CLAIMS

1. A continuous monitoring device attachable to a patient, the monitoring device comprising:

an enclosure having a surface that may be adhered to the patient;

a first pair of electrodes operable to contact the skin of the patient;

a plurality of sensors, each of the plurality of sensors configured to output physiological data relating to a respiratory condition, disorder or ailment of the patient, wherein the sensors include: an impedance plethysmography sensor coupled to the first pair of electrode pads, the impedance plethysmography sensor operable to sense a voltage between the first pair of electrode pads; and a heart rate sensor coupled to the first pair of electrode pads, the heart rate sensor operable to sense a voltage between the first pair of electrode pads;

a signal processor coupled to the impedance plethysmography sensor and the heart rate sensor operable to multiplex respiratory signals and heart rate signals received by the impedance plethysmography sensor and the heart rate sensor from the first pair of electrode pads;

a memory configured to store the physiological data; and

a transceiver operable to transmit the physiological data to an external device.

2. The monitoring device of claim 1, further comprising a second pair of electrode pads to which the impedance plethysmography sensor is coupled for injection of low-amplitude, high-frequency current.

3. The monitoring device of claim 1, wherein the enclosure has a form factor that is one of the group consisting of: a patch, a wristband, a necklace, and a vest.

4. The monitoring device of claim 1, wherein the plurality of sensors includes at least one of an audio sensor, an accelerometer, a gyroscope or a pressure sensor.

5. The monitoring device of claim 1, wherein the enclosure is fabricated from a flexible compliant material.

6. The monitoring device of claim 1, further comprising an adhesive accessory including a top layer, an adhesive layer and a bottom protective layer, the top layer including a skirt and

a cutout in a shape of the surface of the enclosure, wherein when the cutout is removed leaving the skirt in place, the adhesive layer is exposed for adherence to the surface of the enclosure, and when the bottom protective layer is removed, the adhesive layer is exposed for adherence to the patient.

7. The monitoring device of claim 1, further comprising a controller coupled to the memory and the signal processor, the controller programmed via a routine stored in the memory to refine physiological data from the plurality of sensors.

8. A system to monitor a respiratory condition of a patient, the system comprising:

a monitor attachable to the patient, the monitor including:

a plurality of sensors, each of the plurality of sensors configured to output physiological data relating to the respiratory condition of the patient, the plurality of sensors including a respiratory sensor; and

a first transceiver configured to transmit the physiological data;

an external device including a second transceiver configured to receive the physiological data from the first transceiver; and

an analytics platform, coupled to the second transceiver, configured to:

analyze the physiological data received from the second transceiver to determine the occurrence of a symptom of the respiratory condition; and

determine a risk evaluation of an event of the respiratory condition of the patient by correlating impedance measurements from the respiratory sensor with lung volume; constructing a flow-volume curve from the lung volume; extracting one or more tidal volume parameters from the flow-volume curve; deriving features from the tidal volume parameters; applying a first model to the features to determine the risk evaluation; and predicting an event of the respiratory condition by comparing the risk evaluation with a threshold.

9. The system of claim 8, wherein the analytics platform is further configured to analyze environmental data related to the patient in determining the occurrence of the symptom of the respiratory condition.

10. The system of claim 8, wherein the analytics platform is further configured to analyze

demographic data related to the patient in determining the occurrence of the symptom of the respiratory condition.

11. The system of claim 8, wherein the symptom is shortness of breath, wherein the plurality of sensors includes an accelerometer, and a pressure sensor, and wherein the analytics platform is configured to determine shortness of breath using a combination of:

breathing effort determined from the pressure sensor and the accelerometer, and

respiration rate determined from the respiratory sensor.

12. The system of claim 8, wherein the plurality of sensors includes an audio sensor, and wherein the analytics platform is further configured to differentiate between a soft wheeze and other adventitious signals based on data from the audio sensor.

13. The system of claim 8, wherein the analytics platform is configured to apply a second model to the physiological data to determine the occurrence of the symptom of the respiratory condition.

14. The system of claim 13, wherein the second model is configured by machine learning based on collected physiological data and respiratory condition outcome data.

15. The system of claim 8, wherein the plurality of sensors includes an impedance plethysmography sensor, and wherein the analytics platform is configured to determine lung volume by correlating impedance measurements from the impedance plethysmography sensor.

16. The system of claim 15, wherein the one or more tidal volume parameters are drawn from the group consisting of:

Time to Peak Expiratory Flow over Expiratory Time;

Volume at Peak Expiratory Flow over Expiratory Tidal Volume; and

Slope of post-peak Expiratory Flow Curve.

17. The system of claim 8, wherein the analytics platform is further configured to issue an alert based on the risk evaluation.

18. The system of claim 17, further comprising an alert device configured to:

receive the alert issued by the analytics platform, and

alert a person on receipt of the alert.

19. A method to monitor a respiratory condition of a patient, the method comprising:

transmitting physiological data from a monitor attached to the patient, the monitor including:

a plurality of sensors, each of the plurality of sensors configured to output physiological data relating to the respiratory condition of the patient, the plurality of sensors including a respiratory sensor; and

a first transceiver configured to transmit the physiological data;

receiving the physiological data on a second transceiver of an external device configured to receive the physiological data from the first transceiver;

analyzing the physiological data received from the second transceiver via an analytics platform coupled to the second transceiver to determine the occurrence of a symptom of the respiratory condition; and

determining a risk evaluation of an event of the respiratory condition of the patient by correlating impedance measurements from the respiratory sensor with lung volume; constructing a flow-volume curve from the lung volume; extracting one or more tidal volume parameters from the flow-volume curve; deriving features from the tidal volume parameters; and applying a model to the features to determine the risk evaluation.

20. The system of claim 8, wherein the event is an asthma attack.