm may be executed on a computer system that also includes other functions such a telephone or other device (e.g., an IPhone®, IPad®, or Blackberry®), which may have processing and communications capabilities. As discussed, the algorithm may also be stored and executed on the collection device.

[0035] While the example embodiment described above determines the risk for dehydration, other embodiments instead (or additionally) may be used to determine other parameters such as a person's fitness level, the risk of heat stress, and/or other parameters.

[0036] Thus, one embodiment of the present invention comprises a method of determining a probability of dehydration of a person, which comprises receiving data of a heart rate of the person; receiving data of a posture of the person; determining that a first posture of the person satisfies first posture criteria for a first predetermined time period; determining a first heart rate for the person during the first predetermined time period; determining that a second posture of the person satisfies second posture criteria for a second predetermined period subsequent to the first posture of the person satisfying first posture criteria for the first predetermined time period; determining a second heart rate for the person during the second predetermined time period; determining a change in heart rate as the difference between the second heart rate and the first average heart rate; determining a first probability of dehydration based, at least in part, on the change in heart rate; and outputting the first probability of dehydration. The method may further include determining that an activity level of the person is below a threshold level during said second predetermined time period and/or determining a second probability of dehydration, at least in part, by comparing the second heart rate with a predetermined threshold. Determining a first probability of dehydration may comprise dividing the change in heart rate by a baseline change in heart rate. The first posture criteria may comprise sitting or lying down and the second posture criteria may comprise standing (e.g., with an activity level below a threshold and/or substantially stationary). Further, the method may comprise determining that the person transitions from the first posture to the second posture within a third predetermined time period. Finally, the method may further comprise determining that the change in heart rate is above a predetermined threshold and that the increase in heart rate is not due to panic, sweating, exercise, and/or other factors of the person.

[0037] In another embodiment, the present invention comprises a method of determining a probability of dehydration of a person, that comprises receiving data of a heart rate of the person over a time period; receiving data of a posture of the person over the time period; storing in a memory data of the heart rate of the person over the time period; storing in a memory data of the posture of the person over the time period; determining that the posture of the person during the time period satisfies a similarity threshold with a posture envelope that includes a first posture and a second posture; determining a first heart rate for the person while in the first posture; determining a second heart rate for the person while in the second posture; determining a change in heart rate as a difference between the second heart rate and the first heart rate; determining a first probability of dehydration based, at least in part, on the change in heart rate; and outputting the first probability of dehydration. The method may further comprise determining a second probability of dehydration by comparing the second heart rate with a predetermined threshold; determining that an activity level of the person is below a threshold level while the person maintains the second posture; and/or determining that the person transitions from the first posture to the second posture within a predetermined time period. Determining a first probability of dehydration may comprise dividing the change in heart rate by a baseline change in heart rate. The first posture may comprise one of sitting or lying down; and the second posture may comprise standing.

[0038] Further, another embodiment of the present invention comprises a computer program product stored in a non-transitory computer readable medium and executable by a computer system to determine a probability of dehydration of a person, that comprises a code segment to determine that data of a first posture of the person satisfies first posture criteria for a first predetermined time period; a code segment to determine a first heart rate for the person during the first predetermined time period; a code segment to determine that a second posture of the person satisfies second posture criteria for a second predetermined period subsequent to the first posture of the person satisfying the first posture criteria for the first predetermined time period; a code segment to determine a second heart rate for the person during the second predetermined time period; a code segment to determine a change in heart rate a difference between the second heart rate and the first heart rate; a code segment to determine a first probability of dehydration based, at least in part, on the change in heart rate; and a code segment to output the first probability of dehydration. Determining a first probability of dehydration may comprise dividing the change in heart rate by a baseline change in heart rate. The first posture may comprise one of sitting or lying down; and the second posture criteria may comprise standing. The embodiment may further comprise a code segment to determine that an activity level of the person is below a threshold level during said second predetermined time period and/or a code segment to determine that the person transitions from the first posture to the second posture within a third predetermined time period.

[0039] Thus, still another embodiment of the present invention comprises a method of determining a probability of dehydration of a person, that comprises monitoring the heart rate, activity and posture of the person; determining that the person has been in a first posture for a first predetermined time period wherein the first posture is selected from the group of sitting and lying down; determining a first average (or peak) heart rate for the person while in the first posture; determining that the person transitions from the first posture to standing within a second predetermined time period; determining that the person remains standing stationary for a third predetermined time period; determining a second average heart rate (or peak) for the person while in the second posture; calculating a change in heart rate as the second average (or peak) heart rate minus the first average (or peak) heart rate; determining a first probability of dehydration by, at least in part, dividing the change in heart rate by a baseline change in heart rate; determining a second probability of dehydration by comparing the stationary standing heart rate of the person with a predetermine threshold; outputting the probability of dehydration; and providing a notification if the first or second probability of dehydration is above a predetermined threshold.

[0040] Thus, yet another embodiment of the present invention comprises a method of determining a probability of dehydration of a person, that comprises monitoring the heart rate, activity and posture of the person over a time period; storing data of the heart rate, activity and posture of the person over the time period; determining a first average (or peak) heart rate for the person while in the first posture; determining that the activity and posture of the person for the time period satisfies a triggering envelope; determining a second average heart rate (or peak) for the person while in the second posture; calculating a change in heart rate as the second average (or peak) heart rate minus the first average (or peak) heart rate; determining a first probability of dehydration by, at least in part, dividing the change in heart rate by a baseline change in heart rate; determining a second probability of dehydration by comparing the stationary standing heart rate of the person with a predetermined threshold; outputting the probability of dehydration; and providing a notification if the first or second probability of dehydration is above a predetermined threshold.

[0041] It is to be understood that the foregoing illustrative embodiments have been provided merely for the purpose of explanation and are in no way to be construed as limiting of the invention. Words used herein are words of description and illustration, rather than words of limitation. In addition, the advantages and objectives described herein may not be realized by each and every embodiment practicing the present invention. Further, although the invention has been described herein with reference to particular structure, materials and/or embodiments, the invention is not intended to be limited to the particulars disclosed herein. Rather, the invention extends to all functionally equivalent structures, methods and uses, such as are within the scope of the appended claims. Those skilled in the art, having the benefit of the teachings of this specification, may affect numerous modifications thereto and changes may be made without departing from the scope and spirit of the invention.

1. A method of determining a probability of dehydration of a person, comprising:
- receiving data of a heart rate of the person over a time period from a first sensor;
- receiving data of a posture of the person over the time period from a second sensor;
- storing in a memory data of the heart rate of the person over the time period;
- storing in the memory data of the posture of the person over the time period;
- determining, via a processor, that the posture of the person during the time period satisfies a similarity threshold with a posture envelope, wherein the posture envelope comprises a first posture and a second posture;
- determining, via the processor, a first heart rate for the person while in the first posture;
- determining, via the processor, a second heart rate for the person while in the second posture;
- determining, via the processor, a change in heart rate as a difference between the second heart rate and the first heart rate;
- determining, via the processor, a first probability of dehydration based, at least in part, on the change in heart rate; and
- outputting the first probability of dehydration.

2. The method according to claim **1**, wherein said determining the first probability of dehydration comprises dividing the change in heart rate by a baseline change in heart rate.

3. The method according to claim **1**, further comprising determining a second probability of dehydration by comparing the second heart rate with a predetermined threshold.

4. The method according to claim **1**, wherein said first posture comprises sitting.

5. The method according to claim **1**, wherein said first posture comprises one of sitting or lying down, and wherein said second posture comprises standing.

6. The method according to claim **1**, further comprising determining that an activity level of the person is below a threshold level while the person maintains the second posture.

7. The method according to claim **1**, further comprising determining that the person transitions from the first posture to the second posture within a predetermined time period.

8. The method according to claim **1**, further comprising:
- determining a second probability of dehydration by comparing the second heart rate with a predetermined threshold; and
- outputting a signal configured to alert the person of the probability of dehydration when the second probability

of dehydration exceeds a dehydration risk threshold and when the second heart rate is below the predetermined threshold.

9. The method according to claim **8**, wherein the outputted signal comprises any of an alert transmitted to a remote monitor, a locally broadcasted audible alarm, or a combination thereof.

10. The method according to claim **8**, further comprising: determining the dehydration risk threshold based at least in part on a desired risk of dehydration level input by the person.

11. The method according to claim **1**, wherein the first heart rate and the second heart rate comprise an average first heart rate and an average second heart rate, respectively, over the time period.

12. The method according to claim **1**, further comprising: comparing the first probability of dehydration with a dehydration risk threshold; and

outputting a signal configured to alert the person of the first probability of dehydration based at least in part on the comparing.

13. The method according to claim **1**, wherein said determining the first probability of dehydration comprises:

determining a baseline change in heart rate based at least in part on at least one of an age, a weight, a gender, a fitness level, an ambient temperature associated with the person, or a combination thereof; and

dividing the change in heart rate by the baseline change in heart rate.

14. The method according to claim **13**, further comprising: determining the baseline change in heart rate based on crowd sourced data.

15. The method according to claim **1**, further comprising: determining, using data received from at least a third sensor coupled with the body of the person, that the person is experiencing panic or is perspiring, or determining an activity level of the person during the time period; and

preventing a signal configured to alert the person of the first probability of dehydration from being output when the person is experiencing panic or is perspiring.

16. The method according to claim **15**, further comprising: preventing the signal from being output when the activity level of the person is elevated above the activity threshold due to exercise.

17. The method according to claim **1**, wherein determining the second heart rate for the person comprises:

determining the second heart rate for the person only after the person has maintained the second posture for a predetermined time period.

18. A system for determining a probability of dehydration of a person, comprising:

a first sensor configured to receive data of a heart rate of the person over a time period;

a second sensor configured to receive data of a posture of the person over the time period;

a memory configured to store data of the heart rate of the person over the time period, and further configured to store the data of the posture of the person over the time period; and

a processor configured to:

determine that the posture of the person during the time period satisfies a similarity threshold with a posture envelope, wherein the posture envelope comprises a first posture and a second posture;

determine a first heart rate for the person while in the first posture;

determine a second heart rate for the person while in the second posture;

determine a change in heart rate as a difference between the second heart rate and the first heart rate; and

output the first probability of dehydration.

19. The system according to claim **18**, the processor being further configured to:

divide the change in heart rate by a baseline change in heart rate; and

determine the first probability of dehydration based at least in part on the dividing.

20. The system according to claim **18**, the processor being further configured to:

compare the second heart rate with a predetermined threshold; and

determine a second probability of dehydration based at least in part on the comparing.

* * * * *

专利名称(译)	用于确定脱水风险的系统方法和装置		
公开(公告)号	US20160066840A1	公开(公告)日	2016-03-10
申请号	US14/944600	申请日	2015-11-18
[标]申请(专利权)人(译)	柯惠有限合伙公司		
申请(专利权)人(译)	COVIDIEN LP		
当前申请(专利权)人(译)	COVIDIEN LP		
[标]发明人	RUSSELL BRIAN KEITH		
发明人	RUSSELL, BRIAN, KEITH		
IPC分类号	A61B5/00 A61B5/0205 A61B5/16		
CPC分类号	A61B5/4875 A61B5/0205 A61B5/7271 A61B5/746 A61B2560/0475 A61B5/7405 A61B5/7475 A61B5/165 A61B5/4266 A61B5/742 A61B5/02055 A61B5/1116 A61B5/1118 A61B5/14507 A61B5/6823 A61B5/6831 A61B2560/0242 G06F19/34 G06F19/3418 G16H40/67 G16H50/20 G16H50/30 A61B5/72		
优先权	61/352293 2010-06-07 US		
外部链接	Espacenet USPTO		

摘要(译)

提供了一种确定人脱水概率的系统，设备和方法。在一个实施例中，该方法包括接收人的心率数据;接收人的姿势数据;确定该人的第一姿势在第一预定时间段内满足第一姿势标准;通过姿势包络确定人的姿势满足相似度阈值;在第一姿势时确定该人的第一心率;在第二姿势时确定该人的第二心率;确定心率的变化作为第二心率和第一心率之间的差异;至少部分地基于心率的变化确定第一脱水概率;并输出第一次脱水概率。