



US 20100137693A1

(19) **United States**

(12) **Patent Application Publication**
Porras et al.

(10) **Pub. No.: US 2010/0137693 A1**

(43) **Pub. Date: Jun. 3, 2010**

(54) **METHODS AND SYSTEMS FOR PATIENT CARE**

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(21) Appl. No.: **12/620,283**

(22) Filed: **Nov. 17, 2009**

Related U.S. Application Data

(63) Continuation-in-part of application No. 12/233,126, filed on Sep. 18, 2008, Continuation-in-part of application No. 11/591,438, filed on Nov. 1, 2006.

(60) Provisional application No. 61/199,470, filed on Nov. 17, 2008, provisional application No. 60/973,676, filed on Sep. 19, 2007, provisional application No. 60/732,335, filed on Nov. 1, 2005.

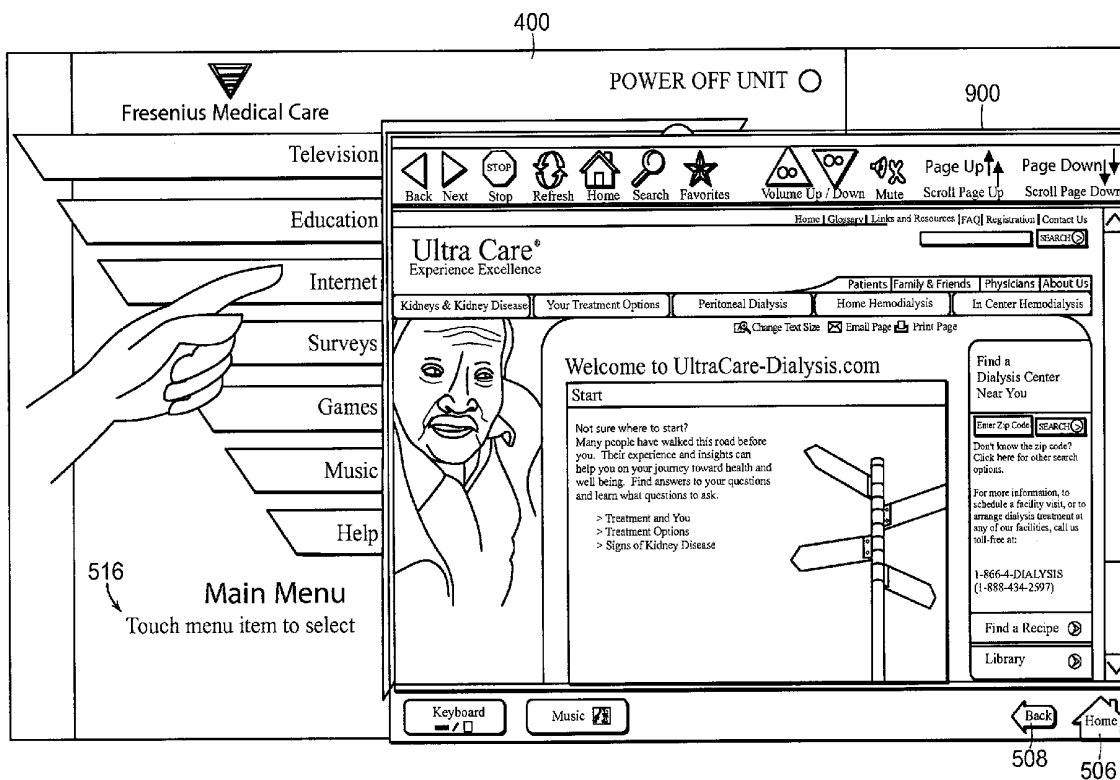
Publication Classification

(51) **Int. Cl.**
A61B 5/00 (2006.01)
G06Q 50/00 (2006.01)

(52) **U.S. Cl.** **600/301; 705/2; 705/3**

(57) **ABSTRACT**

Methods and apparatus for patient care detect a current medical condition of a patient receiving medical treatment, e.g., by sensing blood pressure, heart rate, weight, glucose level, hemoglobin level, and/or blood potassium level (all by way of example) and transmit information regarding that medical condition to a digital data processing system disposed remotely from the medical treatment apparatus. The medical treatment apparatus can be, for example, one for peritoneal dialysis and hemodialysis, and the medical condition can be sensed by sensors coupled to or otherwise utilized in connection with such apparatus.



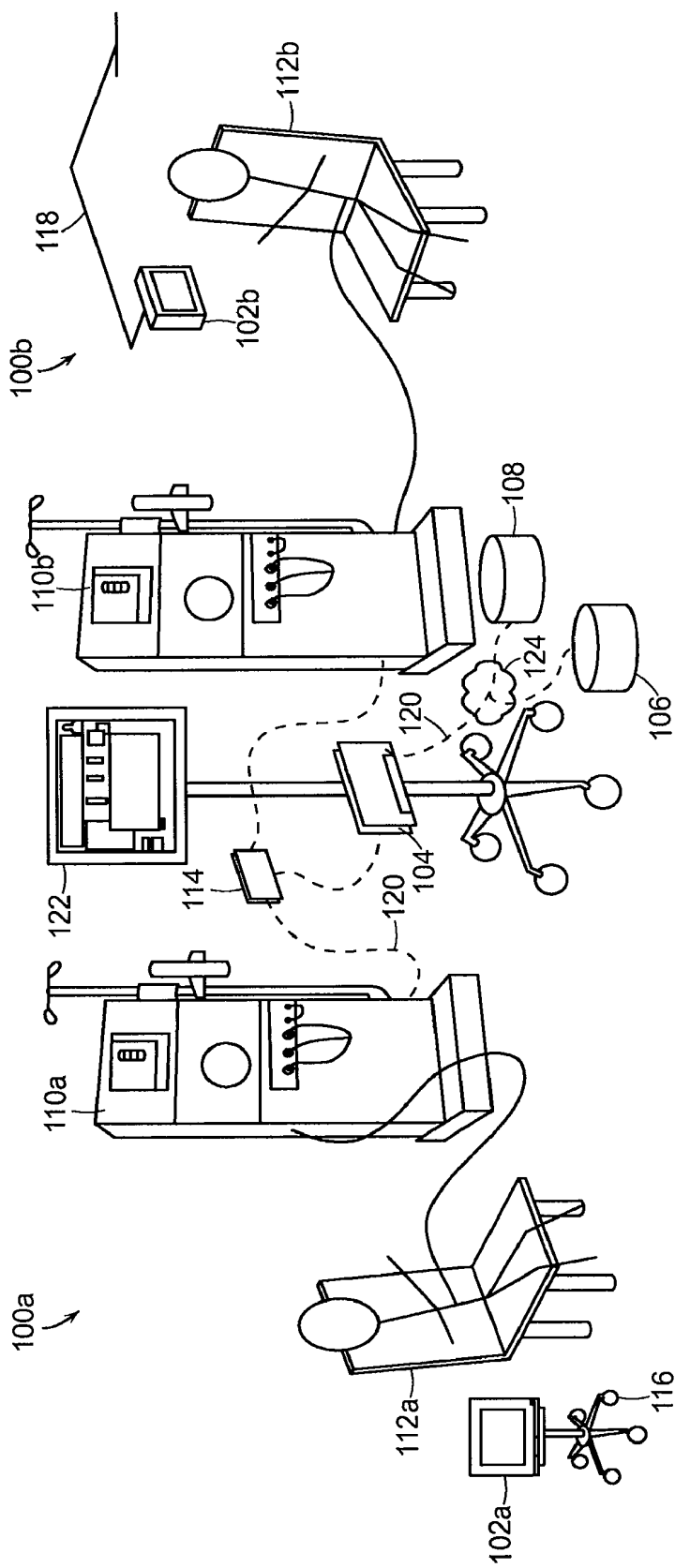


FIG. 1

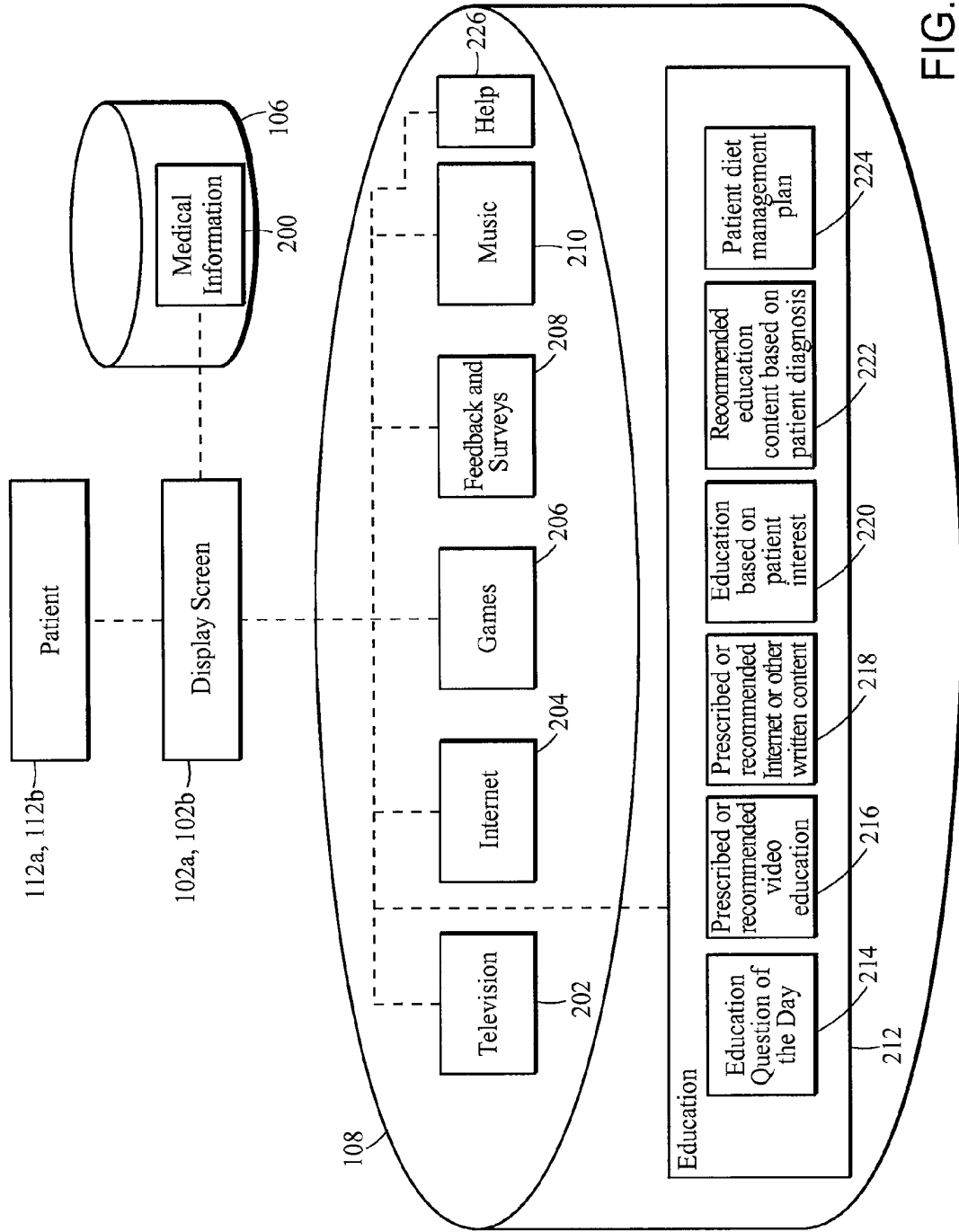


FIG. 2

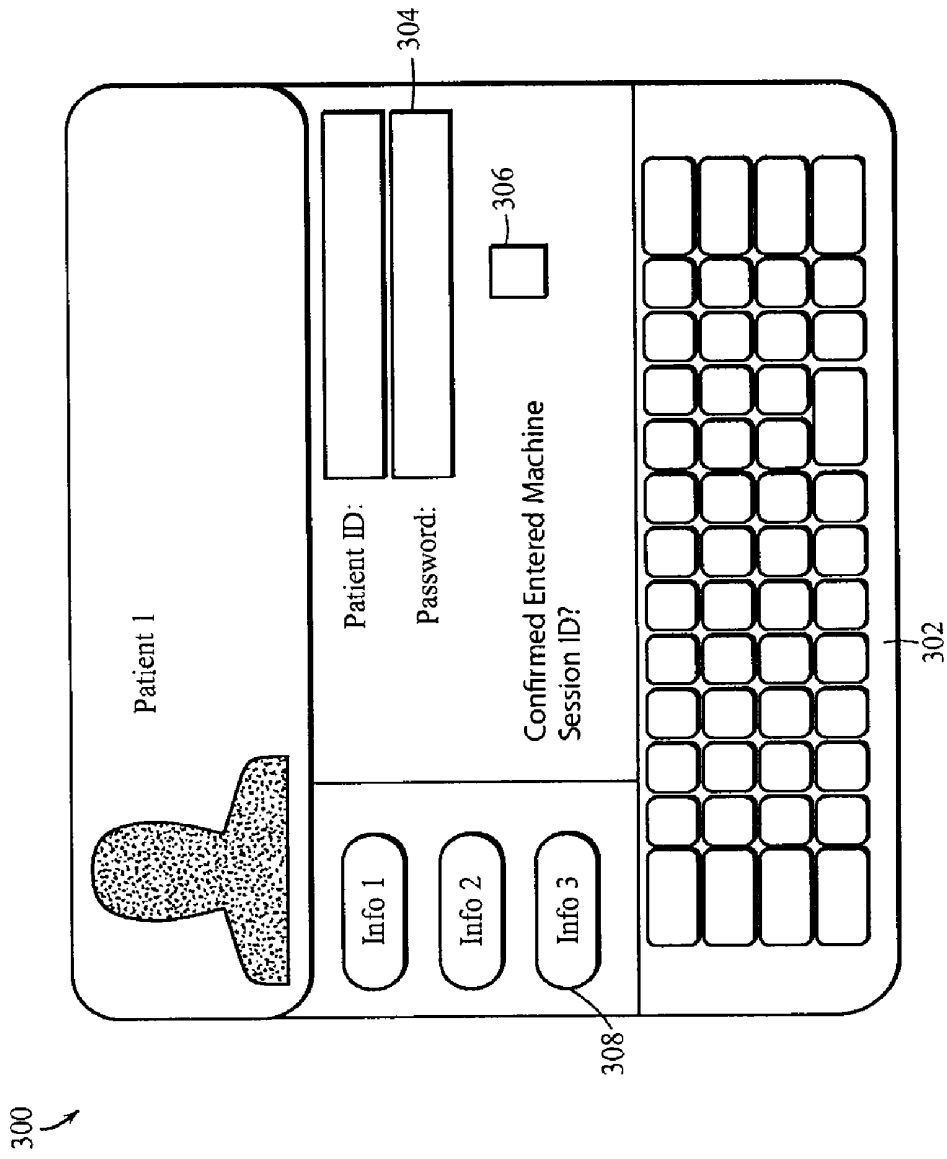


FIG. 3

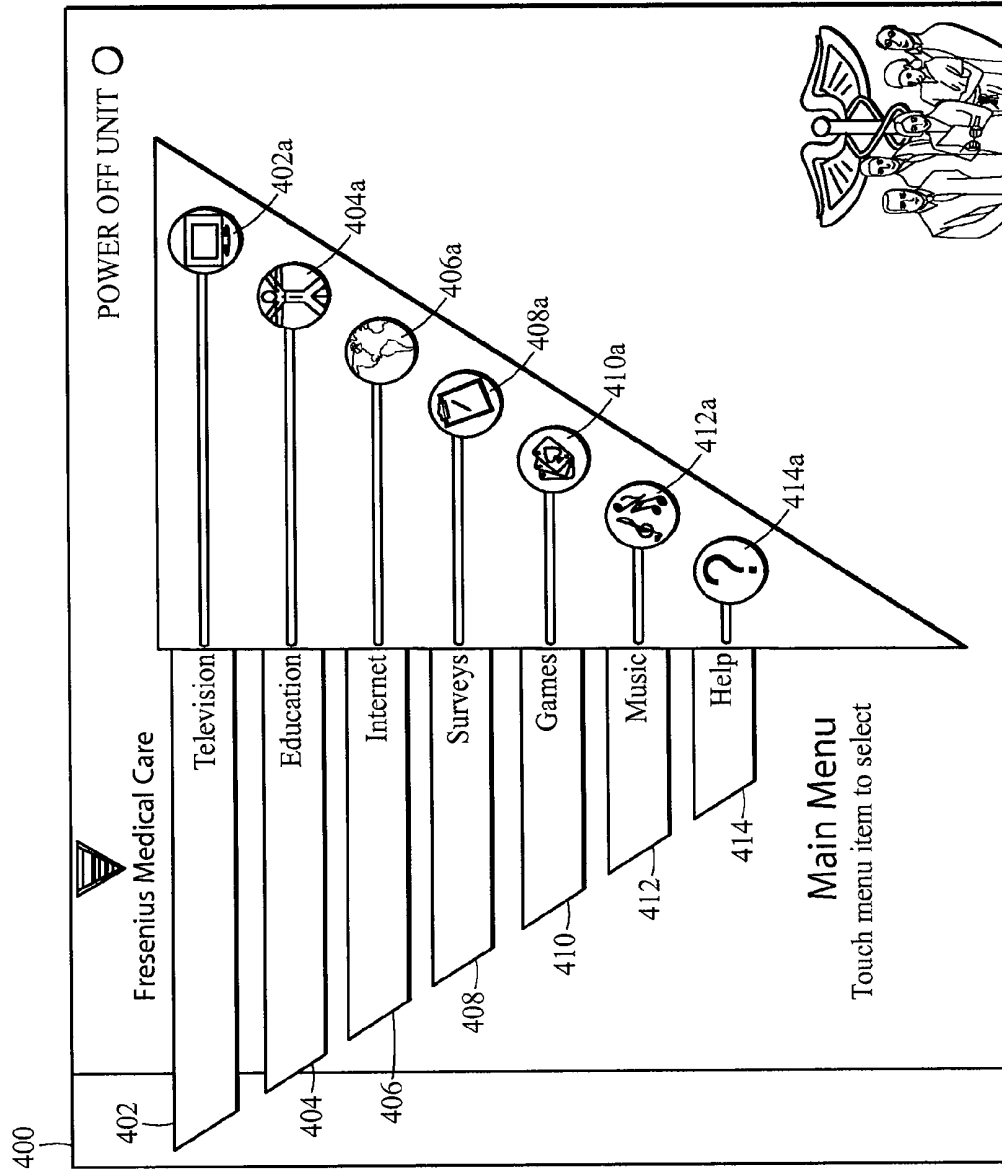


FIG. 4

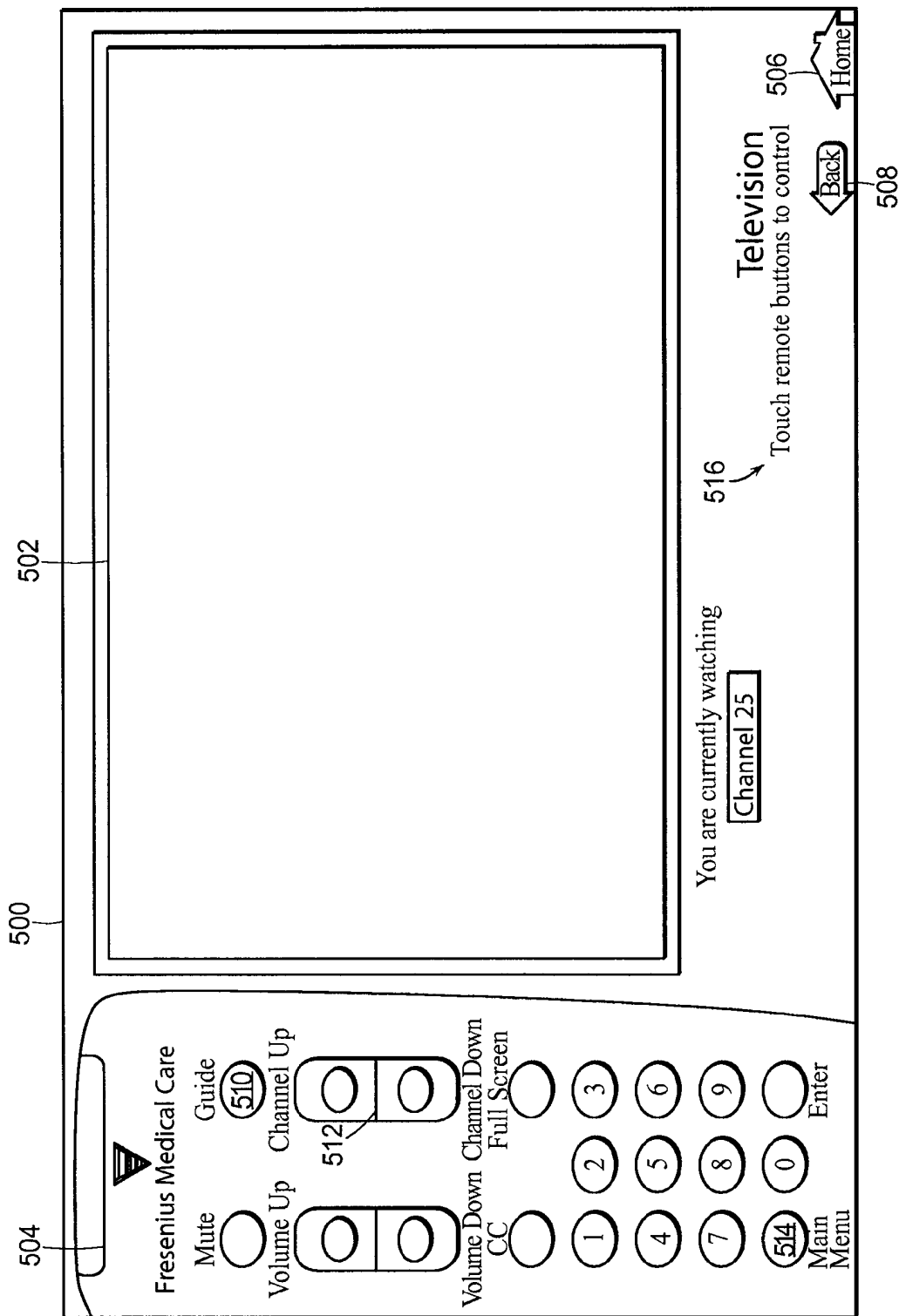


FIG. 5

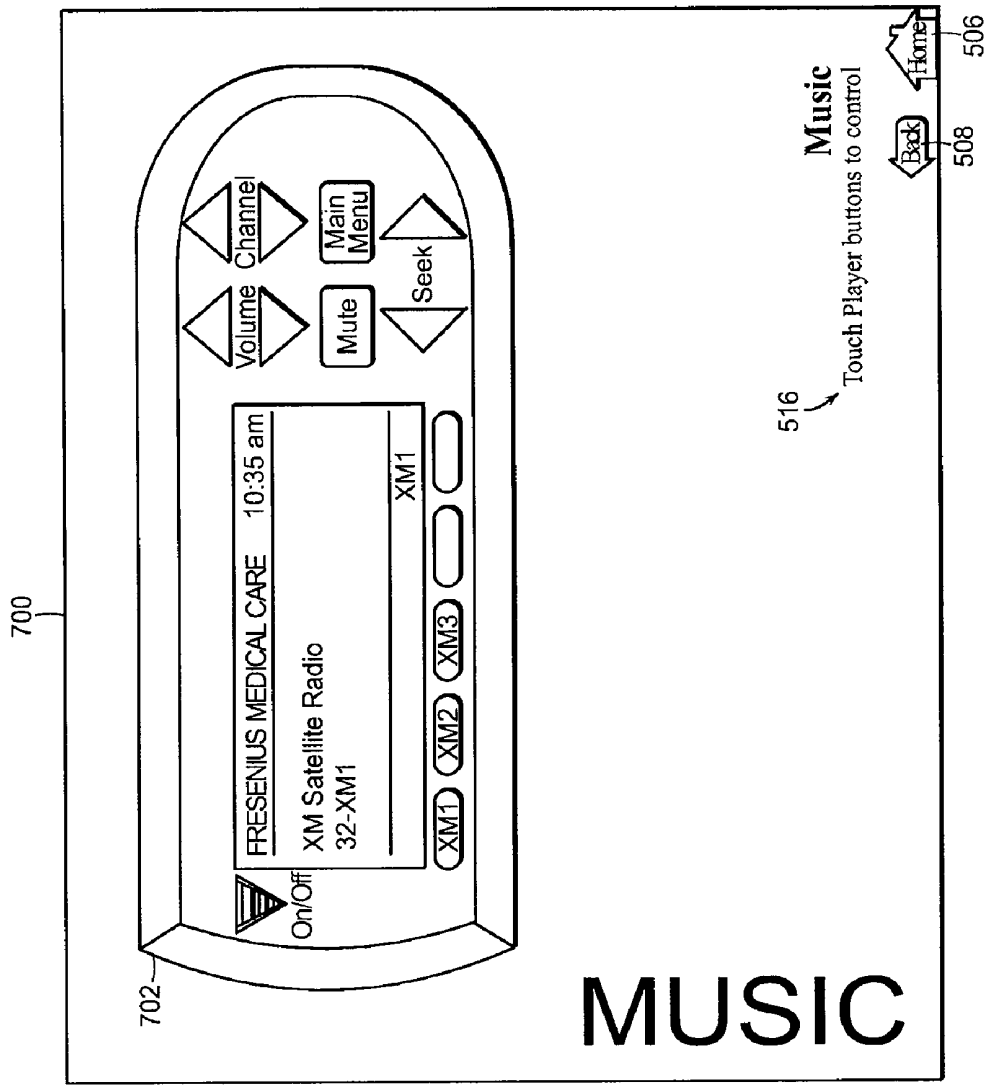


FIG. 7

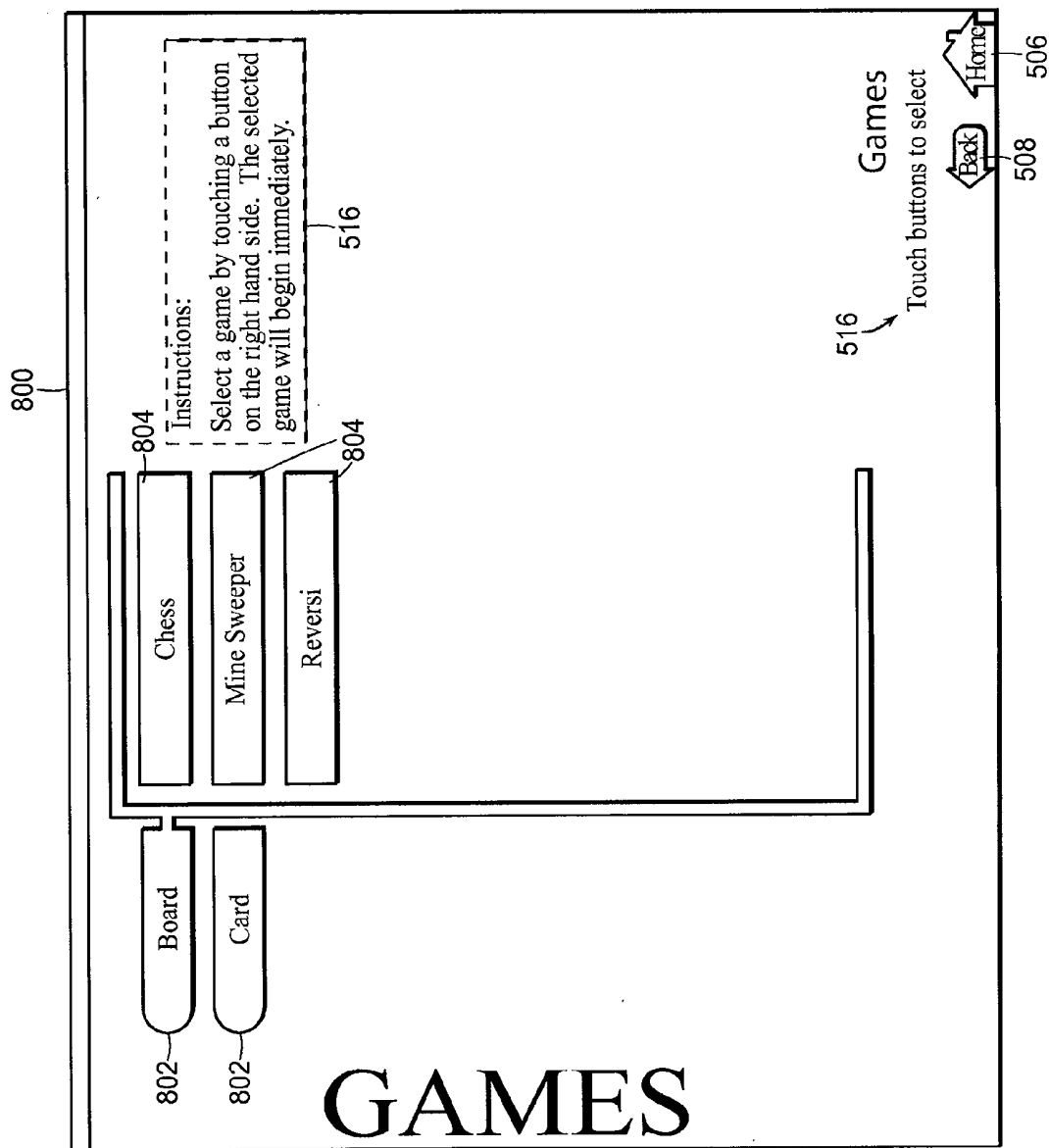


FIG. 8

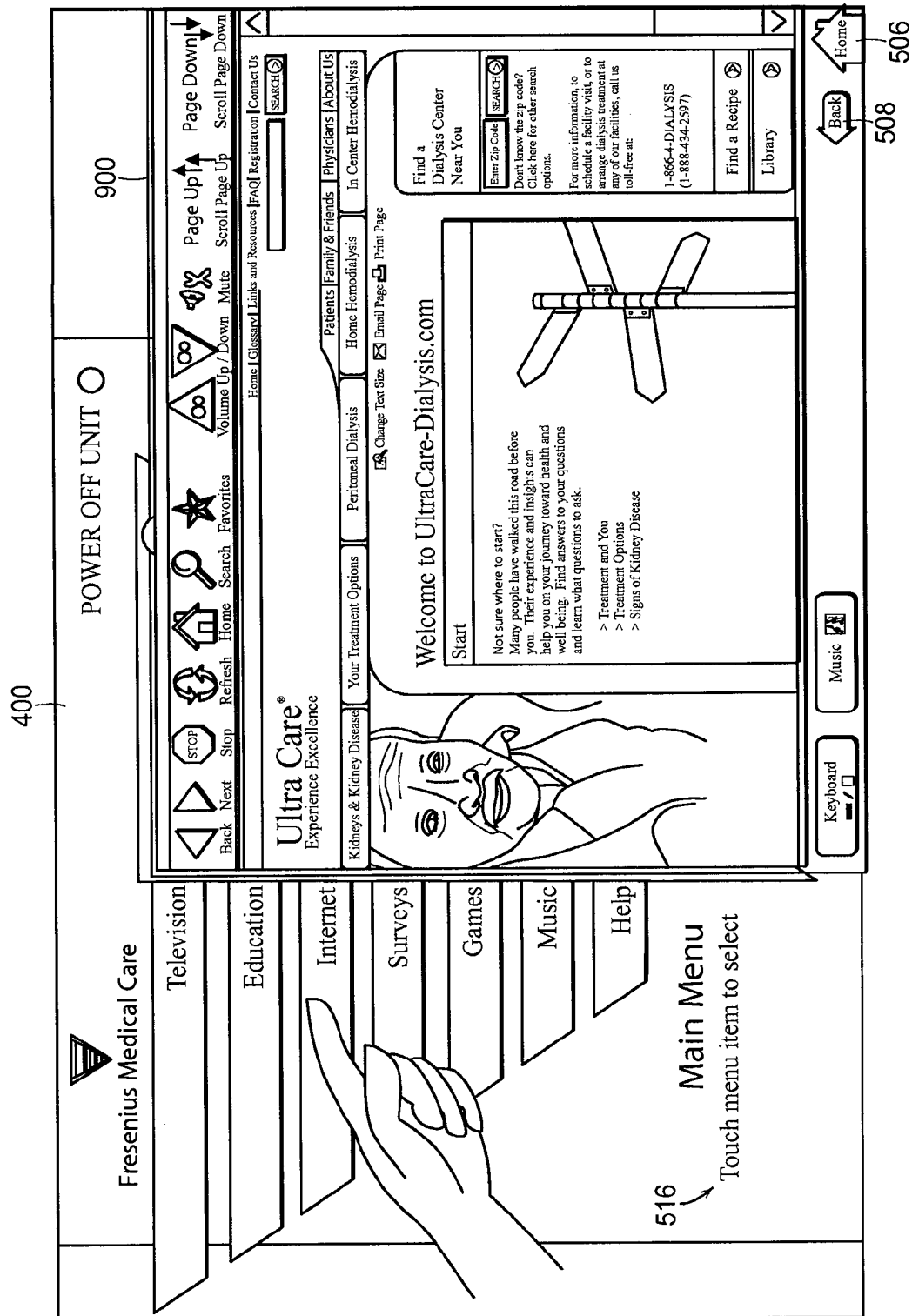


FIG. 9

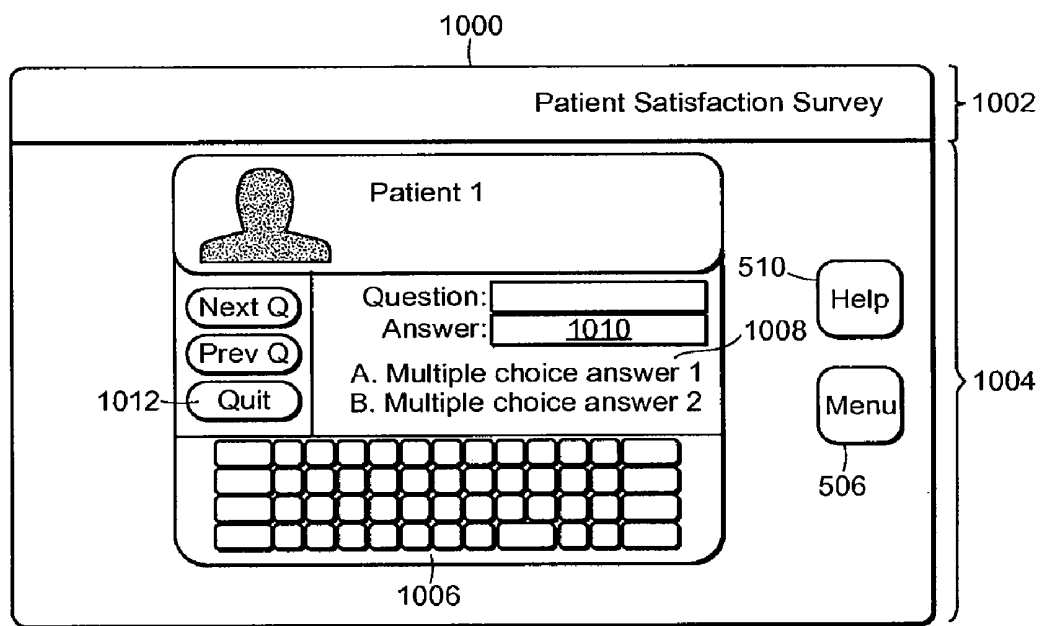


FIG. 10

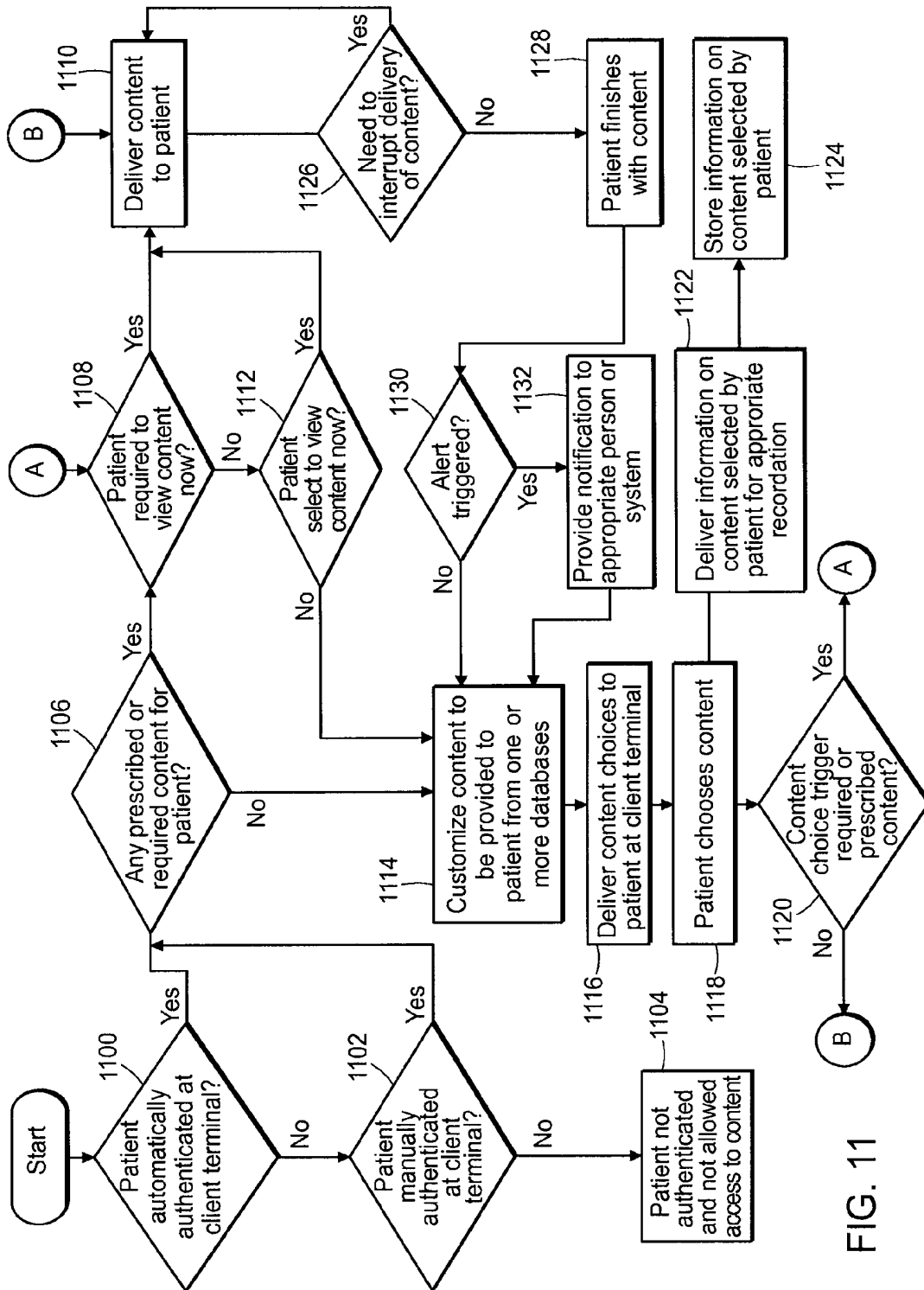
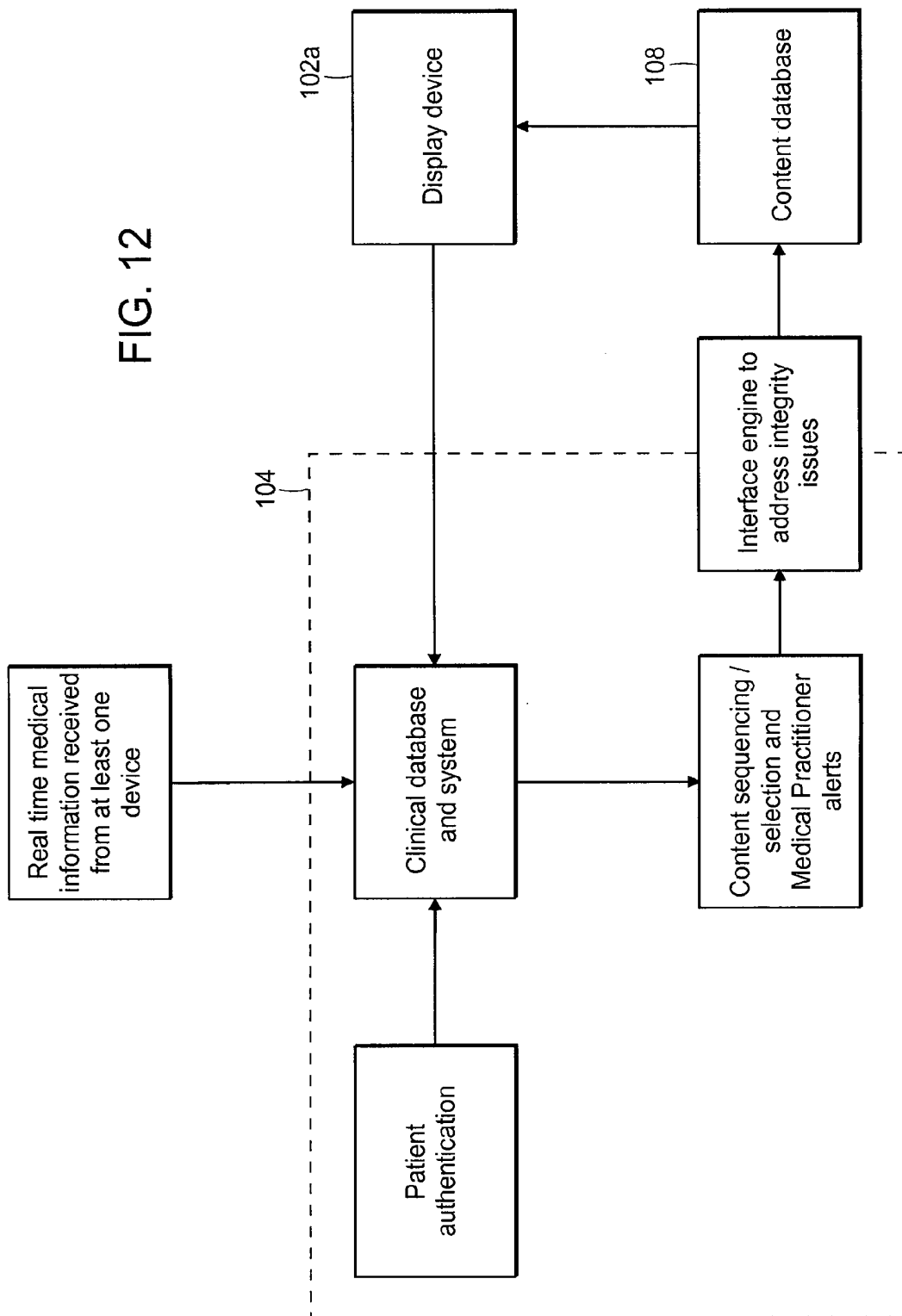


FIG. 11

FIG. 12



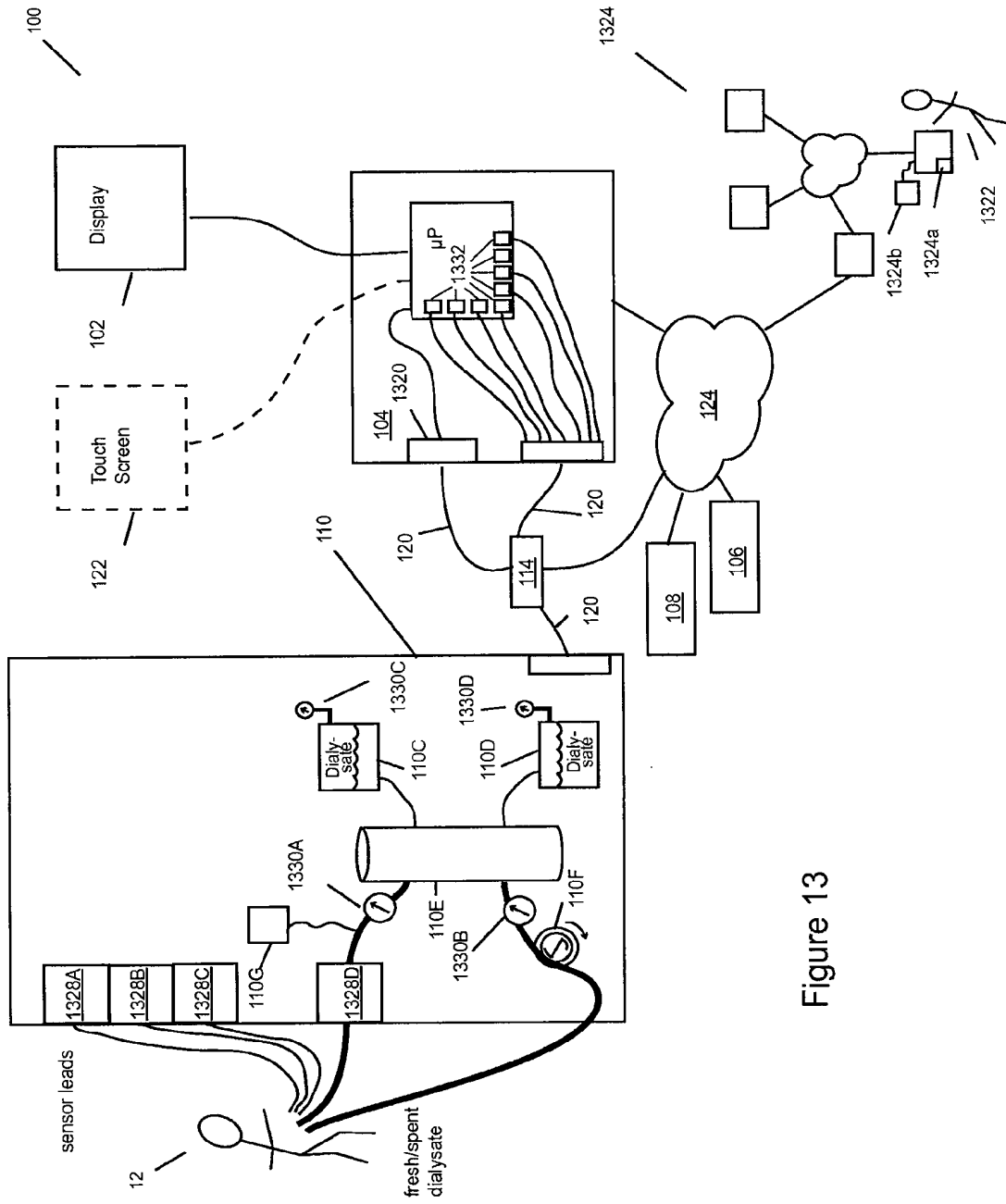


Figure 13

1412 /

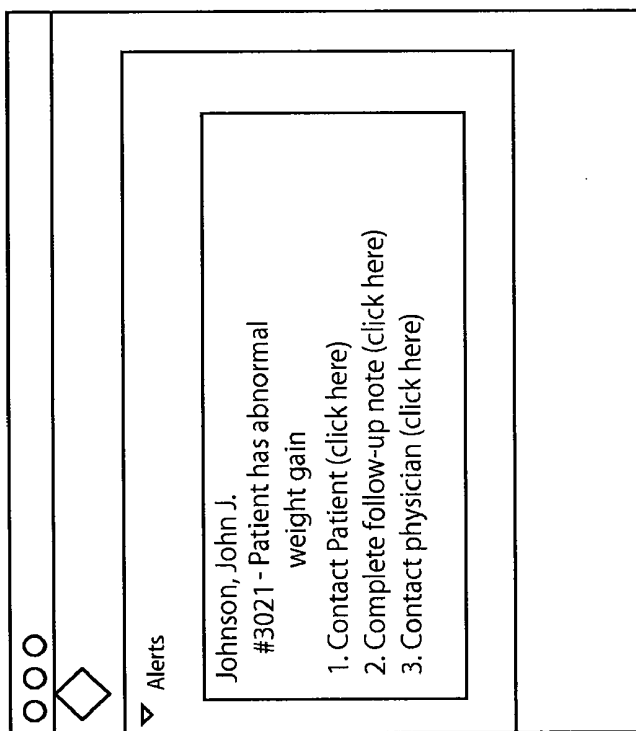


Figure 14B

1410 /

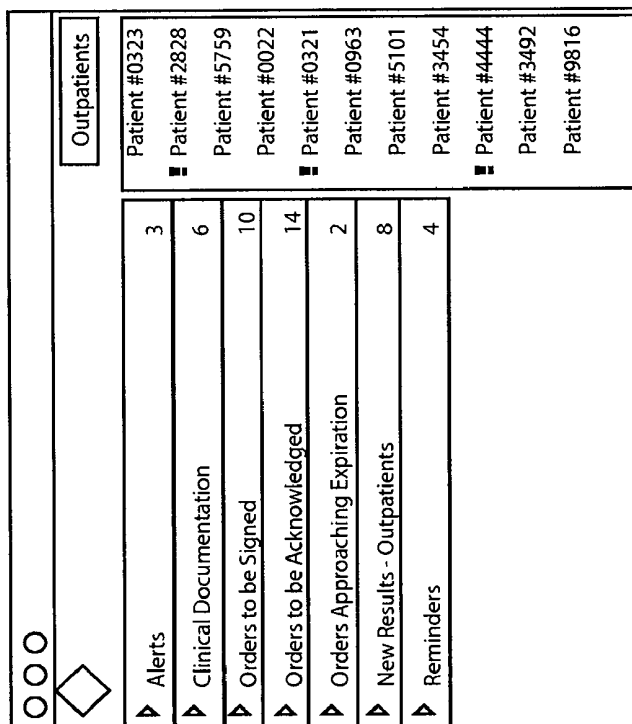


Figure 14A

METHODS AND SYSTEMS FOR PATIENT CARE

[0001] This application claims the benefit of priority of U.S. Provisional Patent Application 61/199,470, filed Nov. 17, 2008, entitled "Patient-Specific Content Delivery Methods and Systems," the teachings of which are incorporated herein by reference.

[0002] This application is also a continuation-in-part of U.S. patent application Ser. No. 12/233,126, filed Sep. 18, 2008, which claims the priority of U.S. Patent Application Ser. No. 60/973,676, filed Sep. 19, 2007, the teachings of both of which are incorporated herein by reference.

[0003] This application is also a continuation-in-part and claims the benefit of priority of U.S. patent application Ser. No. 11/591,438, filed Nov. 1, 2006, which claims the priority of U.S. Patent Application Ser. No. 60/732,335, filed Nov. 1, 2005, the teachings of both of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

[0004] Dialysis is an important treatment regimen for a variety of chronic diseases. To meet the need for regular care, patients typically travel to hospitals or dialysis centers that are designed for efficient and routine dialysis therapy. Typically, a nurse or patient care technician oversees the treatment sessions, assists the patients, and records patient information, such as patient vitals, treatment details, and billing information.

[0005] Like other health care facilities, one difficulty that dialysis treatment centers encounter is maintaining patient participation in treatment and, thereby, improving medical outcome. To large extent this is accomplished by providing educational materials to patients. The hope and theory are that well informed patients will pay special attention to their own treatment, not miss appointments, and keep their health care providers apprised of any changes in condition or circumstance not otherwise revealed by routine medical testing. Unfortunately, this entails distributing a large amount of information to patients. However, material regarding each patient's treatment may not always be readily identifiable or accessible when the patient needs or desires it. Furthermore, even where the health care provider is able to provide materials of potential interest, patients still may not feel they are actively involved with the treatment process, and therefore be less motivated to follow suggested treatment.

[0006] On another front, the advent of more affordable equipment makes home dialysis an option for many patients, who find it offers them greater privacy, flexibility of scheduling and overall comfort. Home dialysis can also be advantageous to health care providers since it does not require the nursing, equipment and space overhead of standard in-center care. However, even for those patients on a course of home dialysis therapy, maintaining patient participation in treatment can be difficult. An additional difficulty is that of patient monitoring. Home therapy affords fewer opportunities to assess patient health, well-being and treatment compliance. Care givers typically have that opportunity only when patients visit their local dialysis clinic for monthly evaluation—and, then, only to the extent that the success of treatment can be determined from routine testing and from patient reporting.

[0007] An object of the invention is to provide improved methods and systems for health care provision.

[0008] A related object is to provide such methods and systems as can be used to improve delivery of information in connection with health care provision, both at home and in-center.

[0009] A further object is to provide such methods and systems as can be used to increase patient participation and satisfaction with health care provision.

[0010] A still further object is to provide such methods and systems as can be used in connection with dialysis treatment and/or otherwise in the provision of health care.

SUMMARY OF THE INVENTION

[0011] The foregoing objects are among those attained by the invention which provides, in some aspects, a method of driving an electronic data interface (e.g., a computer display or a "touch screen") in connection with medical treatment of a patient. Such a method includes detecting a current medical condition of the patient and driving an electronic data interface in order to (i) deliver content to the patient based on that medical condition, (ii) query the patient based on that medical condition, and/or (iii) stimulate participation of the patient in his or her care based on that medical condition. Interactions with the patient are tailored to improve the clinical outcome of the patient's treatment based on the medical condition through education and/or patient participation.

[0012] Related aspects of the invention provide such methods as used in connection with the delivery of hemodialysis and/or peritoneal dialysis treatment of a patient.

[0013] Related aspects of the invention provide such methods in which the step of driving the electronic data interface includes providing textual, audio, video and/or other education material to the patient. According to further related aspects of the invention, the step of driving the electronic data interface includes providing questions to and collecting responses from the patient, e.g., as part of a survey, questionnaire, or other interrogatory process. According to further related aspects of the invention, the step of driving the electronic data interface includes hosting a game (e.g., a "video" board or card game) in which the patient participates, e.g., on the touch screen.

[0014] According to further aspects of the invention, the step of detecting the current medical condition of a patient includes receiving clinical data regarding the patient's current medical condition from medical apparatus, e.g., a hemodialysis or peritoneal dialysis machine, coupled to the patient. Related aspects of the invention include transmitting clinical data regarding the patient's current medical condition from such medical apparatus to a clinical database system and, further, driving the electronic data interface in accord with information pertaining to such condition received from that system.

[0015] Still further aspects of the invention provide methods as described above in which the current medical condition includes a clinical condition of the patient, including, at least one of blood pressure, heart rate, and blood potassium level. According to aspects of the invention practiced in connection with the provision of hemodialysis or peritoneal dialysis, that condition can include other clinical measurements sensed by equipment providing such treatment to the patient.

[0016] Further aspects of the invention provide methods as described above in which the step of driving the electronic data interface includes (i) delivering content to the patient

based the patient's medical history and/or medical record, (ii) querying the patient based on his/her medical history and/or medical record, and/or (iii) stimulating participation of the patient in his or her care based such medical history and/or medical record.

[0017] Still yet further aspects of the invention provide methods as described above that include storing medical records and/or other patient-specific information in a clinical database system.

[0018] Yet still further aspects of the invention provide methods as described above in which the step of driving the electronic data interface includes displaying to the patient a plurality of mode and/or content selection options, permitting the patient to select from among those options, and further driving the electronic data interface in accord with the patient selection. According to related aspects of the invention, such a methodology can be used to permit the patient to select among modes for the provision of textual, audio, video and/or other educational material, and, optionally, within that mode, to select specific content to be delivered; the provision of a survey or questionnaire, and, optionally, within that mode, to select a specific survey or questionnaire to answer; and/or the playing of a game or other patient-participatory experience and, optionally, within that mode, to select a specific game to play.

[0019] According to further related aspects of the invention, the steps displaying to the patient mode selection options, permitting the patient to select from among those options, and/or further driving the electronic data interface in accord with the patient selection can include restricting and/or expanding such selections based on the patient's medical condition and/or his her compliance with medical treatment requirements, goals, or milestones. Thus, by way of non-limiting example, a patient who has satisfactorily brought down his blood pressure may be entitled to a broader range of mode and/or content options, while a patient who has not satisfactorily brought down his blood pressure may be limited to a restricted range of options.

[0020] Further aspects of the invention provide methods as described above in which the step of driving the electronic data interface includes selecting among one or more of the aforementioned modes and/or educational content to be delivered in connection therewith in accord with a preprogrammed algorithm.

[0021] Still further related aspects of the invention provide such methods as enable a medical care professional to select among one or more of the aforementioned modes and/or to select educational content to be delivered to the patient in connection therewith.

[0022] Yet still further aspects of the invention provide methods as described above including driving the electronic data interface to authenticate the patient before one or more of (i) delivering content thereto based on a medical condition, (ii) querying the patient based on that medical condition, and/or (iii) stimulating participation of the patient in his or her care based on that medical condition.

[0023] In another embodiment, a method of delivering patient-specific content includes providing a digital data display device configured to display data to a patient receiving medical treatment and authenticating the patient as a valid user of the digital data display device. The method can further include transmitting first data to the digital data display device from at least one database, wherein the first data is chosen for transmission based on at least real-time data

related to medical treatment of the authenticated patient. The authenticated patient can be allowed to choose from the first data additional data for transmission from the at least one database to the digital data display device.

[0024] Further aspects of the invention provide medical treatment apparatus and systems operating in accord with the methodologies discussed above. In one such aspect, by way of non-limiting example, the invention provides a patient-specific content delivery system that includes a computer-driven interface device (e.g., a display and/or touch screen) configured to display and/or receive information to/from a patient for purposes of any of (i) delivering content to the patient based on that medical condition, (ii) querying the patient based on that medical condition, and/or (iii) stimulating participation of the patient in his or her care based on that medical condition. Such an interface device can, according to aspects of the invention be configured as part of, or to operate connection with, hemodialysis equipment, peritoneal dialysis equipment, or other patient care equipment.

[0025] According to further aspects of the invention, medical treatment apparatus and systems as described above can include a clinical database system in electronic communication that stores information pertaining to real-time medical conditions of a patient undergoing medical treatment. Such a clinical database system can, according to related aspects of the invention, store medical records and other patient-specific information (e.g., medical histories) for use in displaying and/or receiving information to/from the interface device.

[0026] The foregoing are among the objects attained by the invention, which provides in some aspects methods of patient care that include detecting a current medical condition of a patient undergoing therapy via a medical treatment apparatus, e.g., an in-center or home dialysis machine. This can be by sensing blood pressure, heart rate, weight, glucose level, hemoglobin level, and/or blood potassium level (all by way of example) using sensors that form part of (and/or that are coupled to the apparatus) and transmitting information regarding that medical condition to a digital data processing system disposed remotely from the medical treatment apparatus. Related aspects of the invention provide such methods that further include delivering to a health care provider—via the remote digital data processing system—current (i.e., up-to-date) medical condition data regarding the patient under treatment. This can include, for example, presenting that data via trend graphs.

[0027] Further aspects of the invention provide methods for patient care, for example, as described above, that include acquiring any of a still or video image of the patient and transmitting that image to the remotely-disposed digital data processing system, e.g., for presentation to the health care provider.

[0028] In other aspects, the invention provides methods for patient care that include detecting a medical condition of a patient receiving medical treatment by (i) receiving data from a medical treatment apparatus coupled to the patient and/or (ii) accepting from the patient a characterization of any of a medical condition and/or medical treatment. Such a method further includes transmitting information regarding that condition and/or characterization to a digital data processing system disposed remotely from the medical treatment apparatus.

[0029] Further aspects of the invention provide methods for patient care, for example, as described above, wherein the data received from the medical treatment apparatus includes

data from one or more physiometric sensors, and wherein that data is transmitted to the remotely-disposed digital data processing system. Related aspects of the invention provide such methods wherein the received and transmitted data is from operational sensors coupled to the medical treatment apparatus. This can include, for example, data from sensors reflecting treatment times, medication level/dosing data, and so forth.

[0030] Still further aspects of the invention provide methods for patient care, for example, as described above, including generating graphs of one or more data received from the medical treatment apparatus. This can be done, for example, by a processor remote from that apparatus.

[0031] Other aspects of the invention provide methods of patient care that include treating a patient with a medical treatment apparatus, detecting one or more operating conditions of that apparatus via sensors coupled thereto, and analyzing data reflecting those operating conditions to any of track inventory and/or use of supplies in connection with treating the patient. The supplies can include any of erythropoietin, dialysis solutions, other medicines, and/or other supplies utilized in connection with such treatment.

[0032] Further aspects of the invention provide methods for patient care, for example, as described above, including responding to such analysis by effecting ordering and/or delivery of supplies for use in connection with treating the patient.

[0033] In other aspects, the invention provides methods of patient care that include treating a patient with a medical treatment apparatus, detecting operating conditions of that apparatus and/or a current medical condition of the patient, generating an alert based on one or more of those conditions, and displaying that alert, along with a workflow of actions to be taken in response thereto by a health care provider.

[0034] Further aspects of the invention provide methods for patient care, for example, as described above, including responding to selection of a displayed action (e.g., by a nurse or other health care provider) by initiating that action. This can include, for example, contacting a patient, contacting a health care provider and making a notation in a patient record. Further aspects of the invention provide methods for patient care, for example, as described above, wherein the alerts and/or display thereof is executed remotely from the medical treatment apparatus.

[0035] Still further aspects of the invention provide medical treatment apparatus and systems operating in accord with the methodologies discussed above.

[0036] These and other aspects of the invention relating to patient care are evident in the drawings and in the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] A more complete understanding of the invention may be attained by reference to the drawings, in which:

[0038] FIG. 1 depicts a plurality of digital data display devices according to the invention, as well as a plurality of medical treatment apparatus (e.g., dialysis machines) with which such devices may be used;

[0039] FIG. 2 depicts a schematic diagram of a database system according to the invention that stores data for display on a digital data display device;

[0040] FIG. 3 depicts an authentication screen display of a digital data display device according to the invention that facilitates authentication of a patient that may use the digital data display device;

[0041] FIG. 4 depicts a menu screen display of a digital data display device according to the invention that facilitates selection of data for display;

[0042] FIG. 5 depicts a television screen display of a digital data display device according to the invention that facilitates selection of data for display;

[0043] FIG. 6 depicts an education screen display of a digital data display device according to the invention that facilitates selection of data for display;

[0044] FIG. 7 depicts a music screen display of a digital data display device according to the invention that facilitates viewing of data;

[0045] FIG. 8 depicts a games screen display of a digital data display device according to the invention that facilitates viewing of data;

[0046] FIG. 9 depicts an Internet screen display of a digital data display device according to the invention that facilitates viewing of data;

[0047] FIG. 10 depicts a survey screen display of a digital data display device according to the invention that facilitates viewing of data;

[0048] FIG. 11 is a flow diagram illustrating operation of a system according to the invention;

[0049] FIG. 12 depicts a schematic diagram of system according to an invention that facilitates selection and transmission of data for display on a digital data display device;

[0050] FIG. 13 depicts a patient treatment station in accord with the teachings hereof; and

[0051] FIG. 14 depicts screens generated by a system according to the invention to reflect a workflow following issuance of an alert

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

[0052] Described herein are methods, systems and devices for medical treatment and patient care, particularly, by way of non-limiting example, in the context of dialysis centers (including, as used here, hospitals or other central treatment centers) and in the context of homes—though applicable in a range of health care settings. Those methods, systems and devices, which provide for improved clinical outcome of patient care by facilitating generating alerts to, and communications of information with, a health care provider. Those outcomes are also improved through education and/or patient participation, include driving a digital data interface (e.g., a computer display or touch screen) accessible by the patient in accord with that patient's current medical condition. More specifically, that interface can be driven to (i) deliver content to the patient based on a medical condition of the patient, (ii) query the patient based on that medical condition, and/or (iii) stimulate participation of the patient in his or her care based on that medical condition (collectively, "condition-based information transfer"), all in accord with the patient's blood pressure, potassium levels, weight, glucose level, hemoglobin level or other medical conditions.

[0053] FIG. 1 illustrates patient treatment stations **100a**, **100b** according to one practice of the invention. Although two such stations are shown in the drawing, other embodiments may utilize a lesser or greater number of stations. For

example, embodiments of the invention intended for the home may utilize only one such station.

[0054] The patient treatment stations **100a**, **100b** comprise an electronic data interface (e.g., a display screen, a computer driver interface, or a touch screen) **102a**, **102b** that provides a visual and possibly tactile interface with a user and a digital processor **104** that controls the display screen **102a**, **102b** (e.g., vis-à-vis the display of prompts, as well as the input, display, communication, collection and/or storage of the information therefrom and thereto), and that interfaces with other such database systems **106**, **108** (data storage mechanisms such as databases, servers, or otherwise), as well as with medical treatment apparatus, such as dialysis machines **110a**, **110b** (hemodialysis or peritoneal dialysis treatment). The patient treatment station **100a**, **100b** does not necessarily require a physical keyboard for user input, thereby greatly reducing the risk of patient infection. In addition, the display screen **102a**, **102b** interface and the method of condition-based information transfer can allow customized content to be automatically and/or manually chosen by a patient **112a**, **112b** for delivery to the patient **112a**, **112b** in real-time based on a medical condition of the patient **112a**, **112b** at the machines **110a**, **110b**.

[0055] The condition-based information transfer includes one or both of receiving medical condition information from the patient treatment station **100a**, **100b** and delivering content from the databases **106**, **108** to the patients **112a**, **112b** (via the screens **102a**, **102b**) based on the received medical condition information. The customized information delivered to the display screens **102a**, **102b** can include textual, audio, video, and/or other education material that includes clinical data, which can facilitate the improvement of clinical outcome through education and patient participation in their own care, and entertainment, which can improve overall patient satisfaction with their treatment, improve patient compliance with prescribed treatment times, and provide a relaxing atmosphere that can positively affect overall clinical outcomes. The customized information received from the patients **112a**, **112b** can include medical data automatically gathered from the machines **110a**, **110b** and/or from other devices coupled to the patients **112a**, **112b**. The patients **112a**, **112b** can also transfer information to the processor **104** in response to content on the display screens **102a**, **102b**, such as choices of additional content for delivery or answers to survey questions.

[0056] As shown, the stations **100a**, **100b** are each associated with a medical treatment apparatus **110a**, **110b** (in this embodiment, hemodialysis machines) of the type commonly known in the art. The display screens **102a**, **102b** of the stations **100a**, **100b** are in electronic communication with the processor **104** (or otherwise coupled thereto) for use by a user such as a patient **112a**, **112b** being treated with the dialysis machines **110a**, **110b**, a nurse, a patient care technician, or other health care provider. Although two stations **100a**, **100b** are shown, those skilled in the art will appreciate that the processor **104** and the storage mechanisms **106**, **108** may support more than or less than two stations. Furthermore, the stations **100a**, **100b** can be in locations remote from each other and/or the processor **104**. For example, the stations **100a**, **100b** can be located in a clinical setting (e.g., a hospital or a hemodialysis clinic) or a nonclinical setting (e.g., at a home of a dialysis patient receiving peritoneal dialysis using a home-based system).

[0057] The stations **100a**, **100b** can each include a touch screen display **102a**, **102b**, the digital data processor **104**, and an adapter **114**. The touch screen displays **102a**, **102b** can each include a conventional device of that type known in the art for visual and/or tactile interface with an operator—here, patient **112a**, **112b**—operated in accord with the teachings hereof. The units **102a**, **102b** can be based on liquid crystal display technology, cathode ray display technology, or otherwise. Though the illustrated embodiment relies on color display technology, other embodiments may utilize monochrome (e.g., employing shading, hashing, or other visual indicators in place of the colorations discussed below). The displays **102a**, **102b** are sized and provides resolution sufficient to display and collect information of the type described or are otherwise suitable for the digital data environment for which it is used. Preferably the displays **102a**, **102b** can be adapted for ready cleaning and/or sanitization, particularly when used in a clinical environment where multiple people typically use the displays **102a**, **102b**.

[0058] Additionally, while the displays **102a**, **102b** preferably include touch screens, the display devices **102a**, **102b** can include any device capable of displaying information to a user, e.g., a personal computer, a television, a portable digital device, or any other electronic display device. Furthermore, the displays **102a**, **102b** can have any configuration where they may be made easily, comfortably accessible to the patient **112a**, **112b**, such as on a rolling stand **116** (left display **102a**), on an adjustable arm **118** (right display **102b**), or otherwise. In other embodiments, the displays **102a**, **102b** may be more fully portable (e.g., lightweight and with carrying handles), fixed (e.g., wall-mounted or cabinet-mounted) or otherwise—all in the conventional manner of clinically-deployed medical data entry devices.

[0059] The displays **102a**, **102b** can be adapted to provide an ergonomic work station such that data entry puts a minimal stress on the patients **112a**, **112b**. The height and angle of the displays **102a**, **102b** can facilitate data entry and minimize the risk of repetitive stress disorders. The height and angle of the displays **102a**, **102b** also can make their screens less visible to a casual onlooker such as another patient or ambulance driver walking by, which helps protect the confidentiality of any patient data being displayed. The illustrated displays **102a**, **102b** can be set to display a neutral screen saver after a set or variable amount of time of system inactivity to further protect the confidentiality of such patient data.

[0060] The digital data processor **104** can include an embedded processor, personal computer, workstation, mini-computer, mainframe or other digital data processing device of the type known in the art, as adapted in accord with the teachings hereof. The digital data processor **104** may be a stand alone device or may be integral to one or more other components of the illustrated system, e.g., the touch screens **102a**, **102b** and/or medical treatment apparatus **110a**, **110b**. It may, moreover, be coupled for communication over communication links **120** with the touch screen displays **102a**, **102b** and the adapter **114** via any combination of wireless connection (e.g., Bluetooth, 802.1x, or otherwise), wired connection (Ethernet, backplane bus, or otherwise), or otherwise, all in the conventional manner known in the art.

[0061] Communication on one or more of the communication links **120** (which may include more or fewer linked connections than those shown in FIG. 1) may be secured with a mechanism such as IP security (IPsec), Transport Layer Security/Secure Socket Layer (TLS/SSL), wireless TLS

(WTLS), secure Hypertext Transfer Protocol (SHTTP), or any other security mechanism as would be appreciated by those skilled in the art.

[0062] The processor **104** can also be in communication with a data entry device such as a touch screen **122** that provides a visual and tactile interface with an administrator, e.g., a nurse, patient care technician, or other medical personnel. Through the touch screen **122**, a user can coordinate input, display, communication, collection, and/or storage of data between the displays **102a**, **102b**, the processor **104**, and/or the storage mechanisms **106**, **108**. Although only one touch screen **122** is shown in this embodiment, there may be any number of such data entry devices. In the illustrated embodiment, the touch screen **122** operates, e.g., for purposes of data input and display, in the manner described in incorporated-by-reference U.S. patent application Ser. Nos. 60/732,335 and 11/591,438, published as PCT/US 2006/042650 and incorporated by reference herein, though, it may operate otherwise in other embodiments.

[0063] The database systems **106**, **108** can each include a database, a data queue, a buffer, a local or remote memory device, random access memory (RAM), a cache, a server, or digital data storage device of the type known in the art, as adapted in accord with the teachings hereof. The databases **106**, **108** are adapted to communicate with the displays **102a**, **102b** (via the processor **104**) over one or more communication links **120** and possibly over a network **124**, as described herein. Although the storage mechanisms **106**, **108** are shown as separate elements from the processor **104** in this illustrated embodiment, the storage mechanisms **106**, **108** can be integral to the processor **104**, or the storage mechanisms **106**, **108** can otherwise be combined into one storage mechanism or separated into one or more other storage mechanisms. Furthermore, the databases **106**, **108** may communicate using the same or different network **124**, which can itself include one or more interconnected networks. One or both of the storage mechanisms **106**, **108** may be secured using a variety of techniques, as those skilled in the art will appreciate.

[0064] In the illustrated embodiment, operation of the stations **100a**, **100b** in general, and of the touch screens **102a**, **102b** in particular, are controlled by the processor **104**. To this end, and to the extent that this description attributes control and data processor functionality to the touch screens **102a**, **102b**, it will be appreciated that such control and data processing is provided indeed by the processor **104**. Similarly, control and data processing of the storage mechanisms **106**, **108** is provided indeed by the processor **104**.

[0065] The adapter **114** provides communication coupling between the digital data processor **104** (and the storage mechanisms **106**, **108**) and the medical treatment apparatus (here, dialysis machines) **110a**, **110b**. In the illustrated embodiment, the adapter **114** is a Universal Serial Bus (USB) hub of the conventional type known in the art. In other embodiments, the adapter **114** can take on other form factors (electrical and/or physical), such as Ethernet, serial cabling, and so forth, suitable for transmitting data to/from the processor **104** and the apparatus **110a**, **110b** and/or the display **102a**, **102b**. Moreover, the illustrated adapter **114** can be supplanted by, or supplemented with, wireless communications (e.g., based on Bluetooth, 802.1x, and so forth), consistent with the aforesaid purpose. Regardless, the adapter **114** transmits data in a common protocol defined between the processor **104** and the treatment apparatus **110a**, **110b**. In the illustrated embodiment, the adapter **114** is a standalone

device that is coupled with the processor **104** and the apparatus **110a**, **110b** via cabling, as shown, though in other embodiments it may be integral with one of more of the other system components (e.g., the processor **104**, the storage mechanisms **106**, **108**, and/or the apparatus **110a**, **110b**).

[0066] In the illustrated embodiment, the displays **102a**, **102b** are used in connection with the medical treatment apparatus **110a**, **110b** to facilitate medical treatment (here, dialysis treatment) of the patients **112a**, **112b**, as shown. Though the illustrated patients **112a**, **112b** are shown in chairs, those skilled in the art will appreciate that patients can receive treatment in prone or other positions, as well—all in the conventional manner known in the art.

[0067] It will be appreciated that FIG. 1 depicts embodiments of systems and devices according to some practices of the invention, and that other embodiments may have lesser, more and/or other elements than those shown in the drawing and described herein. Thus, for example, embodiments of the invention may have greater or fewer patient treatment stations and/or may be capable of treating greater or fewer patients. By way of further example, embodiments of the invention may utilize greater or fewer displays **102a**, **102b**, touch screens **122**, processors and so forth. By way of further example, the functionality of various ones of the elements illustrated and described herein may be incorporated into and/or otherwise combined with other elements.

[0068] Referring to FIG. 2, the storage mechanisms **106**, **108** are shown in more detail. Information stored in one or both of the storage mechanisms **106**, **108** can be delivered to the patients **112a**, **112b** via the display screens **102a**, **102b** (and the processor **104**). The delivered information can be customized for each patient **112a**, **112b**, chosen in real-time (e.g., on the fly) as the patient **112a**, **112b** is receiving, will soon receive, or has just received, medical treatment at the machines **110a**, **110b**. The delivered data can also be prescribed for the patients **112a**, **112b** by medical personnel before treatment and delivered after patient logon to the system.

[0069] As shown, each of the storage mechanisms **106**, **108** can include information of different types. The information can be input into the storage mechanisms **106**, **108** from a variety of sources. By way of non-limiting example, data can be manually input into the storage mechanisms **106**, **108** by a user (e.g., at the touch screen **122**), obtained from another database including the other one of the databases **106**, **108**, received from a monitoring device such as the machine **110a**, and other similar data entry techniques.

[0070] One database **106** (“clinical database system **106**” or “medical database **106**”) can store medical records and other patient-specific information **200** while the other database **108** (or “content database **108**”) can store content information for delivery to the display devices **102a**, **102b**. The medical information **200** in the medical database **106** can include programmed data and/or current treatment data (or “treatment information”), e.g., the patient’s medical condition-based information (e.g., from the physiometric sensor readings), video and/or still images of the patient (e.g., from the web camera), survey and other query responses, operational sensor readings and/or alerts, etc., from the respective patient treatment stations, as well as from the touch screen **122**. Programmed data generally includes data related to patient identification and previous patient care (e.g., patient medical record data). Non-limiting examples of programmed data (generally, etiology data) include patient name, patient

medical history, medical treatment history, lab results, treatment plans, dietician patient plans, ethnicity, demographics, and other types of similar data.

[0071] Current treatment data generally includes data gathered in real-time while the patient **112a**, **112b** is being treated at the machines **110a**, **110b**, e.g., vital signs, dialysis results and performance, information on kidney function, phosphorous levels (all of which may be gathered, e.g., by sensors **1328A-1328D** and/or sensors **1330A-1330D**), query responses and/or other survey results, video (e.g., surveillance using a video or still-image web camera coupled to the touch screen **102a** that can provide retinal tracking to monitor patient activity), etc. More generally, as discussed above, current treatment data can include patient's medical condition-based information (e.g., from the physiometric sensor readings), video and/or still images of the patient (e.g., from the web camera), survey and other query responses, operational sensor readings and/or alerts, etc., from the respective patient treatment stations, as well as from the touch screen **122**. Current treatment data can be stored in the medical database **106** to create an archive of medication treatment information. The current treatment data (archived and/or from the instant treatment session) can be used by the processor **104** to determine what data from the content database **108** to deliver to a particular patient.

[0072] The content database **108** generally includes information that can be displayed on the display screens **102a**, **102b**, as further discussed below. The information can be dynamically chosen through analysis by the processor **104** such that the patients **112a**, **112b** can view information most relevant to their current medical status. Non-limiting examples of information that can be stored for delivery in the content database **108** include television data **202**, network data **204** (in which case the content database **108** acts similar to a content server), games data **206**, feedback and survey data **208**, music data **210**, education data **212**, and other similar types of data. The education data **212** generally includes information that may be useful in educating the patients **112a**, **112b** about their medical condition and/or medical treatment. For example, the education data **212** can include an education question of the day **214**, prescribed or recommended video education **216**, prescribed or recommended Internet or other written content **218**, education based on patient interest **220**, recommended education content based on patient diagnosis **222**, patient diet management plan data **224**, and other types of similar data. The content database **108** can also include help information **226** related to use of the touch screens **102a**, **102b**, the machines **110a**, **110b**, and/or to data available to users through the touch screens **102a**, **102b**. Data can be categorized any way in the content database **108**, including no categorization at all and categorization as more than one data type (e.g., as education data **212** and as games data **206**).

[0073] FIG. 13 illustrates a patient treatment station **100** (e.g., representing stations **100a** and/or **100b** shown in FIG. 1) according to one practice of the invention. Other patient treatment stations may be similarly constructed or otherwise. As above, the illustrated station comprises inter alia a medical treatment apparatus **110** (e.g., representing apparatus **110a** and/or **110b** shown in FIG. 1), digital data processor **104**, touch screen **122**, all coupled as shown. In the illustrated embodiment, digital data processor **104** is disposed locally with respect to digital data processor **104** (and the patient), as shown.

[0074] As above, it will be appreciated that FIG. 13 depicts embodiments of systems and devices according to some practices of the invention, and that other embodiments may have lesser, more and/or other elements than those shown in the drawing and described herein. Thus, by way of non-limiting example, embodiments of the invention may not utilize touch screens **122** and/or may incorporate the functionality ascribed thereto herein to other elements, such as input/output devices **1324B** coupled to processor **1324**.

[0075] Illustrated medical treatment apparatus **110** comprises a dialysis unit and, more particularly, a hemodialysis unit of the type commercially available or otherwise known in the art for such purpose, e.g., including, for example, fresh and spent dialysate containers **110C**, **110D**, filter/dialyzer **110E**, pump **110F**, supplemental medication supply **110G** (e.g., for heparin and/or other medications), and so forth, as adapted in accord with the teachings hereof. The illustrated medical treatment apparatus **110** is, moreover, of the type adapted for use in the home or other locale remote for a dialysis center, hospital or other central treatment center. Alternatively, or in addition, the apparatus **110** may be adapted for use in such a dialysis center, hospital or other treatment center. This may, for example, at a location in such a center remote from a physician, nurse, patient care technician or other health care provider—or it may be nearby such a provider. In other embodiments apparatus **110** may comprise a peritoneal dialysis machine or other medical treatment apparatus of the type known in the art or otherwise, again, as adapted in accord with the teachings hereof.

[0076] Digital data processor **104** comprises a microprocessor (“ μ P”) or other processing unit of type commercially available or otherwise known in the art, as adapted in accord with the teachings hereof. The digital data processor **104** may be integral to medical treatment apparatus **110** or, as shown here, it may separate therefrom and coupled for communication therewith, e.g., via links **120** and adapter **114**, or otherwise. As above, digital data processor **104** is coupled display **102** (e.g., representing displays **102a** and/or **102b** shown in FIG. 1), as with touch screen **122**. Digital data processor **104** may also be coupled with keyboard or other input device, e.g., mouse, touch-screen, touchpad, etc. (not shown), or output device, all of the type commercially available in the marketplace or otherwise known in the art, again, as adapted in accord with the teachings hereof. The touch screen **122**, display **102** and/or other input and output devices may be integral to medical treatment apparatus **110** or separate therefrom (as shown here).

[0077] Digital data processor **104** is coupled via network interface **1320** to support communications with a health care provider **1322**, e.g., a physician, nurse, patient care technician, administrator, etc. via digital data processing system **1324** (sometimes referred to herein, simply, as “processor **1324**”) and links **120** and network media **124**, e.g., as shown. That media **124** may comprise IP, telephone and/or other networks of the type known in the art—wired, wireless and/or otherwise. Network interface **1320** comprises a modem, network interface card and/or other functionality of the type commercially available in the marketplace or otherwise known in the art suitable for supporting communications over network **124**, as adapted in accord with the teachings hereof. Examples include cable modems, cellular telephone modems, USB modems, Ethernet cards, and combinations thereof, just to name a few. It will be appreciated that some of that functionality for supporting communications with care

provider **1322** via digital data processor **104** and network media **124** may reside on processor **104**, as in the case, for example, of operating system drivers, network protocol stacks, and so forth. Together, this functionality (i.e., hardware and/or software) is referred to, here, as “communications logic.”

[0078] Processor **104** is also coupled with sensors **1328** (by way of non-limiting example, via communications links **120** and adapter **114**) that take biometric readings of the patient **112** to determine his or her medical condition, e.g., in real-time. These “physiometric sensors,” as they are referred to herein, can include blood pressure sensors, heart rate sensors, and so forth. In the illustrated embodiment they are of the type commercially available in the marketplace or otherwise known in the art, as adapted in accord with the teachings hereof. Those sensors may be integral to apparatus **110**, processor **104**, disposed at station **100**, or otherwise. In the illustrated embodiment, the sensors include a heart rate (or pulse) sensor **1328A**, a blood pressure sensor **1328B**, a weight sensor **1328C** and an electrochemical sensor **1328D** (e.g., for sensing blood urea levels, ammonia levels, blood potassium levels, hemoglobin levels, and so forth). Sensors **1328A-1328C** are shown coupled to the patient, while sensor **1328D** is coupled in the blood fluid-flow path of apparatus **110**. Other embodiments of the invention may include a greater or fewer number of such sensors, coupled to the patient, the flow-path of apparatus **110**, etc., as shown or in other ways known in the art, as adapted in accord with the teachings hereof.

[0079] Processor **104** is also coupled to operational sensors **1330** that sense operating conditions of the station **100**, apparatus **110**, and/or components thereof. These can include sensors that measure the rates of fluid flow, fluid temperature, level, and composition, power conditions, maintenance status and so forth, all by way of non-limiting example. In the illustrated embodiment they are of the type commercially available in the marketplace or otherwise known in the art, as adapted in accord with the teachings hereof. Those sensors may be integral to apparatus **110**, processor **104**, disposed at station **100**, or otherwise. In the illustrated embodiment, the sensors include an inflow-rate or pressure sensor **1330A**, and outflow-rate or pressure sensor **1330B**, fresh dialysate level sensor **1330C**, spent dialysate level sensor **1330D**. Additional sensors (not shown) can, by way of non-limiting example, sense treatment times (e.g., on/off times of the apparatus **110**), levels or dosings of fresh and spent dialysate containers **110C**, supplemental medication supply **110G**, and/or of other consumables utilized in connection with treatment. A further such sensor may comprise the aforementioned web camera. In other embodiments, other operational sensors of the type suggested above are provided instead or in addition to those shown in the drawing and/or discussed here.

[0080] Processor **104** can include monitoring logic, here, represented by modules **1332**, that monitor the biometric readings of the patient, operational states of station **100** and/or apparatus **110**, as well as detect alert or alarm (terms which are used interchangeably herein) conditions, e.g., as reported directly from components of station **100** and/or apparatus **110** and/or when readings from the physiometric sensors **1328** and/or operational sensors **1330** fall outside of selected ranges. That monitoring logic can also, by way of non-limiting example, monitor when and for how long the various sensor readings, for example, are outside those ranges.

[0081] Thus, for example, the monitoring logic **1332** can detect the incidence and duration of systolic blood pressure

readings below physician—(or other care provider—) defined levels, as well as changes (deltas) in blood pressure greater than such levels. By way of further example, the monitoring logic can detect when medications are administered and in what quantity. By way of still further example, the monitoring logic can detect when treatment sessions are initiated and how long they are run; the incidence and duration of “door ajar” alerts, “filter replacement” alerts, “dialysate replacement” alerts, and/or other alerts or conditions reflecting whether proper and efficient care is being delivered to the patient **112**, and so forth. Though illustrated here has modules (i.e., software and/or hardware) executing on/forming part of processor **104**, in other embodiments, monitoring logic **1332** can be form part of apparatus **110** and/or may be disposed at station **100**, or otherwise.

[0082] Illustrated digital data processor **104** is coupled to digital data processing system **1324**, e.g., via interface **1320** and network link **124**. That system **1324** may comprise one or more cell phones, smart phones, personal digital assistants, computers, or other devices suitable for communicating with digital data processor **104** to receive the patient’s treatment information, including, for example, medical condition-based information (e.g., real-time physiometric sensor readings), operational sensor readings and/or alerts of the type described above. In the illustrated embodiment, the system **1324** is disposed remotely from station **100** (and from digital data processor **104**).

[0083] Moreover, in the illustrated embodiment, the system **1324** comprises a computer system of the type commonly available in a hospital, dialysis center or other central location of the type that employs or otherwise physicians, nurses, patient care technicians or other health care providers to oversee treatment of patients, all as adapted in accord with the teachings hereof. In other embodiments, the system **1324** is located with the station **100** at the same facility (e.g., in a hospital, dialysis center or other central location) and/or in the same department, floor, ward and/or room of such a facility, by way of non-limiting example, and coupled with computer **104** by way of a bus, network or other media, or combination thereof, wired or wireless, dedicated, shared or otherwise.

[0084] The illustrated system **1324** also includes an analysis/reporting module **1324A**, implemented in software on one or more of the computers or other computational devices making up that system, that analyzes and/or reports the information collected and transmitted by processor **104** in regard to station **100**. That data can include treatment data, e.g., data gathered, e.g., by sensors **1328A-1328D** and/or sensors **1330A-1330D**, alerts generated by monitor modules **1332**, by processor **104**, or otherwise, query/survey results, video (or still images) from the web camera coupled to the touch screen **102a**, **102b**. The system **1324** also includes a touch screen **1324B** (or other combination of input and/or output devices) of the type commercially available in the marketplace or otherwise known in the art (as adapted in accord with the teachings hereof) for presenting results generated by module **1324A**. However, in the illustrated embodiment, the touch screen **1324B** operates, e.g., for purposes of data input and display, in the manner described in incorporated-by-reference U.S. patent application Ser. Nos. 60/732,335 and 11/591,438, published as PCT/US 2006/042650 and incorporated by reference herein, though, it may operate differently in other embodiments.

[0085] Illustrated system **1324** may be coupled to database systems **106**, **108**, e.g., via network **124**. The system **1324** can

execute database management software (not shown) that stores the patient's medical condition-based information (e.g., real-time physiometric sensor readings), operational sensor readings and/or alerts, etc., to the database systems **106**, **108** and/or that retrieves that information therefrom, e.g., for reporting and other purposes consistent with the teachings hereof. In these regards, the database management software can be of the type commercially available or otherwise known in the art for such purpose, as adapted in accord with the teachings hereof.

[0086] Referring to FIG. 3, in the illustrated embodiment, the touch screens **102a**, **102b** operate under control of the processor **104** to provide an entry screen **300** on the touch screens **102a**, **102b**, which the patients **112a**, **112b** (and/or medical personnel such as nurses and patient care technicians) can use to input letters, numbers, and/or other symbols via a keyboard icon **302** to be authenticated as a valid user and thereby access content from the processor **104** and/or the databases **106**, **108** through the touch screens **102a**, **102b**. The entry screen **300** may or may not occupy a substantial entirety of the display screen **102a**, **102b** (e.g., to the exclusion of other screens), as with all screens described herein.

[0087] Although authentication is illustrated in this example as occurring by the patients **112a**, **112b** at the touch screen **102a**, **102b**, the patients **112a**, **112b** may be authenticated in a similar way elsewhere (e.g., through another device in electronic communication with the touch screens **102a**, **102b** and/or the processor **104**) and by a user other than the patients **112a**, **112b** (e.g., an administrator at the display screens **102a**, **102b** or the touch screen **122**). Additionally, those skilled in the art will appreciate that authentication may occur in a multitude of other ways, e.g., using identification techniques such as voice imprint, fingerprint, retinal scan, biometric identification, though an access card, etc.

[0088] As shown in FIG. 3, the touch screens **102a**, **102b** can additionally, or alternatively, display text boxes **304**, check boxes **306**, button icons **308**, or other widgets that a user can use to make input designations on the entry screen **300**. Together, the icons **302**, **304**, **306**, **308** (and/or any others displayed on the screen **102a**, **102b**) can be used to select and/or enter patient (user) identification. Furthermore, the icons **302**, **304**, **306**, **308** (and/or any others displayed on the screen **102a**, **102b**) can be organized in any configuration on the screens **102a**, **102b**, including different configurations on different ones of the screens **102a**, **102b** in communication with the processor **104**. After authentication as a valid user, a user may be able to enter additional information through the entry screen **300**, such as treatment information (e.g., blood pressure, pulse, treatment parameters) and post-treatment information (e.g., next scheduled patient visit, drug prescriptions, and so forth).

[0089] FIG. 4 illustrates a menu screen **400** driven by the processor **104** to the touch screens **102a**, **102b**, e.g., at the start of a treatment session following user authentication (or before, as user authentication may occur after an initial selection on the menu screen **400**, to facilitate selection of content for display on the touch screens **102a**, **102b**). The menu screen **400** displays a plurality of mode selection options **402**, **404**, **406**, **408**, **410**, **412**, **414** (e.g., content corresponding to data types in the medical database **106** and/or the content database **108**) with a corresponding graphic **402a**, **404a**, **406a**, **408a**, **410a**, **412a**, **414a** disposed adjacent to its corresponding text option **402**, **404**, **406**, **408**, **410**, **412**, **414** in the list. By way of non-limiting example, in the illustrated

embodiment, the operator selects a content option by touching the options graphic **402a**, **404a**, **406a**, **408a**, **410a**, **412a**, **414a**. However, those skilled in the art will appreciate that the method for selecting content from the list may vary (e.g., the user may touch the options text bar **402**, **404**, **406**, **408**, **410**, **412**, **414**, use a peripheral device such as keyboard or mouse, or speak the options text if the display screen **102a**, **102b** has voice recognition capability).

[0090] FIGS. **510** illustrate embodiments of various screens that can display based on the patient's content choice on the menu screen **500** (or on another screen since mode and content choices may be made available on various screens). The screens illustrated herein are provided as non-limiting examples; screens can have any configuration and one or more additional screens may be provided to the patients **112a**, **112b** before or concurrent with these content-specific screens, e.g., required viewing content as further described below. As noted above, operation of the devices **102a**, **102b** on which these screens are displayed (and on which the patient or other user provides input) are controlled by the processor **104**. To this end, and to the extent that this description attributes control and data processor functionality to the touch screens **102a**, **102b**, it will be appreciated that such control and data processing is provided indeed by the processor **104**. Similarly, control and data processing of the storage mechanisms **106**, **108** is provided indeed by the processor **104**.

[0091] The screens **400**, **500**, **600**, **700**, **800**, **900**, **1000** can each include one or more navigational features (in addition to or instead of those described for specific ones of the screens **400**, **500**, **600**, **700**, **800**, **900**, **1000**) such as a home button **506** to access the menu screen **400**, a back button **508** to return to the previously viewed screen, a help button **510** (which may provide help regarding the currently viewed screen and/or other features of the touch screen **102a**, **102b** and its user interface), and other similar types of navigational features. The navigational features can be located anywhere on the screens **400**, **500**, **600**, **700**, **800**, **900**, **1000**. Onscreen instructions **516** particular to the currently viewed screen may or may not be provided by default. Scroll buttons (e.g., page up/down buttons, previous/next buttons) can be provided and used if more options are available for selection than can be contemporaneously displayed on any given screen. Any selected option on any screen can open a screen in a new window or in the same window as the screen from which it was selected. Based on the option selected, a user input mechanism may appear on (or disappear from) the screen to ease use of the selected application (e.g., a keyboard appears for use with a crossword puzzle or a numeric keypad appears for use with a multiple choice-based survey).

[0092] Color schemes and/or images on the display screen **102a**, **102b** can be used to help reduce the chance of operator error. For example, in the illustrated embodiment of the menu screen **500**, the graphics **402a**, **404a**, **406a**, **408a**, **410a**, **412a**, **414a** have different images, e.g., a television **402a** for television content and cards **410a** for games content. In the illustrated embodiment of the menu screen **500**, the text options **402**, **404**, **406**, **408**, **410**, **412**, **414** have the same color scheme, but each content choice can have a different color scheme. The color scheme can be used as a reference by the patient **112a**, **112b** during use of the touch screen **102a**, **102b** for determining/confirming which content he/she has selected, e.g., by having a screen background color match the chosen option's color scheme.

[0093] One skilled in the art will appreciate that a variety of patient information can be entered with the methods, systems and devices described herein and that the display on the touch screen **102a**, **102b** can be adapted depending on the intended use. To facilitate data entry and reduce risk of operator error using the touch screen **102a**, **102b**, the processor **104** can render only necessary keypad and/or button icons on the touch screen **102a**, **102b**. Thus, where data entry for an input field selected by the operator (or otherwise activated) requires only numeric values, the processor **104** can render only a numeric keypad on the display **102a**, **102b**. Conversely, where an alphanumeric input field is selected by the operator (or otherwise activated), the processor **104** can render a full (alphanumeric) keypad on the display **102a**, **102b**. As the operator moves from one data entry type to another, the processor **104** can change the icons (or data entry widgets), as necessary, even on the same screen. For example, when a text entry widget is activated, a keyboard can be rendered by the processor **104** on the touch screen **102a**, **102b**. Conversely, when a numeric entry field is activated, a keypad can be rendered.

[0094] The screens discussed herein are not limited to any particular layout or configuration. For example, manipulation tools such as touch-activated icons, pulldown menus, tabs, buttons, selection boxes, and scrollbars can be implemented using any type of manipulation tool. Furthermore, two or more screens may be combined and presented on a single screen and one screen may be divided into two or more screens. There may also be additional screens. Furthermore, users may manipulate the screens in any way, e.g., using a mouse, a touch screen, a stylus, keyboard commands, etc. For example, a user may move his or her mouse pointer over an icon and click on the icon to access a particular functionality.

[0095] Referring first to FIG. 5, upon selection of the television text **402** or graphic **402a**, the touch screen **102a**, **102b** can display a television viewing screen **500**. The television viewing screen **500** can display a television screen **502** that shows television channels like an ordinary television, pre-stored television programs, and the like. Content for the television screen can be delivered to the touch screen **102a**, **102b** from the television data **202** (FIG. 2) or from another source, e.g., a cable or satellite connection.

[0096] The television viewing screen **500** can be programmed to initially display to the patient **112a**, **112b** on a specified channel or with a specified video/audio introduction, or the patient **112a**, **112b** may be able to immediately choose television content on the television viewing screen **500**. The patient **112a**, **112b** can choose content for display on the television screen **502** by, for example, touching buttons on a remote control style menu **504** on the television viewing screen **500**. The remote control **504** can include, among other options, channel up/down buttons **512** and a main menu button **514** to access a television home page (e.g., a guide of available channels). Content **202** for display on the television screen **502** is typically the same for different patients **112a**, **112b**, but the television data **202** may be based at least on identification of the patients **112a**, **112b** as described further below, e.g., restricting users under a certain age to particular television channels.

[0097] If the education option **404**, **404a** is chosen (FIG. 4), then the touch screen **102a**, **102b** can display an education screen **600** as shown in FIG. 6. The education screen **600** can include the education data **212** (FIG. 2) displayed as one or more education content options **602**, which can be presented

textually or graphically as described above regarding the main menu screen **400**. In this example, the education options **602** are shown as a vertical list of text buttons. The education options **602** can be catered to a particular user of the touch screens **102a**, **102b** (as identified by login via the entry screen **300** of FIG. 3) as described further below.

[0098] Non-limiting examples of the education options **602** include treatment information (e.g., dialysis access options, educational information regarding treatment at the dialysis machines **110a**, **110b**, treatment options, etc.), diagnosed patient conditions (e.g., diabetes, high blood pressure, etc.), self medical care issues (e.g., diet and medicine, living well, safety, etc.), financial help, caregivers, working/employment issues, and similar types of educational information. Upon selection of one of the education options **602**, another menu of category specific education options **604** can appear, e.g., on a new screen, on the education screen **600** in tree format to the right of the selected option (as shown), or otherwise. The category specific education options **604** can also be catered to a particular user as explained below. The education option **602** to which the displayed category specific options **604** apply may be highlighted, such as by changing its color, changing its appearance to look as if it has been depressed, or otherwise highlighting the education option **602** (as shown, the selected access options button **602** is ringed in green).

[0099] Although not always specifically mentioned with regard to particular screens, category specific options can be available on any screen, e.g., choices of music genres, radio stations, preprogrammed playlists, etc. upon selection of the music option **412**, **412a** prior to accessing the music screen **700** of FIG. 7.

[0100] The music screen **700** can include an audio player **702** which can play music and/or other types of audio. The audio player **702** can play music data **210** from the content database **108** and/or other audio content, such as radio stations (accessed like a traditional radio or over a network such as the Internet) and recorded audio (e.g., compact discs, digital music, etc.). The patients **112a**, **112b** may be able to provide music content for play through the audio player **702**, e.g., by interfacing a portable music player to the display device **102a**, **102b**.

[0101] Referring to FIG. 8, if the games option **410**, **410a** is chosen (FIG. 4), then the touch screen **102a**, **102b** can display a games screen **800**. The games screen **800** in this example initially presents game category options **802** (e.g., board, cards, sports, word, educational, etc.), which when selected trigger display of game options **804** within the selected category. The games screen **800** may not list game category options but instead present a list of all games, organized alphabetically, by approximate game completion time, by favorites as indicated by previous choices by the patient **112a**, **112b**, or other organizational scheme. The game options **804** can include traditional games (e.g., solitaire, chess, Mine Sweeper, Reversi, hearts, poker, checkers, crossword puzzles, baseball, pinball, etc.) and/or educational games designed to educate in game format (e.g., word searches or Hangman using medical terms, trivia, constructing nutritionally appropriate meals within a certain time limit or given various food options, etc.).

[0102] Patients **112a**, **112b** under a certain age may only receive educational game options or may receive educational game options when they select the education option **404**, **404a**. When the patient **112a**, **112b** selects one of the game options **804**, the game can start immediately, or rules may first

be made available. Additionally, the patients **112a**, **112b** may be able to play games against each other, e.g., coordinated and/or hosted by the processor **104** and using the communication links **120**.

[**0103**] Referring to FIG. 9, if the internet option **406**, **406a** is chosen (FIG. 4), then the touch screen **102a**, **102b** can display an Internet screen **900**. The Internet screen **900** is shown as a separate, popup window from the menu screen **400** from which it was selected. The Internet screen **900** can function like any browser, as is well known in the art. The Internet screen **900** can provide access to any one or more networks, such as the Internet, an intranet, an extranet, and any other similar type of content-providing network. The network(s) available through the Internet screen **900** can be direct-connected and/or networked to the processor **104** and/or interface **102a**, **102b**.

[**0104**] Referring to FIG. 10, if the surveys option **408**, **408a** is chosen (FIG. 4), then the touch screen **102a**, **102b** can display a surveys screen **1000**. The surveys screen **1000** illustrates a survey in progress. Before displaying the surveys screen **1000**, the touch screen **102a**, **102b** may first display one or more choices of surveys that the patient **112a**, **112b** can choose to begin (new surveys) and/or complete (in-progress surveys). Surveys can include any question/answer type interaction, such as a feedback form, a questionnaire, or other interrogatory process regarding any aspect of patient care such as how the patient **112a**, **112b** is feeling, the patient's response to treatment, the patient's understanding of his/her treatment and condition program, the patient's understanding of what he/she should be doing in connection with his/her treatment program, functionality of the station **100a**, **100b** and other similar types of questioning.

[**0105**] In this embodiment, the surveys screen **1000** includes a title bar **1002** indicating the content being viewed and a content window **1004** showing the actual content. The screens displayed to a particular patient typically have the same general configuration (color scheme, font, button locations, etc.), e.g., the surveys screen **1000** having the same configuration as the music screen **700** (unlike in these illustrated examples where the surveys screen **1000** and the music screen **700** have different configurations). The surveys screen **1000** includes a keyboard **1006** which the patient **112a**, **112b** can use to enter one of the provided choices **1008** in an answer box **1010**. Alternatively, the user may be able to touch one of the provided choices **1008** by way of answer. One or more survey navigation buttons **1012** can be provided which can allow the patient **112a**, **112b** to, for example, return to the previous question, move to the next question, or quit the survey.

[**0106**] Operation

[**0107**] FIG. 11 is a flow diagram illustrating operation of systems according to the invention. Although the system flow diagram is described with reference to the elements included in the embodiments described above, this or a similar process, including the same, more, or fewer steps, reorganized or not, may be performed in connection with other embodiments of the invention. Furthermore, for simplicity of discussion, the system flow diagram is described with reference to the treatment station **100a**, although the same can apply to treatment station **100b** (and any other station as described herein).

[**0108**] As shown in the drawing, the processor **104** determines **1100** if the patient **112a** has been automatically authenticated at the treatment station **100a**, and more particularly at the display device **102a**. Authentication of the patient **112a**

can allow the processor **104** to provide customized information to the display device **102a** based on the patient **112a** currently using the display device **102a**. Authentication can also help assure that only authorized users can access data, some of which may be confidential medical information, available at the display device **102a** via the processor **104**.

[**0109**] In instances where the treatment station **100a** is located in a clinical setting (e.g., a hospital or a hemodialysis clinic), automatic authentication can occur, for example, if an administrator authenticates the patient **112a** by identifying the patient and entering authorization clearance at the touch screen **122**. (In the illustrated embodiment, authentication is not required in instances where the treatment station **100a** is disposed in a nonclinical setting (e.g., in the patient's home), though, other embodiments may vary in this regard.

[**0110**] In another example, the patient **112a** may be wearing or carrying an automatic authorization mechanism such as a radio frequency identification (RFID) tag that the display device **102a** and/or the processor **104** can automatically detect when the patient **112a** is within sufficient proximity. In instances where the treatment station **100a** is located in a clinical setting (e.g., a hospital or a hemodialysis clinic), the touch screen **122** can be utilized in connection with RFID-based authorization instead or in addition to the display **102a** and/or processor **104**.

[**0111**] In yet another example, the machine **110a** may be programmed for the patient **112a**, and the processor **104** can identify the patient based on the machine's programming.

[**0112**] If the patient **112a** has not been automatically authenticated, then the processor **104** determines **1102** if the patient **112a** can be manually authenticated. Manual authentication can occur using the entry screen **300** described above. If a first attempt at authentication fails, the patient **112a** may receive one or more additional attempts to log on to the system, although the number of additional attempts may be limited. If the patient **112a** cannot be manually authenticated, the processor **104** denies **1104** the patient **112a** any further access to content through the display screen **102a**. The processor **104** can also optionally trigger an error message or alert to be sent to an administrator, or more specifically to the touch screen **122** or other device (e.g., touch screen monitor **1324B** coupled to remote digital data processing system **1324**), so an administrator can assist the patient **112a** with login.

[**0113**] Once authenticated either automatically or manually, the processor determines **1106** if there is any required or prescribed content to be displayed to the patient **112a** on the touch screen **102a**. Required or prescribed content can include any content that has been recommended or prescribed (typically by a physician or other health care provider) for the patient **112a** to view, either at the time it is presented or at a later time, typically during the same treatment session in which it was first presented to the patient **112a**. The required or prescribed content can be specific to the patient **112a** (e.g., regarding a recently prescribed medication or an aspect of treatment) or it can be general (e.g., how the machine **110a** works). The processor **104** may consider the patient's location in determining whether required or prescribed content exists. For example, patients who are receiving treatment at a treatment station **100a** located in a clinical setting (e.g., a hospital or a hemodialysis clinic)—e.g., where they can ask follow-up questions directly to a health care provider—may receive different documentation than those who are

receiving treatment at a station **100a** that is located in non-clinical setting (e.g., in the patient's home).

[0114] By way of non-limiting example, required or prescribed content can include educational materials regarding treatment prescribed by medical personnel (e.g., a physician, social worker, dietician, etc.), instructions regarding the patient treatment station **100a**, question of the day, tip of the day, appointment reminders or recommendations, and other types of similar content. That content may be provided in a more abbreviated document, for example, when delivered to a patient who is receiving receiving treatment in a hemodialysis clinic, e.g., since follow-up questions can be answered directly by the nurse or other provider. On the other hand, that same content may be delivered in a more complete form, when delivered to a patient who is receiving treatment at home.

[0115] If the processor **104** determines that there is required or prescribed content for the patient **112a**, the processor **104** determines **1108** if the patient **112a** must view the required or prescribed content now, i.e., before the patient **112a** can choose content for viewing on the touch screen **102a** and/or before the touch screen **102a** displays content option choices (e.g., the menus screen **400**) to the patient **112a**. If the patient **112a** must view the required or prescribed content at the instant time, then the processor **104** retrieves the required or prescribed content from the appropriate one or ones of the databases **106**, **108** and delivers **1110** the required or prescribed content to the touch screen **102a** for display to the patient **112a**. If the patient **112a** need not view the required or prescribed content at the instant time (e.g. because the patient **112a** can choose to view the required or prescribed content anytime within a certain amount of time, such as a week), the patient **112a** can be presented with the option to view the required or prescribed content.

[0116] The processor **104** can determine **1112** whether the patient **112a** selects to view the required or prescribed content by, e.g., receiving an input signal from the touch screen **102a**. If the patient **112a** selects to view the required or prescribed content, then the processor **104** retrieves the required or prescribed content from the appropriate one or ones of the databases **106**, **108** and delivers **1110** the required or prescribed content to the touch screen **102a** for display to the patient **112a**.

[0117] If the patient **112a** does not select to view the required or prescribed content, or if there was not any required or prescribed content for the patient **112a**, then the processor **104** customizes **1114** content to be retrieved from and provided to the patient **112a** from one or both of the databases **106**, **108** (typically, the content database **108**). One skilled in the art will appreciate that the content for delivery to the screen **102a** can be chosen with a variety of schemes that extrapolate, average, and/or rank content based on such factors as current patient data, previous patient data, and/or "normal" patient values.

[0118] FIG. 12 depicts functional aspects of the processor **104** and elements according to one practice of the invention which can receive real-time data (e.g., from the machine **110a** and/or its attendant sensors **1328A-1328D** and/or **1330A-1330D**, from the screen **102a**, etc.), analyze that data to determine content delivery, and deliver content to the touch screen **102a**.

[0119] Referring back FIG. 11, at the beginning of patient treatment session, i.e., typically immediately following authentication of the patient **112a**, the processor **104** may

choose content for delivery based on real-time data (e.g., blood pressure, weight, glucose level, hemoglobin level, etc., e.g., from the sensors **1328A-1328D**, and/or operational data, e.g., from sensors **1330A-1330D**), as well as on non-realtime and/or historical data. For example, the processor **104** can consider archived patient medical data (such as that stored in the medical database **106**) indicating diagnosed diseases, previous diet instructions, currently prescribed medications, composition of used or spent dialysate, and the like, and deliver specifically related educational information.

[0120] For another example, the processor **104** can consider the patient's current medical condition (e.g., as measured by sensors **1328A-1328D**) and/or the patient's compliance with one or more requirements, goals, or milestones (e.g., as determined dosing, on/off times, etc., determined by modules **1332** from operational sensors **1330A-1330D**) in determining content choices to present on the display screen **102a**. Whether the patient **112a** has complied with a requirement, met a goal, or met a milestone can be stored in the database **106** (or other location accessible by the processor **104**), and the processor **104** can grant or deny the patient **112a** access to particular content from the content database based on the patient's compliance.

[0121] For example, after viewing a certain type or amount of educational and/or required material, a new entertainment option such as the Internet can be made an available mode choice as a "reward" to the patient **112a**. For another example, if the patient **112a** has met a treatment-related goal, such as appearing for all scheduled hemodialysis appointments within a certain time period (e.g., one month) or demonstrating a reduced potassium level over time, then the patient **112a** may be granted a reward such as free access to otherwise fee-based content such as cable television or coupons to stores (which may be electronically redeemed using the screen **102a** or provided in hard copy to the patient **112a**). For yet another example, if the patient **112a** previously failed to comply with a requirement or failed to meet a goal, then the processor **104** may deny the patient **112a** access to particular content, e.g., games, premium cable television channels, etc. Access to denied content may be restored in real-time, such as if the patient **112a** views an educational video on the screen **102a** or, in instances where the patient is receiving treatment in a clinical setting, after the patients discusses a missed goal with a medical practitioner who may manually restore patient content access via the screen **122**.

[0122] Once the processor **104** has determined content for the patient **112a**, the processor **104** can deliver **1116** the content to the patient **112a** (or, more specifically, the touch screen **102a**). This delivered content here generally includes choices of content (video, audio, games, etc.) that can be delivered from the content database **108** upon selection by the patient **112a**, such as a customized menu of options on the main menu screen **400** or customized educational materials available through the education screen **600**.

[0123] Presented with two or more content options, the patient **112a** can choose **1118** via the touch screen **102a** content he/she wishes to access. The patient's choice can be communicated to the processor **104**, which can determine **1120** whether the patient's content choice triggers delivery of required or prescribed content. The processor **104** can also optionally deliver **1122** information identifying the content selected by the patient **112a** to an appropriate location for appropriate recordation **1124** (e.g., to one or both of the databases **106**, **108** where it may be later accessed by the

processor 104 to determine content for delivery to the patient 112a, or even to other patients since the processor 104 may choose content based on popularity among patients having similar medical conditions). If no required or prescribed content is associated with the patient's choice, then the processor 104 can deliver 1110 the selected content to the display screen 102a.

[0124] Delivery of required or prescribed content may be triggered for a variety of reasons, such as requiring the patient 112a to view instructions for a game or audio player before being allowed to access it or requiring a patient to watch part one of an educational video before allowing them to watch a subsequent part of the video. If delivery of required or prescribed content is triggered by the patient's selection, the required or prescribed content can be delivered to the touch screen 102a as described above (including not necessarily providing to the patient 112a at the instant time).

[0125] Customization of content for delivery 1110 can be an ongoing process for the processor 104. For example, the processor 104 can receive real-time medical information from the machine 110a, e.g., from the sensors 1328A-1328D and/or sensors 1330A-1330D (and/or other device, e.g., a standalone blood pressure monitor, weight scale, glucose meter, home hemoglobin analyzer, or supplemental oxygen device), regarding a current medical condition of the patient 112a. Non-limiting examples of real time medical information include blood pressure, heart rate, blood potassium level, content analysis of fluids transferring in and out of the patient 112a during dialysis treatment, weight, glucose level, hemoglobin level, and other types of similar information that may be monitored and/or catalogued regarding the patient 112a. Real time medical information can be communicated from machine 110a to the processor 104 for storage in the medical database 106 where it can be accessed at a later time, possibly for analysis regarding medical trend information that may be used by the processor 104 to determine what content to deliver to the patient 112a during the instant or subsequent treatment.

[0126] Considering real-time medical information and/or other factors such as a duration of the instant treatment session (e.g., as determined from sensors 1330A-1330D) and a history of Internet websites visited, the processor 104 can determine 1126 if there is any need to interrupt delivery of content to the patient 112a. Interruption may be necessary for a variety of reasons. For example, real time medical information regarding the patient 112a received at the processor 104 may trigger delivery of content, e.g., a blood pressure measurement above a certain predetermined level (generally or specific to the patient 112a) may trigger a delivery of a message to the patient 112a that a high blood pressure level has been detected and that they should attempt corrective action such as reclining. In another example, the machine 110a may begin a new stage of treatment or be nearing end of treatment, and the processor 104 can send an alert to the patient 112a informing him/her of the treatment's progress. In yet another example, a high potassium level measurement may trigger delivery of dietary information on how to reduce potassium levels in the blood, including lists of foods to avoid eating and cooking recipes.

[0127] If interruption of content delivery to the touch screen 102a is necessary, then the processor 104 can deliver 1110 the newly determined content to the patient 112a. The content viewed by the patient 112a at the time of interruption may be paused for continuation at a later time. If there is no

need for interruption, the patient 112a can finish 1128 viewing the content, e.g., finish playing a game, finish watching a video, listen to music until the patient 112a stops it, read educational pamphlet material, browse the Internet until the patient 112a closes the browser, etc.

[0128] In some embodiments of the invention, the processor controls the selection of delivered content in accord with the following guidelines:

[0129] Can be mandatory videos, such as one on potassium levels.

[0130] Survey may trigger other required or recommended content

[0131] Can periodically (for example, every hour) require additional content to be received/viewed.

[0132] Appointments with dietitians or other healthcare providers can be recommended or required.

[0133] Educational games such as constructing a nutritionally appropriate meal should/could be included; can play against others.

[0134] Can be based on information from tracking Internet searches, TV viewing, or other content or activities of the patient. For example, by tracking web surfing and/or chatroom activity it may be determined that the patient is seeking information on treating headaches and information on headaches could be provided or required.

[0135] After the patient 112a finishes 1128 viewing particular content, the processor 104 can customize 1114 a new set of content (e.g., menu options) for delivery to the patient 112a, or the processor 104 can provide previously determined content. However, based on the content the patient 112a finished, an alert may be triggered, so the processor 104 determines 1130 if an alert is triggered and, if so, provides 1132 notification of the alert to an appropriate person or system.

[0136] Alerts can be triggered for a variety of reasons. For example, they may be reported to processor 104 directly by components of station 100 and/or apparatus 110. Alternatively, or in addition, they can be triggered by the monitoring logic 1332 detects that readings from the physiometric sensors 1328 and/or operational sensors 1330 fall outside of selected ranges. That monitoring logic can also, by way of non-limiting example, monitor when and for how long the various sensor readings, for example, are outside those ranges.

[0137] For another example, the patient 112a may have completed a survey, and an alert may be generated and sent by processor 104 to inform an administrator, e.g., working locally to treatment station 100a and/or working at the remote system 1324, to forward the survey results to an appropriate survey coordinator. For still another example, particularly if the patient 112a is under a certain age, finishing a game with a score above a certain level may trigger an alert by the processor 104 to be sent (e.g., via electronic mail, text message, phone, pager, illuminating a light proximate to the display screen 102a and/or (in instances where the patient is receiving treatment in a clinical setting, the touch screen 122, etc.) to such an administrator, e.g., in the treatment room, who can deliver a prize to the patient 112a. For yet another example, if the patient 112a views a particular educational video, an alert may be sent by the processor 104 to such an administrator, e.g., in the treatment room, to provide the patient 112a with particular materials (e.g., further reading, materials useful in implementing a taught procedure, etc.) when the patient 112a finishes treatment at the machine 110a. In each of these cases, alerts triggered by processor 104 can be

output to screens 102a and/or 112, instead of or in addition to being sent via electronic mail, text message, etc.

[0138] In addition to generating and reporting alerts locally, e.g., by processor 104, such alerts can be generated by remote system 1324, e.g., based on like data transmitted to it by processor 104. For this and other purposes, the communications logic (e.g., network interface 1320) operates under control of the processor 104 to transmits treatment data, e.g., query/survey responses to the digital data processing system 1324, along with readings from sensors 1328A-1328D and 1330A-1330D, video (or still images) from the web camera coupled to the touch screen 102a, 102b, and alerts from monitoring logic 1332, etc., to system 1324 for consideration by health care provider 1322 and/or reporting/analysis by module 1324 in accord with the teachings hereof. In the illustrated embodiment, that information is transmitted e.g., at or around the time of completion of each treatment session, though, they can be transmitted at regular intervals (e.g., daily, weekly and so forth), e.g., when the device 110a, network 28 and/or data processing system 1324 is otherwise amenable to such transfer.

[0139] As noted and in addition to the above, features of systems according to the invention may include a capability to track the inventory and/or use of supplies (including without limitation erythropoietin, PD solutions, other medicines, and other supplies) in the patient's home, e.g., as determined from readings taken from the operational sensors 1330A-1330D, from querying the patient, or otherwise. Such data can be compared by processor 104 against measures or estimates of existing supply and/or prior history of supply use, and changes, increases or decreases can be noted and charted or graphed, e.g., on screens 102a and/or 112. Software executing on the processor 104 can, further, analyze the data and/or results of those comparisons, e.g., using expert systems logic, operational analysis techniques, statistics, or the like, all of the type known in the art, as adapted in according to the teachings hereof, e.g., to reach conclusions regarding underlying causes and/or resulting conditions, which can also be displayed on screen 102b. In addition to, or in lieu of, of the foregoing, the processor can also signal alerts pertaining to supply use, changes therein, underlying causes and/or resulting conditions.

[0140] Such conclusions might include, by way of illustrative example, concluding that their low supplies at the patient's home, excessive use of supplies, unusually low use of supplies, use of supplies inconsistent with a care plan, use of supplies in conformance with a care plan, etc.

[0141] Alternatively, or in addition, the aforesaid comparisons and analysis can be performed by module 1324A based on data transmitted to system 1324 by processor 104. And, more generally, all of the activities attributed herein to processor 104 may, in some embodiments, be performed by processor 1324 and vice versa.

[0142] Regardless, following such analysis(ies) performed by processor 104 and/or system 1324, the patient, care provider(s), insurer, third party, etc., can be notified via electronic mail, text message, phone, pager, or otherwise, of the inventory and/or use of supplies, related charts or graphs, and issues and conclusions that may be derived therefrom (low supplies at the patient's home, excessive use of supplies, unusually low use of supplies, use of supplies inconsistent with a care plan, use of supplies in conformance with a care plan, etc.).

[0143] Among other things, if the inventory at the home is low, the processor 104 and/or system 1324 may trigger a resupply from a care provider, third-party, etc., e.g., by automatically effecting the shipment of supplies to the patient and/or or by generating a notice to an appropriate person that the product inventory is low and resupply may be required.

[0144] Also as noted and in addition to the above, features of systems according to the invention may include facilitating analysis of patient related data at a location different than the patient's home, such as a central office, and communication of patient related data and related analyses to health care providers. For example, patient weight data collected by sensors 1328A-1328D may be transmitted by processor 104 to system 1324, where module 1324A may be chart or graph weight changes over time, showing weight gain or loss trends, and may output such chart/graph via device 1324B and/or signal the patient, care provider(s), insurer, third party, etc., via electronic mail, text message, phone, pager, or otherwise, of the results. More generally, query/survey responses to the digital data processing system 1324, along with readings from sensors 1328A-1328D and 1330A-1330D, and alerts from monitoring logic 1332, may be transmitted by processor 104 to system 1324 for reporting and/analysis consistent with the teachings hereof—including provision of content, generation of alerts, and/or performing other functions attributed elsewhere herein to processor 104.

[0145] FIG. 14A depicts a screen 1410 of the type generated by module 1324A for display on touch screen 1324B identifying a list of active patients and a workflow (or workflow) of actions to be taken by a nurse or other health care provider with respect to them. Included in the display are exclamation points (or other indications) of patients for which alerts have been generated, e.g., at the patient treatment station and/or by module 1324A: here, three such alerts are indicated.

[0146] When a nurse or other health care provider selects the "Alerts" drop-down on the touch screen (or alternatively clicks on the exclamation point adjacent the patient's I.D.), the system 1324 generates a screen 1412 of the type shown in FIG. 14B identifying the alert condition for the specific patient. Here, that alert concerns abnormal weight gain. The module 1324A also generates on that screen a workflow of tasks for the nurse to execute in response to the alert, e.g., contacting the patient, making a note of the contact in the patient's record and contacting the physician. In the illustrated system, the nurse can select those items on the touch screen in order to initiate the respective task, e.g., automatic phone dialing, pulling up of a 'contact note' dialog box, etc.

[0147] Although shown in FIGS. 14A-14B and discussed above as being generated by module 1324A on touch screen 1324B, like screens can be generated by processor 104 for display on touch screen 122 and/or for transmission to, and display on, touch screen 1324B.

[0148] A further appreciation of operation of systems according to the invention may be attained by reference to the following script for a video depicting use and operation of systems according to the invention at a treatment center:

[0149] Narrator:

[0150] Welcome to the Clinic. We'll see how our new clinical system [constructed and operated in accord with the teachings hereof] supports patient care management and clinical decision making.

[0151] We'll also see how [touch screen 122] frees up the clinic staff to spend more time with the patient.

- [0152] Finally, we'll see how our patients use the new Direct-Touch Patient Entertainment System, as we deliver on the
- [0153] UltraCare promises of Individual Patient care and excellent customer service.
- [0154] (In the video, the nurses have are reading and/or entering data via touch screen 112. The patient, Gretchen, is seated taking treatment from apparatus 110a and interacting with touch screen 102a)
- [0155] [The nurses have] been taking care of Gretchen, but let's see what she's been so busy doing!
- [0156] With the patient treatment station [constructed and operated in accord with the teachings hereof], Gretchen has access to digital radio, satellite TV, movies, games, educational material, and the internet.
- [0157] Gretchen, do you mind showing us the Direct-Touch system?
- [0158] Gretchen:
- [0159] (Gesturing to touch screen 102a) Hi! Let me show you how I use this! It's a touch screen so I just pick exactly what I want from the menu.
- [0160] The best thing about this system is that I get to watch what I feel like—sometimes it's a movie, and sometimes it's a video to help me understand how to eat right . . .
- [0161] My dietitian says I'm doing a much better job these days managing my Po-tah-see-um. I think it's really helped to review the rules right here whenever I want to. And here's something I didn't expect—satellite radio!
- [0162] (Touching screen 102a and pretending to sing) OH! I love this song! (She listens to the music for a few seconds).
- [0163] I don't suppose we have time to listen to the whole thing . . . it reminds me of a handsome Swedish gentleman I met once.
- [0164] (Glancing at screen 102a) Let's see—where next? Surveys? That's where I can let the staff know how things are going, and so on.
- [0165] (Glancing toward video monitor/audience and giving thumbs up) But let me show you the games—this really helps when the treatment seems long . . .
- [0166] There's card games and also board games—I'm getting pretty good!
- [0167] And I can even access the internet! It's neat, and I guess I'm going to use this a lot in the future.
- [0168] I think I've covered it all. Now I think I'll get back to my movie if you don't mind! Thanks for stopping by!
- [0169] A still further appreciation of operation of systems according to the invention may be attained by reference to the following script for a video depicting use and operation of systems according to the invention in instances where the patient and patient care station (namely apparatus 110 and processor 104) are located at the patient's home, whereas the health care providers are disposed remotely (e.g., at the hospital or central treatment center) with access to digital data processing system 1324:
- [0170] Narrator:
- [0171] (Video image of architectural blueprint of patient's home transitions to "zoom/fly in" to patient's bedroom, with patient seated on bed, near dialysis machine 110, touch screen 102a and processor 104.) [System according to the invention improve] patient awareness and compliance while enhancing the self-care process and facilitates physician interaction.
- [0172] (Video images zooms in to touch screen 102a. Video image transition to screen with menu and examples, e.g., as shown in FIG. 4 hereof). Home care patients can use the intuitive touch-screen interface to choose from a variety of activities and programs. They can view educational materials and messages targeted to their specific needs. They can also access lab results, personalized nutrition advice, surveys and even a patient report card.
- [0173] (Video depicts animated graphic showing data from apparatus 110a and other diagnostics in patient's home "flowing" into computer 104.) Because [the touch screen 102a and processor 104 are] connected directly to the [treatment apparatus 110a], at home, all pertinent data and vital signs flow straight into the system. The system can connect to other diagnostic instruments [in the patient's home], as well. Devices include scales, blood pressure cuffs, glucose meters and many more . . .
- [0174] (Video shows dialysate and other supplies for apparatus 110a appearing on graphic and then cuts to video of real supplies in patient's home.) The system even tracks inventory data for each patient so supplies and deliveries can be adjusted more efficiently, according to individual needs.
- [0175] (Video shows screen shots of touch screen of remote digital data processing system 1324 with graph of data transmitted from processor 104 and/or analyses thereof generated by module 1324A). Sophisticated embedded analytics put metrics and critical information in the hands of clinicians, instantly.
- [0176] (Video shows patient at home getting on weight scale! A graphical animation shows data from that scale traveling to processor 104 and, from there, to digital data processing system 1324). With the system's technology, clinicians will have a better and more current view into their patient's treatment. For example, the system can record the patient's vital signs & weight, without the need for a paper log.
- [0177] (Video shows nurse viewing touch screen of remote digital data processing system 1324. On screen is a worklist of alerts, one of which is the alert "Unexpected Weight Gain." Nurse clicks on that alert, using digital data processing system 1324). The system's workflow engine [e.g., executing on processor 104 and/or module 1324A of computer 1324] which is always processing information, identifies the weight gain trend. It notifies the home support nurse, so the next time she reviews her work list, she can view the details with a click.
- [0178] (Video shows touch screen of remote digital data processing system 1324 with trended graph of patient's weight and blood pressure, showing unexpected weight gain.) A trend graph confirms the unexpected weight gain.
- [0179] (Video shows nurse using digital data processing system 1324 to pull up on touch screen of that system a clinical summary of the patient's history). She can then access & review the patient's full record, with another click of the mouse, and determine whether contacting the patient is necessary.

- [0180] (Video shows nurse using digital data processing system 1324 to click on information displayed on the touch screen of that system. The screen displays “Dialing Mr. Johnson”.)
- [0181] Nurse:
- [0182] “How are you Mr Johnson? I’m calling because I noticed that you’ve been gaining weight . . .”
- [0183] Narrator:
- [0184] (Video shows nurse talking to patient; she, located at the treatment center; he, at home). The system’s technology gives patients a digital lifeline so they don’t have to feel isolated and alone, simply because home dialysis is their best option.
- [0185] (Video shows nurse hanging up from phone call. Using digital data processing system 1324 she pulls up on the monitor of that system a “Progress Note” screen to document the call. Video shows that screen with some data preentered/template) After the call, it’s easy to enter a progress note . . . and convenient templates ensure that the standard work flow is followed.
- [0186] (Video shows screen displayed on touch screen of digital data processing system 1324. Bottom of screen shows order note from physician asking to be alerted on weight gain. Nurse clicks on “Yes” button on screen using system 1324.) When the physician requests it, the nurse can create an alert on the physician’s worklist so he will be aware of any unusual trends.
- [0187] (Video shows overhead shot of physician’s office.) The physician can then review the alert . . . and access the full medical record if necessary.
- [0188] (Video shows touch screen of another computer of digital data processing system 1324 displaying physician’s work list, including the alert of the patient’s unexpected weight gain.) He can also choose to change the order . . . or leave a note for the nurse . . . or simply acknowledge the alert.
- [0189] (Video shows physician using that computer to pull up from digital data processing system 1324 the patient’s clinical summary). With the system, physicians, as well as clinical staff, dietitians and social workers can access all of their patients’ data from remote locations, and then interact with one another and the patient, at any time. In effect, it’s like making a house call—online.
- [0190] Physician:
- [0191] (Video shows touch screen 102a at patient’s home displaying live video image of physician, while he and patient engage in video “chat”) Hi Mr. Johnson. I wanted to talk to you because I see that you had a question, yesterday, about your access . . .
- [0192] Narrator:
- [0193] (Video continues to show touch screen 102a as patient at home continues to talk to physician on screen). The system brings clinic levels of support to the physician and home therapy staff, increasing visibility to the patient, and enabling better individualized care for every patient, every day, every home.
- [0194] (Video shows blueprint of patient’s home). With the system, physicians and home therapy staff have the tools to support home patients as if they were in-center, enabling better individualized care for every patient, every day, in every home. For patients, this means a greater sense of safety, efficiency and confidence when they dialyze at home.
- [0195] Described above are devices, methods and systems meeting the aforementioned objects, among others. Benefits of such devices, methods and systems include:
- [0196] Patients more likely to take treatments as prescribed and complete treatments.
- [0197] Provides alternate focus from pain; makes treatment a less painful experience
- [0198] Improves patient compliance with treatments
- [0199] Improves therapeutic outcomes
- [0200] Improves patient care results may increase physician compensation/reimbursement
- [0201] Improves patient interactivity/communication with healthcare provider
- [0202] Enhance patient self-care
- [0203] Enhance provider responsiveness
- [0204] In regard to monitoring and/or provision of supplies to the patient, advantages include: tailoring delivery process for patient (automate re-ordering, trigger call from customer service); Inventory management (scan supply barcodes; lower inventory.); track usage of dialysate solutions, EPO and other medicines and/or supplies; facilitate notification to patient, care provider, insurer, etc.; trigger resupply from care provider, third-party, etc.
- [0205] Physician will have more access to patient (decrease sense of “out-of-sight, out-of-mind”; improved ability to manage patient)
- [0206] Decrease drop-out rate by better support to patient
- [0207] Improved Patient training/education/support
- [0208] Home Nurses, Dietician, & Social Worker can focus on exceptions, as driven by workflow/alerts
- [0209] Overall: increases value of treatment to patients, their families, and clinicians/physicians.
- [0210] Connectivity & communications
- [0211] Patient data available in near-real-time
- [0212] Integrate into clinical workflows, alerts
- [0213] Improved information flow to clinicians/physicians
- [0214] Increase billing frequency for commercial payers
- [0215] Patient reminders (EPO (Erythropoietin) days, etc)
- [0216] Patient could get additional support/training over the network as needed (ask questions)—deal with patient concerns/fears
- [0217] Web camera
- [0218] physician/clinician can see patient
- [0219] Equipment troubleshooting.
- [0220] Better data collection for use by care providers (including dietician and social worker to insure compliance) and for home medicine management.
- [0221] Simplicity for patient
- [0222] Small enough that patient can keep it where it is convenient
- [0223] Equipment in patient’s home can be battery powered or powered by wall outlet and can be embodied in different form factors
- [0224] PDA
- [0225] All-in-One PC
- [0226] Laptop
- [0227] Can take advantage of bandwidth/connectivity trade-offs.

- [0228] Avoids unnecessary action by patient (including avoiding requirement of asking patient to track treatment record, bring same to clinic, etc.)
- [0229] Avoids requiring physician/clinician to needlessly acquire and analyze information in patient's home treatment regime (use workflows-worklists/Use Alerts; Focus on Problem Resolution; Information is transmitted automatically to central database).
- [0230] Home vs Clinic-Based use of patient treatment station:
- [0231] Users & clinician not competing for access to hardware
- [0232] Only have to set up one network connection/session
- [0233] Same authentication process covers usage for charting & entertainment/education
- [0234] CCPD & home-HD patients are sleeping while cycling
- [0235] Patients are at home—already have access to their choice of entertainment (TV, DVD, radio, books, etc)
- [0236] Deliver patient report cards, tailored education
- [0237] Those skilled in the art will appreciate that the embodiments discussed and shown herein are merely examples of the invention and that other embodiments fall within the scope thereof. Thus, by way of non-limiting example, it will be appreciated that a patient treatment station of the type described above can be used with a variety of medical treatment and diagnostic apparatus, in addition to dialysis machines. By way of further example, it will be appreciated that, in some embodiments (e.g., where sanitary conditions are of less concern and/or are compensated for in other ways), the touch screens can be replaced by a conventional displays (e.g., cathode ray tube (CRT), liquid crystal display (LCD), or otherwise) and a keyboards or other input devices. By way of still further example, methods, systems and devices according to the invention may utilize lesser, more and/or other elements than those shown in the drawings and described herein, and that the functionality of various ones of the elements shown or describe here may be incorporated into and/or otherwise combined with other elements.

In view thereof, what we claim is:

1. A method of patient care, comprising:
 - detecting a current medical condition of a patient receiving medical treatment, wherein the detecting step includes any of sensing at least one of blood pressure, heart rate, weight, glucose level, hemoglobin level, and blood potassium level, and
 - transmitting information regarding the medical condition to a digital data processing system disposed remotely from the medical treatment apparatus.
2. The method of claim 1, wherein the medical treatment apparatus includes one or more sensors utilized in connection with peritoneal dialysis and hemodialysis treatment.
3. The method of claim 1, further comprising delivering to a health care provider from the remote digital data processing system up-to-date medical condition data.
4. The method of claim 1, wherein the delivering step includes generating trend graphs with the medical condition data.
5. The method of claim 1, further comprising
 - acquiring any of a still or video image of the patient, and
 - transmitting that image to the remotely-disposed digital data processing system.

6. A method of patient care, comprising:
 - detecting a medical condition of a patient receiving medical treatment, wherein the detecting step includes any of receiving data from a medical treatment apparatus coupled to the patient,
 - accepting from the patient a subjective characterization of any of medical condition and/or medical treatment,
 - transmitting information regarding any of the medical condition and the subjective characterization to a digital data processing system disposed remotely from the medical treatment apparatus.
7. The method of claim 6, wherein
 - the step of receiving data from the medical treatment apparatus includes receiving data from one or more physiometric sensors that take biometric readings of the patient, and
 - the step of transmitting information to the remotely-disposed digital data processing system includes delivering data from one or more of those physiometric sensors to that digital data processing system.
8. (canceled)
9. The method of claim 6, wherein
 - the step of receiving data from the medical treatment apparatus includes receiving data from one or more operational sensors that sense operating conditions of the medical apparatus, and
 - the step of transmitting information to the remotely-disposed digital data processing system includes delivering data from one or more of those operational sensors to that digital data processing system.
10. (canceled)
11. The method of claim 6, wherein
 - the step of receiving data from the medical treatment apparatus includes receiving image data from a camera coupled to the medical treatment apparatus, and
 - the step of transmitting information to the remotely-disposed digital data processing system includes delivering data from that web camera to that digital data processing system.
12. The method of claim 6, wherein the medical treatment apparatus is any of a device for peritoneal dialysis and hemodialysis treatment.
13. The method of claim 6, further comprising generating graphs of one or more datum received from the medical treatment apparatus.
14. The method of claim 6, further comprising any of reporting and/or analyzing one or more datum received from the medical treatment apparatus.
15. The method of claim 14, wherein the steps of reporting and/or analyzing are executed by a processor local to the medical treatment apparatus.
16. A method of patient care, comprising:
 - treating a patient with a medical treatment apparatus,
 - detecting one or more operating conditions of the medical treatment apparatus via sensors coupled thereto,
 - analyzing data reflecting those operating conditions to any of track inventory and/or use of supplies in connection with treating the patient.
17. The method of claim 16, where the supplies includes any of erythropoietin, dialysis solutions, other medicines, and other supplies utilized in connection with such treatment.
18. The method of claim 16, comprising responding to the analyzing step by effecting any or ordering and delivery of supplies for use in connection with treating the patient.

19. The method of claim 16, wherein the detecting step includes taking readings from one or more operational sensors coupled to the medical treatment apparatus.

20. The method of claim 19, wherein the step of taking readings includes taking readings of levels or dosings of consumables utilized in connection with treatment.

21. The method of claim 20, wherein step of taking readings of levels or dosing includes taking readings of any of fresh and spent dialysate and supplemental medications.

22. The method of claim 16, wherein the analyzing step includes comparing data reflecting operating conditions of the medical treatment apparatus against any of measures or estimates of existing supply and/or prior history of supply use.

23. The method of claim 22, wherein the analyzing step includes any of analyzing the data reflecting the operating conditions and/or results of said comparisons to reach determine underlying causes and/or resulting conditions.

24. A method of patient care, comprising:
treating a patient with a medical treatment apparatus,
detecting any of an operating conditions of the medical treatment apparatus and a current medical condition of the patient receiving medical treatment,
generating an alert based on one or more of said operating conditions and medical conditions,
displaying such alert, along with a workflow of actions to be taken in response thereto by a health care provider.

25. The method of claim 24, comprising to responding to selection of a displayed action by initiating that action.

26. The method of claim 25, where the actions include contacting a patient, contacting a health care provider and making a notation in a patient record.

27. The method of claim 24, wherein any of the generating step and the displaying step are executed remotely from the medical treatment apparatus.

28. The method of claim 27, comprising transmitting more operating conditions of the medical treatment apparatus to a digital data processing system disposed remotely from the medical treatment apparatus.

29. A patient care system, comprising:

- A. a medical treatment apparatus,
- B. one or more sensors coupled to the medical treatment apparatus that detect a current medical condition of a patient receiving medical treatment, the medical condition including any of a blood pressure, heart rate, weight, glucose level, hemoglobin level, and blood potassium level, and
- C. a processor local to the medical treatment apparatus that transmits information regarding the medical condition to a digital data processing system disposed remotely from the medical treatment apparatus.

30-44. (canceled)

45. A patient care system, comprising:

- A. a medical treatment apparatus,
- B. one or more sensors coupled to the medical treatment apparatus that detect a current medical condition of a patient receiving medical treatment,
- C. one or more sensors coupled to the medical treatment apparatus that detect an operating condition thereof, and
- D. any of a touch screen or other output device,
- E. a processor coupled to the one or more sensors and to the touch screen or other output device, the processor generating an alert based on the conditions detected thereby and causing that alert to be displayed on the touch screen or other output device, along with a workflow of actions to be taken in response thereto by a health care provider.

46-48. (canceled)

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专利名称(译)	用于患者护理的方法和系统		
公开(公告)号	US20100137693A1	公开(公告)日	2010-06-03
申请号	US12/620283	申请日	2009-11-17
[标]申请(专利权)人(译)	费森尤斯医疗保健集团		
申请(专利权)人(译)	费森尤斯医药HOLDINGS, INC.		
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IPC分类号	A61B5/00 G06Q50/00		
CPC分类号	A61M1/16 A61M2205/3553 A61M2205/3584 A61M2205/505 A61M2205/59 G09B5/02 G06F19/3418 G06F19/3481 G06Q50/22 G06Q50/24 G06F19/3406 A61M1/1611 A61M1/3609 A61M2205/3331 G06F19/00 G16H10/20 G16H10/60 G16H20/40 G16H40/63 G16H40/67		
优先权	61/199470 2008-11-17 US 60/973676 2007-09-19 US 60/732335 2005-11-01 US		
外部链接	Espacenet USPTO		

摘要(译)

用于患者护理的方法和装置检测接受医学治疗的患者的当前医学状况，例如通过感测血压，心率，体重，葡萄糖水平，血红蛋白水平和/或血钾水平（均作为示例）和将关于该医疗状况的信息发送到远离医疗设备设置的数字数据处理系统。医疗设备可以是例如用于腹膜透析和血液透析的医疗设备，并且医疗状况可以通过耦合到这种设备或以其他方式与这种设备结合使用的传感器来感测。

