sampling a physical data value from the at least one fluid sensor in the patient module;

calculating, via the computing device, a virtual data for the patient module, including at least one of an immediate vital sign and a long-term clinical course of the patient module, in at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system, by implementing at least one algorithm that evaluates the identified clinical scenario, the physical data from at least one sensor, and the optional input from the operator setting the virtual variable; and wherein:

the plurality of therapeutic machines includes an extracorporeal membrane oxygenation (ECMO) machine, and a heart lung machine (HLM); and

no hardware changes to the patient module are required for running any one of the plurality of therapeutic machines.

[0012D] Disclosed herein is medical simulation system, comprising:

a patient module that represents a human body, the patient module comprising:

a fluid circuit coupleable to one or more different types of therapeutic machines for interactively communicating a fluid therebetween;

a patient display/delivery device coupled to the patient module; and

a computing device coupled to the patient module and the patient display/delivery device, the computing device comprising a processor and a memory that are coupled to each other; and wherein the computing device is configured to:

interact with the patient module to simulate one or more vital signs of the patient module as the patient module interacts with the one or more different types of therapeutic machines; and

receive physical data from the patient module;

instruct the patient module to implement a clinical scenario;

calculate at least simulated pressure signal based on a measured pressure for the patient module interacting with the one or more different types of therapeutic machines;

display the calculated virtual data the patient display/ delivery device; and wherein

the computing device contains a superset of programming capability for one or more different types of therapeutic machines;

the virtual data calculated simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body; and

the one or more different types of therapeutic machines do not include a device that does not couple directly to the patient module

[0012E] Disclosed herein is a computer-implemented method of operating a medical simulation system including a patient module with a fluid circuit and a patient display/delivery device, wherein the method is implemented on a computing device having a memory, a processor and a storage device having stored instructions which, when executed by the at least one processor, implement the method, said method comprising:

receiving from the patient display/delivery device, an input instruction to select and to control the medical simulation system;

instructing the patient module to implement a clinical scenario

calculating at least simulated pressure signal based on a measured pressure for the patient module interacting with the one or more different types of therapeutic machines

calculating and communicating one or more virtual physiological conditions to the patient display/delivery device;

communicating the calculated virtual data the patient display/ delivery device; and wherein

the computing device simulates a plurality of types of therapeutic machines;

the virtual data calculated simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body.

[0012F] Disclosed herein is a medical simulation system, comprising:

means for simulating a human body comprising:

means for simulating a fluid circuit of the human body as coupled to at least one of a plurality of different types of therapeutic machines for interactively communicating a fluid therebetween;

means for displaying information and delivering treatment to the human body being simulated;

means for computing data for the simulation of the human body, wherein the means for computing data is configured to:

interact with the means for simulating the human body to simulate one or more vital signs while interacting with the at least one of the plurality of different types of therapeutic machines; and

receive data from the means for simulating the human body and provides instructions to the means for simulating the human body to implement a clinical scenario; and wherein:

the medical simulation system simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body.

CLAIMS

I/We claim:

1. A medical simulation system, comprising:

a patient module representing a human body, the patient module comprising:

a fluid circuit coupleable to an extracorporeal membrane oxygenator (ECMO) machine for interactively communicating a fluid therebetween;

a patient display/delivery device; and

a computing device coupled to the patient module and the patient display/delivery device, wherein the computing device includes a processor and a memory coupled to each other; and wherein:

the computing device interacts with the patient module to simulate vital signs of the patient module as the patient module interacts with the ECMO machine; and

the computing device receives physical data from the patient module and provides instructions to the patient module to implement a clinical scenario.

2. The medical simulation system of claim 1 wherein:

the patient module further comprises:

an input port disposed in the fluid circuit;

an output port disposed in the fluid circuit;

at least one fluid sensor disposed in the fluid circuit for measuring a fluid property; and

at least one control device disposed in the fluid circuit for altering a fluid performance in the fluid circuit; and

the patient display/delivery device displays at least a portion of the clinical scenario for an operator, and is configured to receive an instruction from the operator to adjust at least one virtual control of the ECMO machine; and

the computing device further comprises:

an instructor display coupled to the processor, the instructor display for displaying details of the clinical scenario; and wherein:

the computing device is coupled to the patient module via an analog-to-digital converter module.

3. The medical simulation system of claim 2 wherein the fluid circuit further comprises:

the output port is coupled to an output conduit in the patient module, the output port for outputting fluid from the patient module to the ECMO machine; and

the input port is coupled to an input conduit in the patient module, the input port for receiving fluid from the ECMO machine to the patient module; and wherein:

the output port is configured as a venous drain;

the input port is selectively configured as a venous return or an arterial return to the patient module; and wherein:

the fluid circuit has a same routing path in the patient module regardless of whether the input port is configured as the venous return or the arterial return.

4. The medical simulation system of claim 1 wherein the means for varying the cannula resistance is a stepper motor proportioning valve having a selectively variable internal diameter that varies a flow rate of the fluid over a range a neonate to for a range for an adult, as instructed by the computing device based upon the clinical scenario.

5. The medical simulation system of claim 2 wherein the processor and memory are configured to implement a process of:

receiving the clinical scenario selection that is selected via an interface to the computing device;

receiving a physical data from the at least one fluid sensor in the patient module, wherein the data from the at least one fluid sensor measures any changes in the fluid received from the ECMO machine in response to a change the operator made to the ECMO machine;

calculating at least one virtual fluid data, via an algorithm, for the patient module based on at least one of the clinical scenario, and the physical data from the at least one fluid sensor; and

the at least one virtual fluid data is one of a central venous pressure (CVP), a coronary sinus pressure (CSP), a pulmonary pressure, an arterial pressure, arterial flow rate, and venous flow rate.

6. The medical simulation system of claim 5 wherein the processor and memory are further configured to implement a process of:

receiving an optional input from the operator, via a patient display/delivery device coupled to the computing device, to select one of a virtual drug dose, a virtual lab test, a change to a virtual control presented by the clinical scenario; and

receiving an optional input from an instructor, via an instructor interface, to modify one of a virtual control data.

7. The medical simulation system of claim 6 wherein the processor and memory are further configured to implement a process of:

calculating, via the computing device, a virtual data for the patient module, including at least one of an immediate vital sign and a long-term clinical course, in at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system, by implementing at least one algorithm that evaluates at least one of the clinical scenario, the physical data from at least one sensor, the change to the virtual control by the operator, the at least one virtual fluid pressure, and the optional input from the instructor;

displaying one or more of the immediate vital sign and a long-term clinical course on at least one of the patient display/delivery device and the GUI; and

optionally generating a control signal to the at least one control device in the patient module based on the algorithm and the clinical scenario.

8. The medical simulation system of claim 6 wherein the patient module further includes:

a microcontroller and a memory coupled to the at least one sensor and the at least one control device; and wherein:

the microcontroller and memory implement at least one algorithm that simulate a reflexive action of the patient module based on one or more of the at least one fluid sensor and the at least one control device in the patient module; and

the microcontroller can operate independently of the computing device.

9. The medical simulation system of claim 11 wherein:

the virtual data virtual data generated from the at least one algorithm for the patient module includes at least one of a central venous pressure (CVP), a coronary sinus pressure (CSP), a cardiac output, a mixed venous O2 saturation level, an active clotting time (ACT), a heparin resistance, an elevated of blood pressure level, a heart failure mode, a pathology condition, EKG pattern, oxygenation delivery rate and CO2 removal rate, a blood clotting property, and concurrent blood gas levels for of pre-oxygenator, post-oxygenator, and arterial and venous blood categories.

10. The medical simulation system of claim 5 wherein:

the computing device programmably implements the clinical scenario;

the clinical scenario comprises a plurality of sequential steps that are automatically implemented;

each of the sequential steps contains a time value specifying the duration of the sequentially timed step, or contains a condition precedent specifying a condition that must be satisfied before advancing to a next step;

at least one of the sequential steps contains a value for controlling the at least one control device in the patient module; and

at least one of the sequential steps contains physiological data of a body being simulated.

11. The medical simulation system of claim 10 wherein:

the plurality of steps is received on an electronic file with field-separated columns for data entries, and with at least one row entry for each sequential step;

the clinical scenario can be interrupted by an instructor input at an end of a given step and pause or cancel the clinical scenario;

an annotation can be entered, via the instructor display or the patient display, into the electronic file for the clinical scenario at a given step to document a performance of the operator; and

at least one of the sequential steps contains an audio/visual file, for a surgical operation or a diagnostic treatment information for the simulated patient; and

the audio/visual file is one of a text-to-voice script for a verbal communication to the operator, a video clip of a surgical operation, and a video or image of a clinical test requested in the clinical scenario.

12. The medical simulation system of claim 1 wherein:

the computing device is selectable to operate in a real mode or in a simulation mode;

the real mode interacts with the patient module to evaluate the at least one fluid property measured and to provide a signal to the at least one control device; and

the simulated mode provides no interaction with the patient module and calculates all data for a simulated patient.

13. A medical simulation system, comprising:

a patient module representing a human body, the patient module comprising:

a fluid circuit coupleable to at least one of a plurality of different types of therapeutic machines for interactively communicating fluid therebetween; and

a computing device coupled to the patient module, wherein the computing device comprising a processor coupled with a memory; and wherein:

the computing device interacts with the patient module to simulate the patient undergoing therapy with the at least one of the plurality of types of therapeutic machines;

the plurality of different types of therapeutic machines is one of an extracorporeal membrane oxygenation (ECMO) machine, and a heart lung machine (HLM);

the at least one clinical scenario is selected based on an identified therapeutic machine chosen from the plurality of different types of therapeutic machines for; and

no hardware changes are required to the patient module for any of the plurality of different types of therapeutic machines;

14. The medical simulation system of claim 13 wherein the at least one of the plurality of types of therapeutic machines is one of:

a ventricular assist device (VAD);

a hypothermic intraperitoneal chemotherapy (HIPEC);

an emergency cardiac life support (ECLS);

a heater/cooler machine (HCM); and

an aortic balloon pump.

15. The medical simulation system of claim 14 wherein the patient module further comprises:

at least one fluid sensor disposed in the fluid circuit for measuring a fluid property;

at least one control device for altering a fluid performance; and

at least one port coupled to the fluid sensor; and wherein:

the at least one fluid sensor measures a fluid property that is common among all of the plurality of types of therapeutic machines;

the at least one control device controls a fluid performance that is common among all the plurality of types of therapeutic machines;

the computing device algorithmically generates at least one virtual fluid property of the patient module that is needed by the clinical scenario for identified therapeutic machine;

the computing device displays the at least one virtual fluid property on at least one of a patient display/delivery device used by the operator, and an instructor display of the computing device used by an instructor; and

the computing device displays a virtual control, on the instructor display, having a selectable parameter for the identified therapeutic machine.

16. The medical simulation system of claim 15 wherein the fluid circuit further comprises:

at least one output port coupled to an output conduit in the patient module, the at least one output port for outputting fluid from the patient module to the identified therapeutic machine; and

at least one input port coupled to an input conduit in the patient module, the input port for receiving fluid from the identified therapeutic machine; and wherein:

the output port is configured as a venous drain of the patient; and

the input port is selectively configured to as a venous return or an arterial return of the patient module as configured by the computing device according to the clinical scenario chosen and according to the identified therapeutic machine.

17. The medical simulation system of claim 16 wherein:

the fluid property that is common among all of the plurality of types of therapeutic machines includes at least one of an input fluid pressure that represents either an arterial return pressure or a venous return pressure, an output fluid pressure that represents a venous drain pressure, and a flow rate of fluid on the input conduit; and

the at least one control device that is common among all the plurality of types of therapeutic machines includes at least one of a diameter of the input conduit that represents a diameter of a cannula used for the input, and a diameter of the output conduit representing a cannula used for an output.

18. The medical simulation system of claim 15 wherein the processor and memory are configured to implement a process of:

receiving the clinical scenario selected via an interface to the computing device;

receiving a physical data from the at least one sensor in the patient module, wherein the data from the at least one sensor measures any changes in the fluid received from the identified therapeutic machine in response to any change the operator made to the identified therapeutic machine;

calculating at least one virtual fluid data, via an algorithm, for the patient module based on at least one of the clinical scenario, and the physical data from the at least one fluid sensor; and

the at least one virtual fluid data is one of a central venous pressure (CVP), a coronary sinus pressure (CSP),a pulmonary pressure, an arterial pressure, arterial flow rate, and venous flow rate.

19. The medical simulation system of claim 17 wherein the processor and memory are further configured to implement a process of:

calculating, via the computing device, a virtual data for the patient module, including at least one of an immediate vital sign and a long-term clinical course of the patient in at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system, via an algorithm that evaluates at least one of the clinical scenario, the data from at least one sensor, the change to the virtual control by the operator, and the optional input from the instructor;

displaying on at least one of the patient display/delivery device and the GUI, the at least one of an immediate vital sign and a long-term clinical course, and any change to the virtual control;

optionally generating a control signal to the at least one control device in the patient module based on the algorithm and the clinical scenario; and

optionally generating a control signal to the at least one virtual control simulated by the computing device, based on the algorithm and the clinical scenario.

20. The medical simulation system of claim 19 wherein:

receiving an input from the operator via a patient display/delivery device coupled to the computing device, wherein the input from the operator is for any one of a drug dose, and a change to the virtual control required by the clinical scenario or input by the operator on the patient display; and

receiving an optional input from an instructor, via an instructor interface, to modify one of a virtual control data.

21. The medical simulation system of claim 18 wherein:

a selection is made by the operator to add another one of the plurality of types of therapeutic machines, as an additional therapeutic machine, to the simulation system;

the computing device simulates at least another one of the plurality of types of therapeutic machines as a virtual therapeutic machine that is algorithmically interfaced with the identified one of the plurality of types of therapeutic machines.;

the virtual therapeutic machine algorithmically interacts with the identified therapeutic machine that is coupled to the patient module;

the computing device simulates at least one virtual control feature of the virtual therapeutic machine; and

the computing device modifies at least one of an immediate vital sign and a long-term clinical course of the patient based on the operator input to the virtual control feature of the virtual therapeutic machine.

22. The medical simulation system of claim 21 wherein:

the identified therapeutic machine is the ECMO machine;

the additional therapeutic machine is a VAD machine;

the data from the at least one sensor in the patient module measures a change in the flow rate of the fluid received from the ECMO machines that results from a change in the pump flow rate setting made by the operator; and

the virtual control change made by the operator on the patient display/delivery device is a change in the ECMO oxygenation rate that is algorithmically simulated by the computing device and displayed on the patient display/delivery device.

23. A method of programmably implementing one of a plurality of clinical scenario in a simulation system having a patient module coupled to a computing device and to one of a plurality of therapeutic devices, the method comprising:

receiving an input identifying one of the plurality of therapeutic devices as an identified therapeutic device to which the patient module is coupled for the clinical scenario;

receiving an input identifying one of the plurality of clinical scenarios as an identified clinical scenario to be evaluated on the identified therapeutic device;

receiving a sequential step of data from the identified clinical scenario;

reading a data value, contained in the sequential step of data, for at least one control device in the patient module;

reading a data value, contained in the sequential step of data, for at least one physiological condition for the patient module; and

reading a data value, contained in the sequential step of data, for at least one virtual control in the identified therapeutic device for the patient module;

receiving an optional input from an operator, via a patient display/delivery device, of a setting of a virtual variable of the identified therapeutic machine;

sampling a physical data value from the at least one fluid sensor in the patient module;

calculating, via the computing device, a virtual data for the patient module, including at least one of an immediate vital sign and a long-term clinical course of the patient module, in at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system, by implementing at least one algorithm that evaluates the identified clinical scenario, the physical data

from at least one sensor, and the optional input from the operator setting the virtual variable; and wherein:

the plurality of therapeutic machines includes an extracorporeal membrane oxygenation (ECMO) machine, and a heart lung machine (HLM); and

no hardware changes to the patient module are required for running any one of the plurality of therapeutic machines.

24. The method of claim 23 further comprising:

calculating at least one virtual fluid data, via an algorithm, for the patient module based on the identified clinical scenario, and the physical data from the at least one fluid sensor; and

the calculating operation additionally evaluates the at least one virtual fluid pressure in the algorithm.

25. The method of claim 23 further comprising:

receiving an additional optional input from the operator, via a patient display/delivery device coupled to the computing device, to select one of a virtual drug dose, a virtual lab test, a change to a virtual control presented by the clinical scenario;

receiving an optional input from an instructor, via an instructor interface, to modify one of a virtual control data; and

the calculating operation additionally evaluates the additional optional input from the operator and the optional input from the instructor in the algorithm.

26. The method of claim 23 further comprising:

receiving a time value, contained in the sequential step, that specifies a duration of the sequential step, or contains a condition precedent specifying a condition that must be satisfied before advancing to a next step;

automatically advancing the clinical scenario to a next step upon expiration of the time value or satisfaction of the condition precedent; and

receiving an optional input from the instructor for implementing one of an instruction to pause, cancel, or advance the clinical scenario, a modification of a virtual variable, and an override of a vital sign or a long-term clinical course.

27. The method of claim 23 further comprising:

displaying, on one of a patient monitor/ delivery device and an instructor display, one of a changed vital sign, a changed virtual value selection, and a new diagnostic tool;

outputting a control signal to the at least one control device in the patient module based on the calculating operation;

communicating at least one of an audio and a video file identified in a sequential step, for an instruction or a related-procedure for the given sequential step of the clinical scenario, including at least one of a text-to-voice script, a head-cam video clip of a surgeon's view of the operation, and a video or picture of a diagnostic test result (angiogram); and

optionally storing, at a given sampling resolution, one or more of the control values and virtual control choices by the operator and the resulting algorithmically calculated data.

28. The method of claim 23 further comprising:

adjusting, reflexively, at least one control variable in the patient module, via a microcontroller disposed in the patient module, based on the at least one data value measured in the patient module; and wherein:

the adjusting operation in the patient module is performed independently and without any input from the computing device.

29. The method of claim 23 further comprising:

receiving an input to operate the simulation system in a real mode or in a simulation mode; and wherein:

the real mode interacts with the patient module to evaluate the at least one fluid property measured and to provide a signal to the east one control device disposed; and

the simulated mode provides no interaction with the patient module and calculates all data for patient.

CLAIMS

1. A medical simulation system, comprising:

a patient module that represents a human body, the patient module comprising:

a fluid circuit coupleable to one or more different types of therapeutic machines for interactively communicating a fluid therebetween;

a patient display/delivery device coupled to the patient module; and

a computing device coupled to the patient module and the patient display/delivery device, the computing device comprising a processor and a memory that are coupled to each other; and wherein the computing device is configured to:

interact with the patient module to simulate one or more vital signs of the patient module as the patient module interacts with the one or more different types of therapeutic machines; and

receive physical data from the patient module;

instruct the patient module to implement a clinical scenario;

calculate at least simulated pressure signal based on a measured pressure for the patient module interacting with the one or more different types of therapeutic machines;

display the calculated virtual data the patient display/ delivery device; and wherein

the computing device contains a superset of programming capability for one or more different types of therapeutic machines;

the virtual data calculated simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body; and

the one or more different types of therapeutic machines do not include a device that does not couple directly to the patient module.

2. The medical simulation system of claim 1 wherein:

the fluid circuit contains a superset of fluid conduits;

at least one of the superset of fluid conduits is required to interface with each of the one or more different types of therapeutic machines; and

the computing device includes a superset of programming capacities in order to interface with any of the one or more different therapeutic machines.

3. The medical simulation system of claim 1 wherein:

the computing device can simulate at least one of the blood paths of venous out/ venous in (VV) or venous out / arterial in (VA) to the patient module without any plumbing hardware changes in the fluid circuit.

4. The medical simulation system of claim 1 wherein:

the computing device is further programmed to:

model the patient attribute dynamically as one of a patient getting sicker, a patient with an acute condition, a crashing patient, and a recovering patient.

5. The medical simulation system of claim 1 wherein:

the computing device is further configured to:

degrade a baseline heart metric of the human body in a first algorithm based on input from a second algorithm that simulates the pathological condition.

6. The medical simulation system of claim 1 wherein:

the at least one system of the human body for which a degree of the pathological condition is simulated includes at least one of a cardiovascular system, a pulmonary system, and a co-morbidly of both the cardiovascular system and the pulmonary system.

7. The medical simulation system of claim 1 wherein:

the fluid circuit of the patient module further comprises:

one or more variable physical control devices that simulate a degree of the pathological condition of at least one of a cardiovascular system, a pulmonary system, or a co-morbidly of both the cardiovascular system and the pulmonary system.

8. The medical simulation system of claim 1 wherein:

the one or more different types of therapeutic machines to which the medical simulation system can interface includes an extracorporeal membrane oxygenator (ECMO) machine.

9. The medical simulation system of claim 1 wherein:

the at least one or more different types of therapeutic machines to which the medical simulation system can interface includes a heart lung machine (HLM) for a cardiopulmonary bypass clinical scenario, an extra corporeal life support (ECLS) device, a ventricular assist device (VAD), a dialysis machines, a hyperthermic intraperitoneal chemotherapy (HIPEC) machine, an aortic balloon pump (ABP), or an ECMO machine.

10. The medical simulation system of claim 1 wherein:

the computing device and the patient module are configured to model one or more reactions of one or more systems of the human body being simulated with the at least one of the one or more different types of therapeutic machines.

11. The medical simulation system of claim 7 wherein the patient display/delivery device is further configured to:

receive and display physical data from the patient module;

receive a virtual physiological conditions calculated by the computing device; and

display on the patient display/delivery device, one or more selectable parameters to adjust the at least one of the one or more different types of therapeutic machines; and wherein:

each operation of receiving data, receiving conditions, and displaying selectable parameters simulate the degree of the pathological condition of at least one of the cardiovascular system, the pulmonary system, or the co-morbidly both the cardiovascular system and the pulmonary system.

12. The medical simulation system of claim 1 wherein:

the computing device is further configured to:

receive a custom clinical scenario of clinical data for at least one of: an activated clotting time (ACT), an arterial or venous color duplex imaging, a blood monitoring unit (BMU), a heparin management system (HMS), a blood gas analyzer, a cerebral oximetry (NIRS), a pulse oximetry, and a bispectral index (BIS) cerebral monitor.

13. The medical simulation system of claim 1 wherein additional factors of the human body being simulated include:

at least one of a plurality of patient-specific factors chosen from: a height, a sex, a weight, a body surface area (BSA), a physiologic factor of left ventricular (LV) and right ventricular (RV) contractility, a heart rate, a depth of anesthesia, a metabolic rate, an arterial pressure, a pulmonary artery pressure, an EKG including multiple arrhythmias, a heparin resistance, a change in blood pressure, and a heart failure.

14. The medical simulation system of claim 1 further comprising:

a first machine selected from the one or more different types of therapeutic machines;

a second machine selected from the one or more different types of therapeutic machines; and wherein:

the medical simulation system simulates an operation and an adjustment of the first machine and of the second machine concomitantly with each other and allows an independent input to at least one of the first machine and the second machine; and

the clinical scenario simulates a termination of the first machine and a transition to only the second machine.

15. The medical simulation system of claim 1 wherein:

the patient display/delivery device is configured to:

receive an input instruction to select the clinical scenario;

receive an input instruction to control the at least one of the one or more different types of therapeutic machines to treat the clinical scenario; and

receive an input of the degree of the pathological condition of at least one of a cardiovascular system, a pulmonary system, or a co-morbidly of both the cardiovascular system and the pulmonary system.

16. The medical simulation system of claim 1 wherein:

the computing device is further configured to:

receive from the patient display/delivery device, the input instruction to select and to control;

control the one or more variable physical controls of the fluid circuit;

calculate and communicate one or more virtual physiological conditions to the patient display/delivery device; and wherein:

at least one of the operations of receiving, controlling, calculating and communicating are based upon the degree of the pathological condition of at least one of a cardiovascular system, a pulmonary system or a co-morbidly of both the cardiovascular system and the pulmonary system.

17. The medical simulation system of claim 1 wherein:

the clinical scenario simulates a termination of the first machine and a transition to only the second machine.

18. The medical simulation system of claim 14 wherein:

the first machine is an ECMO machine, and the second machine is a VAD.

19. The medical simulation system of claim 1 wherein:

the one or more systems of the human body include at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system; and

the patient display/delivery device displays an impact of the one or more reactions to the one or more systems of the human body.

20. The medical simulation system of claim 1 wherein:

the degree of a pathological condition simulated includes at least one of a plurality of pulmonary conditions that include a dead space, a pulmonary shunt fraction, an airway resistance, and a pulmonary compliance.

21. The medical simulation system of claim 20 wherein:

the computing device calculates blood gas parameters based upon the degree of pathological conditions of pulmonary conditions being simulated and based upon adjustments received from the patient display/delivery device for the at least one of the one or more different types of therapeutic machines.

22. A computer-implemented method of operating a medical simulation system including a patient module with a fluid circuit and a patient display/delivery device, wherein the method is implemented on a computing device having a memory, a processor and a storage device having stored instructions which, when executed by the at least one processor, implement the method, said method comprising:

receiving from the patient display/delivery device, an input instruction to select and to control the medical simulation system;

instructing the patient module to implement a clinical scenario

calculating at least simulated pressure signal based on a measured pressure for the patient module interacting with the one or more different types of therapeutic machines

calculating and communicating one or more virtual physiological conditions to the patient display/delivery device;

communicating the calculated virtual data the patient display/ delivery device; and wherein

the computing device simulates a plurality of types of therapeutic machines;

the virtual data calculated simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body

23. The method of claim 22 further comprising:

interacting with a patient module to simulate one or more vital signs of the patient module as the patient module interacts with the at least one or more different types of therapeutic machines; and

receiving physical data from the patient module and providing instructions to the patient module to implement a clinical scenario; and wherein:

the at least one system of the human body for which one or more virtual physiological conditions is calculated based upon the degree of pathological condition includes at least one of a cardiovascular system, a pulmonary system, and a co-morbidly of both the cardiovascular system and the pulmonary system.

24. The method of claim 22 further comprising:

modeling one or more reactions of one or more systems of the human body being simulated with the at least one of the plurality of different types of therapeutic machines; and wherein:

the one or more systems of the human body include at least one of a cardiovascular system, a respiratory system, a hematological system, and a renal system.

25. The method of claim 22 further comprising:

receiving a custom clinical scenario of clinical data for at least one of an activated clotting time (ACT), an arterial or venous color duplex imaging, a blood monitoring unit (BMU), a heparin management system (HMS), a blood gas analyzer, a cerebral oximetry (NIRS), a pulse oximetry, and a bispectral index (BIS) cerebral monitor.

26. The method of claim 23 further comprising:

degrading a baseline heart metric of the human body in a first algorithm based on input from a second algorithm that simulates the pathological condition.

27. The method of claim 24 further comprising:

receiving from the patient display/delivery device, the input instruction to select and to control;

controlling the one or more variable physical controls of a fluid circuit in the patient module; and

calculating and communicate one or more virtual physiological conditions to the patient display/delivery device; and wherein:

at least one of the operations of receiving, controlling, calculating and communicating are based upon the degree of the pathological condition of at least one of a cardiovascular system, a pulmonary system or a co-morbidly of both the cardiovascular system and the pulmonary system.

28. The method of claim 23 further comprising:

calculating blood gas parameters based upon the degree of pathological conditions of pulmonary conditions being simulated and based upon adjustments received from the patient display/delivery device for the at least one of the plurality of different types of therapeutic machines.

29. A medical simulation system, comprising:

means for simulating a human body comprising:

means for simulating a fluid circuit of the human body as coupled to at least one of a plurality of different types of therapeutic machines for interactively communicating a fluid therebetween;

means for displaying information and delivering treatment to the human body being simulated;

means for computing data for the simulation of the human body, wherein the means for computing data is configured to:

interact with the means for simulating the human body to simulate one or more vital signs while interacting with the at least one of the plurality of different types of therapeutic machines; and

receive data from the means for simulating the human body and provides instructions to the means for simulating the human body to implement a clinical scenario; and wherein:

the medical simulation system simulates the clinical scenario of the human body according to a degree of a pathological condition of at least one system of the human body.