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United States Patent [19]

Goodman

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[54] **METHOD AND APPARATUS FOR A PERSONAL HEALTH NETWORK**

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[21] Appl. No.: **978,892**

[22] Filed: **Nov. 26, 1997**

Related U.S. Application Data

[63] Continuation of Ser. No. 518,783, Aug. 24, 1995, abandoned, which is a continuation-in-part of Ser. No. 334,936, Nov. 7, 1994, abandoned.

[51] **Int. Cl.**[6] **A61N 5/04**

[52] **U.S. Cl.** **600/300**

[58] **Field of Search** 600/300, 301, 600/529; 128/920–925

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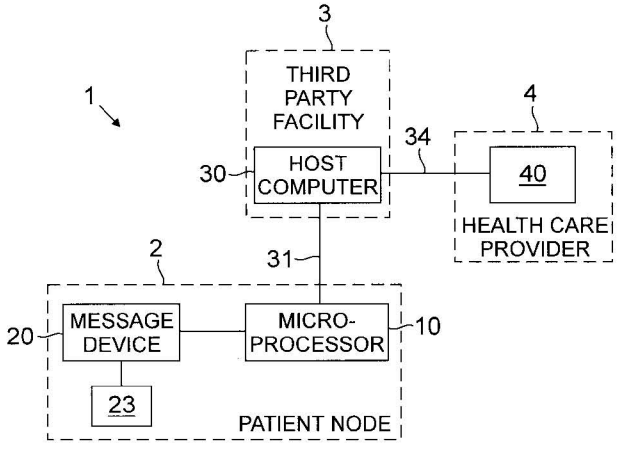
[57] **ABSTRACT**

A method and system for a health network comprising a facility, operated by a party other than the patient or health care provider, for collecting and routing information pertaining to the health care of a patient to the patient and the health care provider. The health network utilizes two-way communication between the patient and the facility, and the health care provider and the facility. In one embodiment, the facility receives treatment instructions from the health care provider that are specifically developed for each patient. Algorithms are developed based on such instructions. The algorithms are then programmed into an appropriately configured message device in the possession of the patient. The patient is prompted by the message device to measure and enter relevant physiological data, e.g., peak flow, etc., as dictated by the treatment instructions. Based on the measured physiological data and the algorithm, messages are displayed on the message device advising the patient of a specific course of treatment, e.g., to administer medicine, to call the health care provider, to go to the emergency room, etc., or, alternatively, such messages can provide more general information related to the patient's current health status. These results can be transmitted to the facility and the health care provider. The algorithm can be modified, as appropriate, to reflect changes in the treatment plan.

25 Claims, 7 Drawing Sheets



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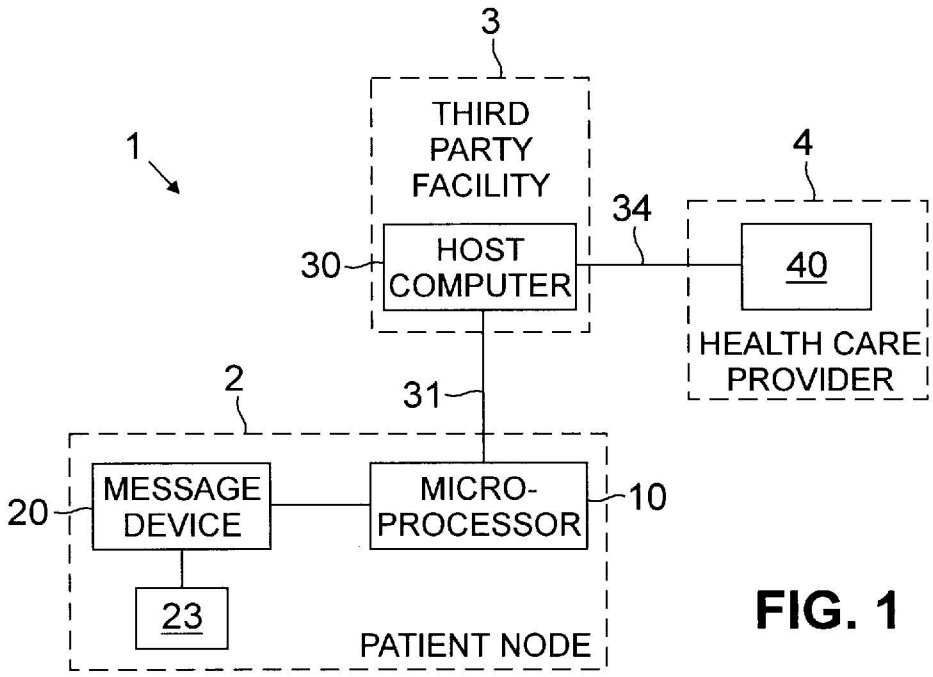

3
THIRD PARTY FACILITY
1
4
34
30
HOST COMPUTER
40
HEALTH CARE PROVIDER
2
31
20
MESSAGE DEVICE
MICRO-PROCESSOR
10
23
PATIENT NODE

FIG. 1

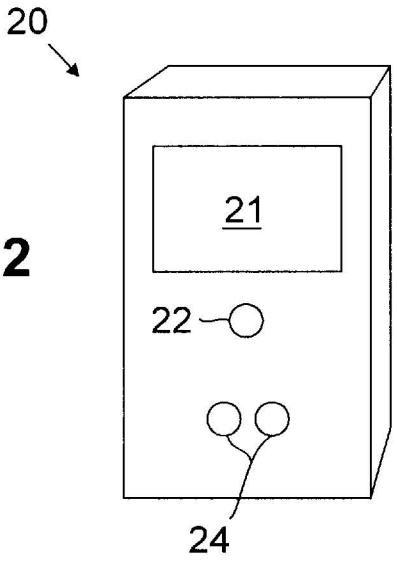
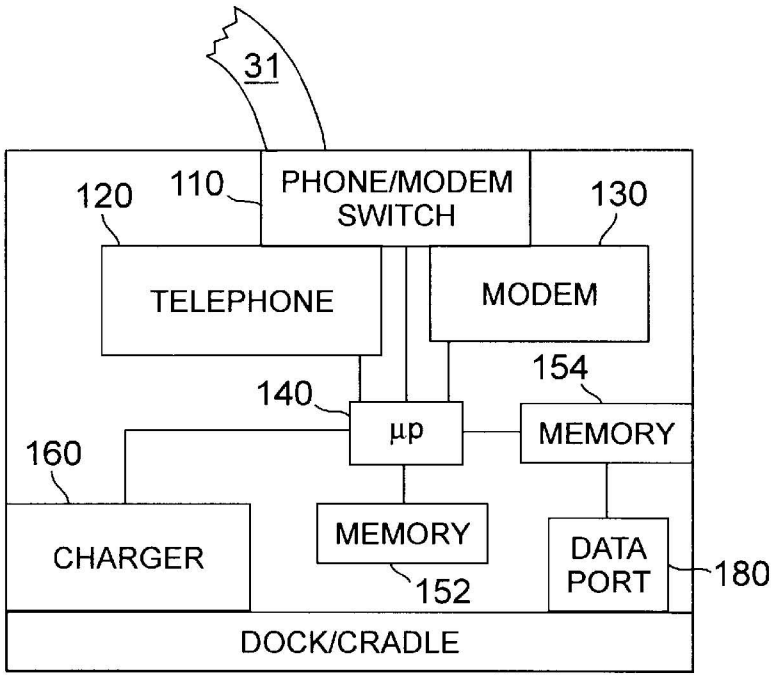

20
21
22
24

FIG. 2

FIG. 2A


31
120
110
PHONE/MODEM SWITCH
130
TELEPHONE
MODEM
154
140
µp
MEMORY
160
CHARGER
MEMORY
152
DATA PORT
180
DOCK/CRADLE

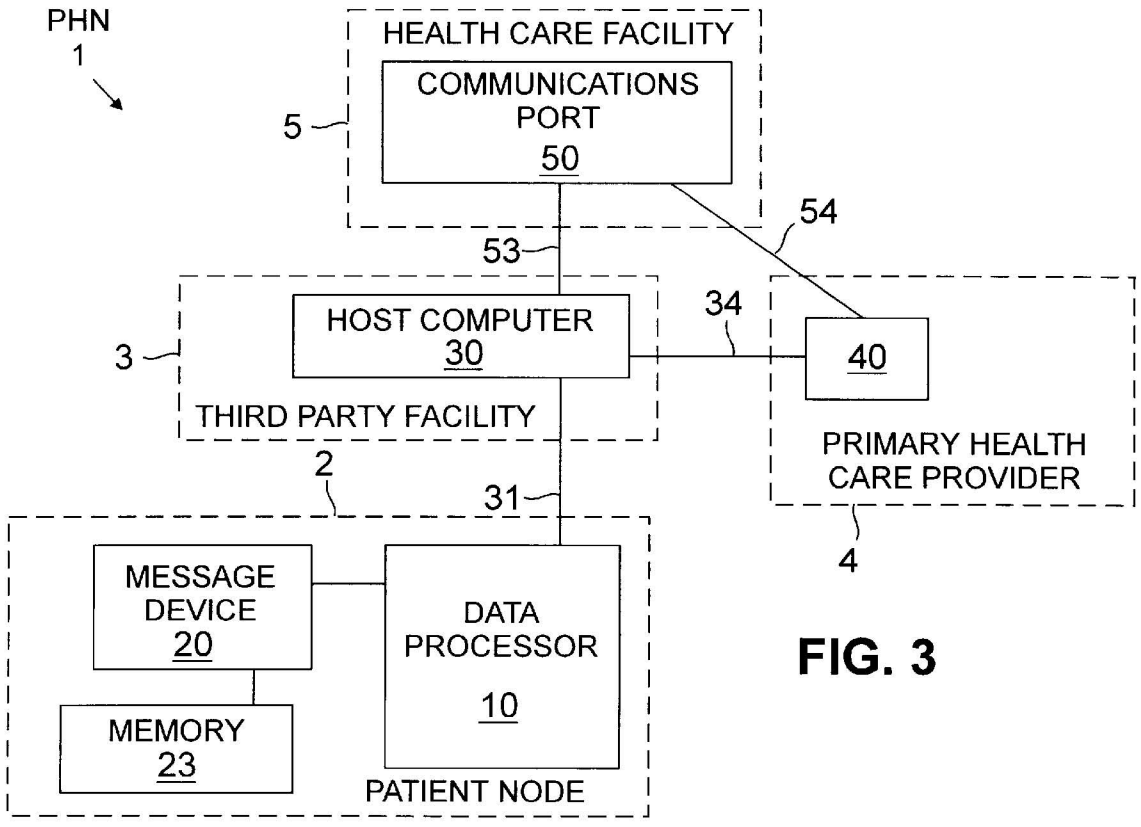

PHN
1
HEALTH CARE FACILITY
COMMUNICATIONS PORT
50
5
54
53
34
HOST COMPUTER
30
40
3
THIRD PARTY FACILITY
PRIMARY HEALTH CARE PROVIDER
2
31
4
MESSAGE DEVICE
20
DATA PROCESSOR
10
MEMORY
23
PATIENT NODE

FIG. 3

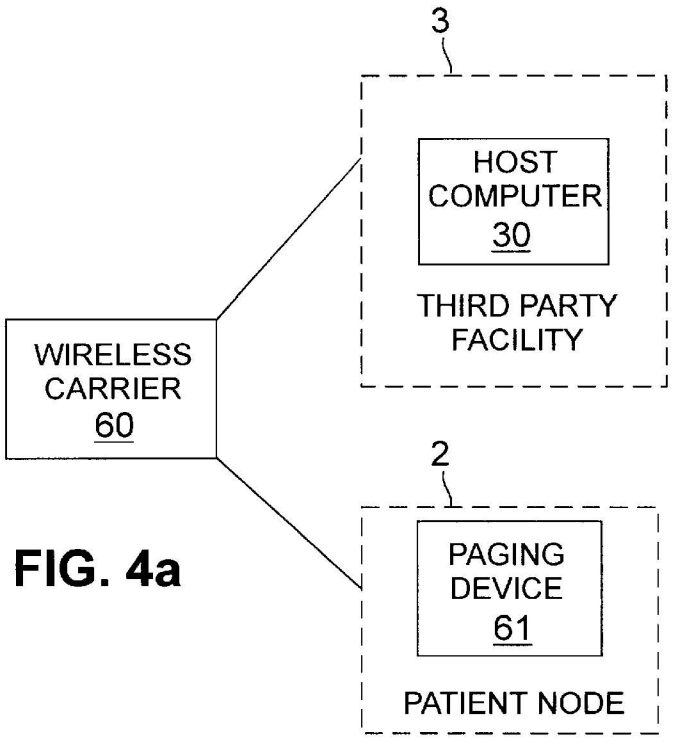


FIG. 4a

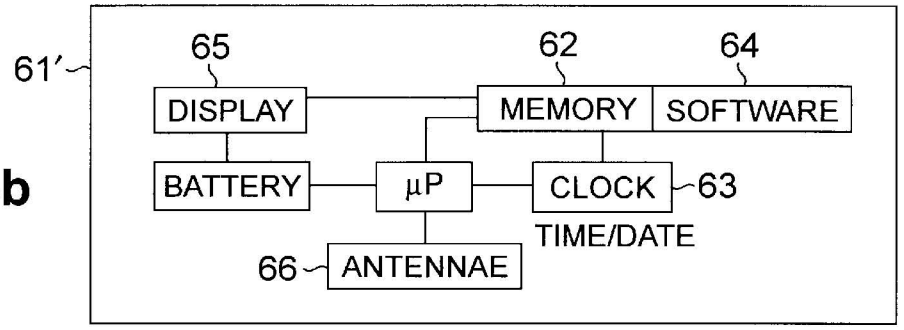


FIG. 4b

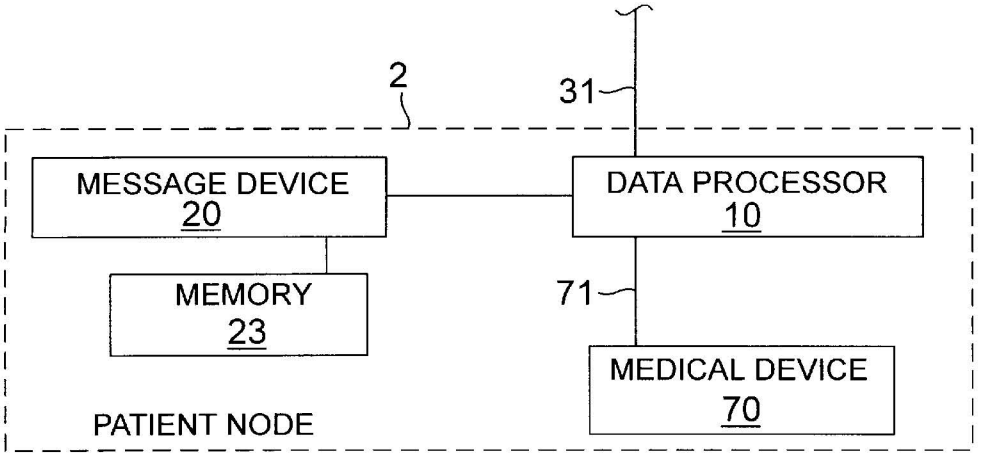


FIG. 5

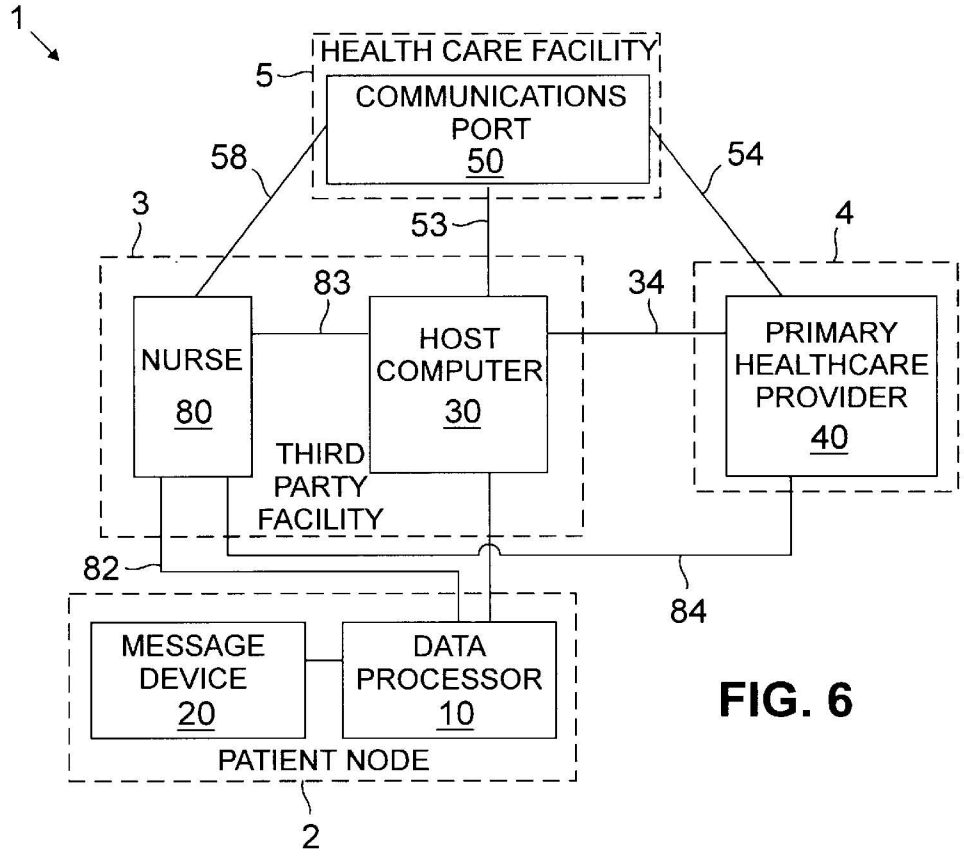

1
HEALTH CARE FACILITY
5
COMMUNICATIONS PORT
50
58
54
3
53
4
83
34
NURSE
80
HOST COMPUTER
30
PRIMARY HEALTHCARE PROVIDER
40
THIRD PARTY FACILITY
82
84
MESSAGE DEVICE
20
DATA PROCESSOR
10
PATIENT NODE
2

FIG. 6

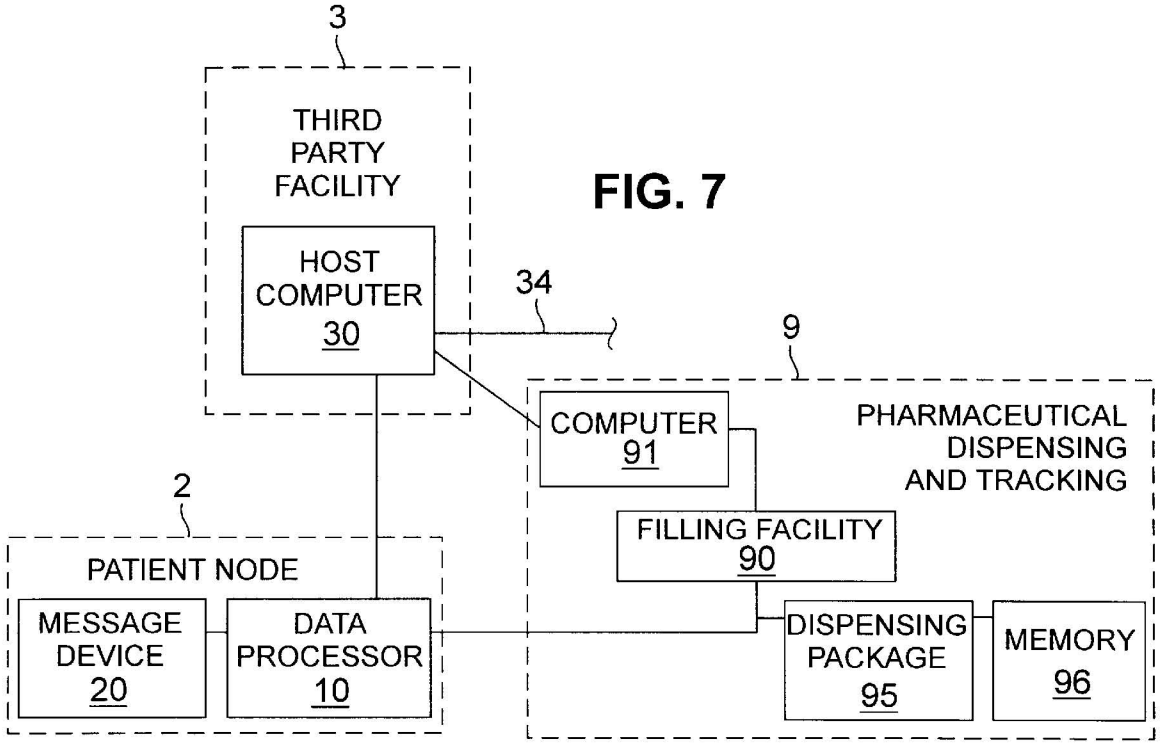

3
THIRD PARTY FACILITY
HOST COMPUTER
30
34
9
COMPUTER
91
PHARMACEUTICAL DISPENSING AND TRACKING
2
FILLING FACILITY
90
PATIENT NODE
MESSAGE DEVICE
20
DATA PROCESSOR
10
DISPENSING PACKAGE
95
MEMORY
96

FIG. 7

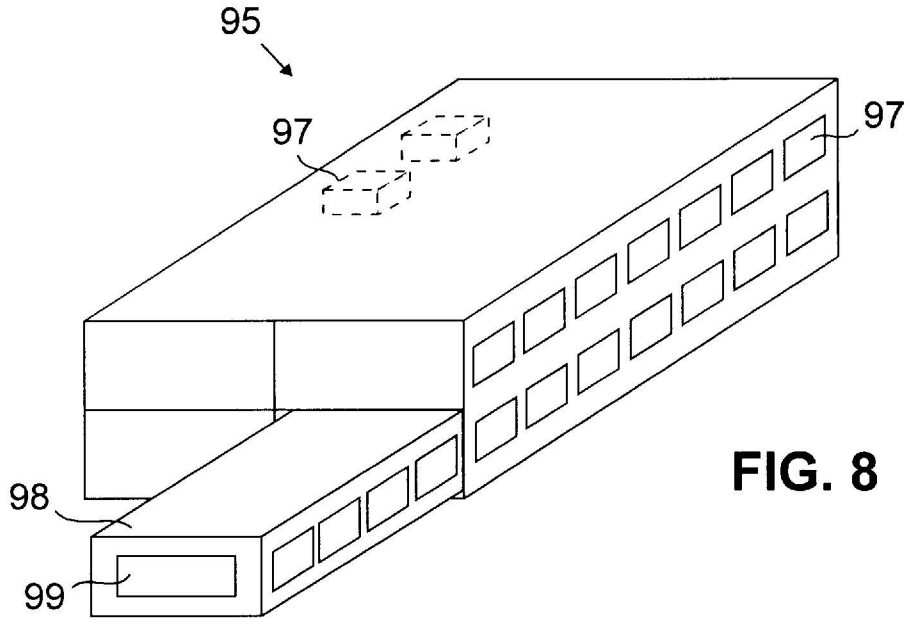
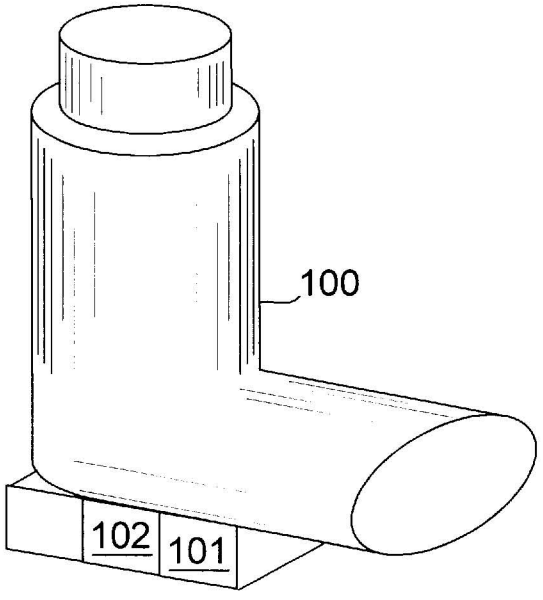


FIG. 8

FIG. 9



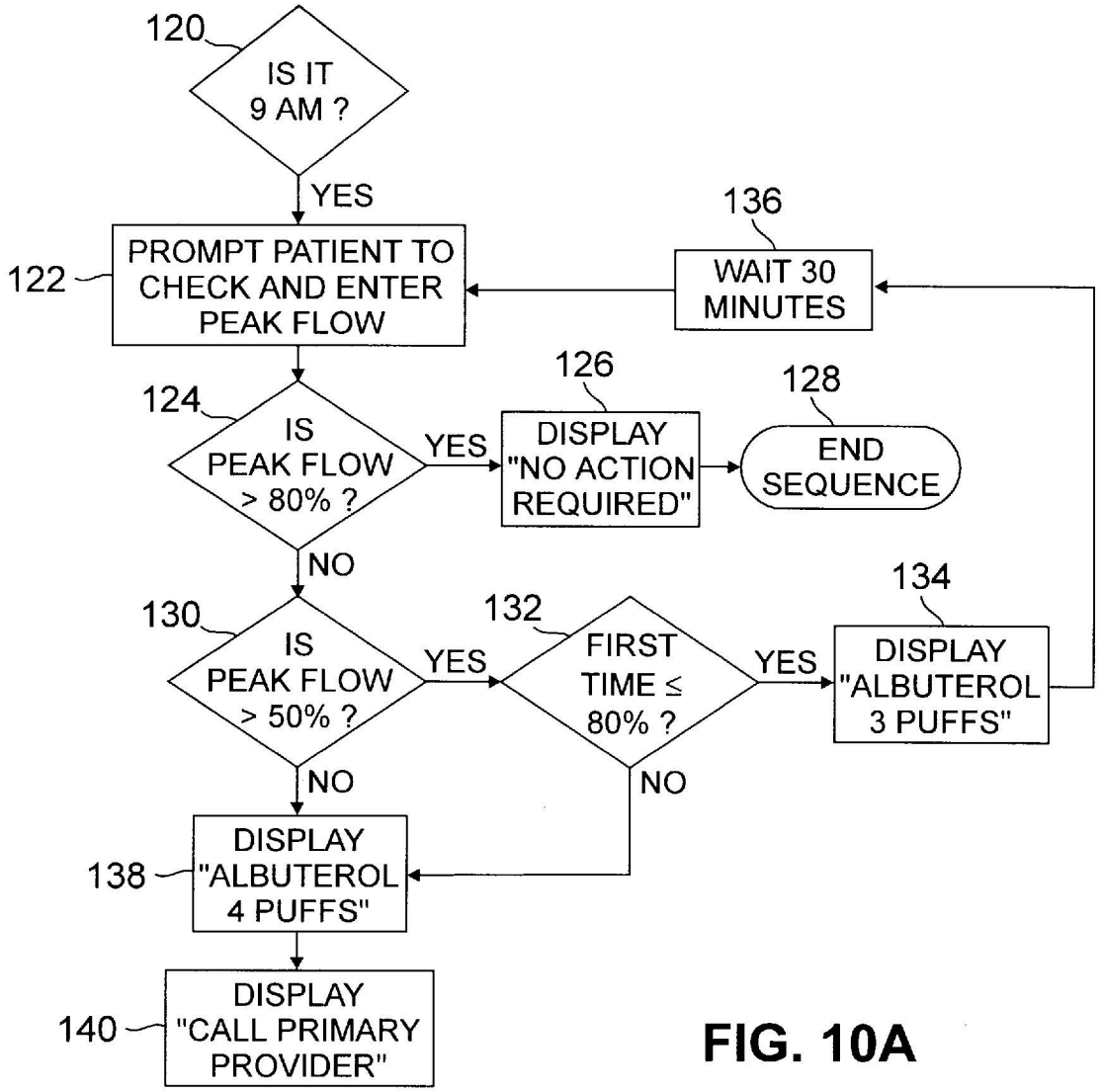

120
IS IT 9 AM ?
YES
122
PROMPT PATIENT TO CHECK AND ENTER PEAK FLOW
136
WAIT 30 MINUTES
124
IS PEAK FLOW > 80% ?
YES
126
DISPLAY "NO ACTION REQUIRED"
128
END SEQUENCE
NO
130
IS PEAK FLOW > 50% ?
YES
132
FIRST TIME ≤ 80% ?
YES
134
DISPLAY "ALBUTEROL 3 PUFFS"
NO
NO
138
DISPLAY "ALBUTEROL 4 PUFFS"
140
DISPLAY "CALL PRIMARY PROVIDER"

FIG. 10A

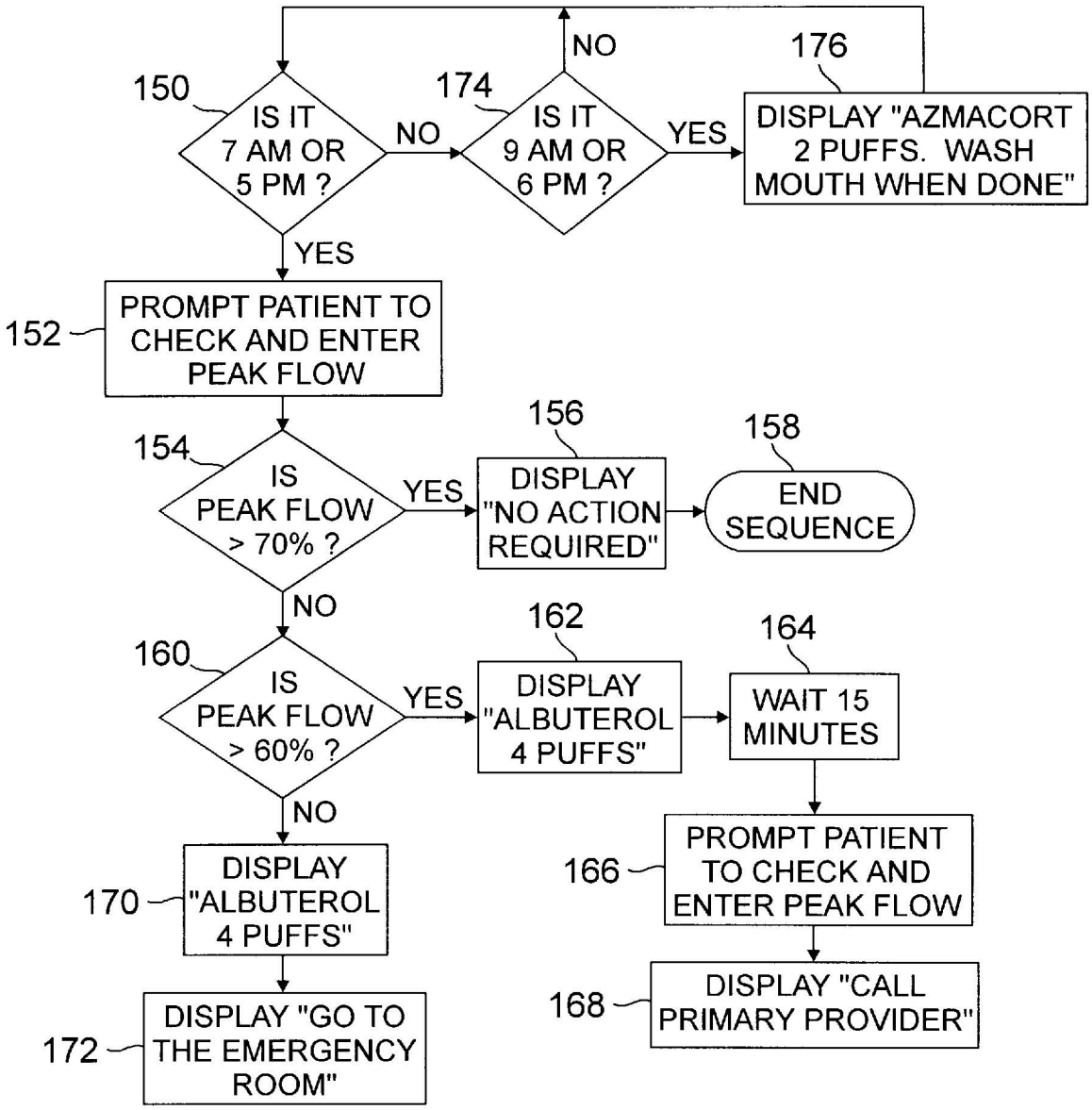

150
IS IT 7 AM OR 5 PM ?
NO
174
IS IT 9 AM OR 6 PM ?
NO
YES
176
DISPLAY "AZMACORT 2 PUFFS. WASH MOUTH WHEN DONE"
YES
152
PROMPT PATIENT TO CHECK AND ENTER PEAK FLOW
154
IS PEAK FLOW > 70% ?
YES
156
DISPLAY "NO ACTION REQUIRED"
158
END SEQUENCE
NO
160
IS PEAK FLOW > 60% ?
YES
162
DISPLAY "ALBUTEROL 4 PUFFS"
164
WAIT 15 MINUTES
NO
166
PROMPT PATIENT TO CHECK AND ENTER PEAK FLOW
168
DISPLAY "CALL PRIMARY PROVIDER"
170
DISPLAY "ALBUTEROL 4 PUFFS"
172
DISPLAY "GO TO THE EMERGENCY ROOM"

FIG. 10B

METHOD AND APPARATUS FOR A PERSONAL HEALTH NETWORK

This application is a continuation of application Ser. No. 08/518,783 filed on Aug. 24, 1995 which is a continuation in part of Ser. No. 08/334,936, filed Nov. 7, 1994 now abandoned.

FIELD OF THE INVENTION

The invention relates to a system, methods and apparatus for monitoring a person's health, and more particularly to a comprehensive patient management system.

BACKGROUND OF THE INVENTION

Outpatient management of chronic disease may be ideally described as a series of discrete tasks that are interrelated and modulated by information flowing back to the primary health care provider. The elements of outpatient care thus include (1) prescribing a treatment, typically drug-based; (2) a patient independently obtaining the prescribed medication, e.g., filling a prescription at a pharmacy and/or purchasing over-the-counter medication; (3) the patient talking the medication as prescribed; (4) monitoring the effects of the self-medicating treatment; and (5) modifying the treatment based on patient response.

In the traditional model of outpatient management, the information interchange steps (4) and (5), critical to successful treatment programs, occur sporadically. Oftentimes, the exchange occurs during a follow-up visit to the primary care provider or to an emergency room or hospital. Further, the information flow was typically one way, from the physician to the patient.

More recently, in the era of the patient as consumer and health care reform, this situation has changed dramatically. The information flow is no longer so sporadic or one way, but the process of closely monitoring outpatient treatments is inconvenient to both the patients and health care providers. For the patient, it means numerous trips to the doctor's office, often for simple matters like a blood pressure check, that could as easily be performed at home. For the physician, close monitoring is inefficient, both because the issues are routine and it limits the ability to increase the number of patients under management. As a result, the known processes of outpatient management result in many patients "falling through the cracks" and consuming needless and expensive resources for trivial or routine follow-up care.

A wide variety of devices have been proposed to improve outpatient management of the chronically ill. Most such devices are directed to improving patient health through increasing compliance with a medication regimen.

U.S. Pat. No. 4,490,711 discloses a programmable multiple alarm timing device. The device may be programmed for up to a selected number of alarms per day. As the alarm is silenced, a counter is incremented. Thus, the counter indicates how many times the user was alerted to take his or her medication. The counter can be interrogated by pushing a button on the device which will cause the count to appear on an LCD included with the device. A memo book is used in conjunction with the timer.

U.S. Pat. No. 4,504,153 discloses a pharmacist-programmable/physician-programmable medication prompting system wherein a pharmacist/doctor inputs data regarding a medication schedule into the memory of a prompting device which generates a prompting signal according to the schedule. The prompter may be incorporated in the cap of a mechanized medication container. The cap of the container may only be opened when the prompting signal is present. Removal of the cap produces a reset signal terminating the prompt. A counter counts the number of times the reset signal is generated, providing a compliance record.

U.S. Pat. No. 4,695,954 discloses a medical dispenser for dispensing medications to a patient at prescribed times. The device includes apparatus for sensing whether medication is being taken as it becomes available. A nursing home/hospital version has a transmitter and antenna that transmits, in real time, patient compliance information to a nursing station. Also, stored patient compliance information can be printed out. A home version of device does not transmit compliance information, but this information can be retrieved from the display on the device itself.

U.S. Pat. No. 4,975,842 discloses an electronic patient diary that allows a patient to electronically log the onset and end of a preselected health event, such as a pain episode, and subjectively assess some characteristic of the event, i.e., the extent of the pain. All information is recorded in memory and may be downloaded to an external computer. The device can also prompt the user regarding the time and dosage of medication.

U.S. Pat. No. 5,157,640 discloses an electronic watch that may be programmed by direct link to a pharmacist's host computer to store a medication regimen. When a medication is to be taken, an alarm is sounded, and the medication and dosage are identified on the display of the watch. The watch is programmed by placing it in a cradle which is in communication with the host computer.

The prior art falls far short of providing a comprehensive outpatient management system. Most prior art devices are simply directed to the compliance issue.

Thus there is a need for a comprehensive outpatient management system which evaluates compliance with a medication regimen, monitors the effect of the treatment, allows 2-way information exchange between the provider and the patient, and reduces the physician's burden of closely monitoring outpatient treatment.

SUMMARY OF THE INVENTION

The aforementioned need is met by a system, methods and apparatus for a personal health network. In one embodiment, the health network comprises a host computer which is in communication with a computer of a health care provider, and with a data processor that is in the possession of a patient. A message device, also in the possession of the patient, is adapted to send data to, and receive data from, the data processor. The host computer, which is operated by a party other than the patient or health care provider, functions as a central station for collecting, analyzing and routing data. In one embodiment, the host computer receives, from the health care provider, a treatment plan that is developed specifically for each patient. Algorithms are developed based on such a plan. The algorithms are then programmed into an appropriately configured message device. The patient is prompted by the message device to measure and enter relevant physiological data, e.g., peak flow, etc, as dictated by the treatment plan. Based on the measured physiological data and the algorithm, messages are displayed on the message device advising the patient of a specific course of action, e.g., to administer medicine, to call his health care provider, to go to the emergency room, etc. These results can be transmitted to the facility and the health care provider. The algorithm can be modified by the health

care provider, as appropriate, to reflect changes in the treatment plan. As a result, the message device incorporates a customized treatment plan that is updatable based on data provided by the patient and health care provider.

BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the invention will be apparent upon consideration of the foregoing objects and the following detailed description of preferred embodiments of the present invention, taken in conjunction with the accompanying drawings, in which like reference numerals refer to like elements, and in which:

FIG. **1** shows a block schematic diagram of a personal health network in accordance with a preferred embodiment of the present invention;

FIG. **2** shows a message device of the network of FIG. **1**;

FIG. **2**A shows a block schematic diagram of a message device of the network of FIG. **1** in accordance with a preferred embodiment of the invention;

FIG. **3** shows a block schematic diagram of a personal health network in accordance with an alternate embodiment of the present invention;

FIG. **4***a* shows an alternate implementation of the message device and data processor of FIG. **1**;

FIG. **4***b* shows a preferred embodiment of the alternate implementation of the message device of FIG. **4***a;*

FIG. **5** shows an alternate embodiment of the personal health network of the present invention wherein compatible medical devices communicate with the data processor;

FIG. **6** shows an embodiment of the personal health network of the present invention which includes a case manager nurse;

FIG. **7** shows an embodiment of the present invention which incorporates a pharmaceutical dispensing and tracking system;

FIG. **8** shows an embodiment of a dispensing package of FIG. **7**;

FIG. **9** shows an embodiment of a dose inhaler adapted for use with the system of FIG. **7**;

FIG. **10***a* shows an algorithm based on an exemplary treatment plan for a first asthma patient; and

FIG. **10***b* shows an algorithm based on an exemplary treatment plan for a second asthma patient.

DETAILED DESCRIPTION OF THE INVENTION

An embodiment of a personal health network ("PHN") **1** of the present invention is show in FIG. **1**. The PHN **1** comprises at least one patient node **2**, at least one third party facility **3** and at least one health care provider **4**. Each third party facility **3** preferably includes a host computer **30** which is in communication with each patient node **2** being managed by the facility **3** over a communication link **31**. The host computer **30** also is in communication with each health care provider **4** for each patient **2**, over a communication link **34**.

Each patient node **2** includes a data processor **10** and a message device **20**. The data processor **10** is in communication with host computer **30** via communication line **31** and is used for downloading information to, and receiving information from, message device **20**. The host computer **30** is operated by a third party. The third party is responsible for the operation of the PHN **1** and placement of the software and, in certain cases, hardware, that comprise the various embodiments and/or components of the PHN **1**. The host computer **30** of the third party facility **3** functions as a central station for collecting information which can be appropriately routed to the patient **2**, health care provider **4** or other location, as discussed in more detail below. The processor **10** and message device **20** are in the possession of a patient **2**.

For purposes of clarity only one patient node **2**, and third party facility **3**, and one health care provider **4** are illustrated in FIG. **1**. However, it should be understood that there may be a plurality of patient nodes **2** and a plurality of health care providers **4** in communication with the third party facility **3**. Indeed, the third party facility **3** may include more than one such facility (e.g., covering differing geographic or demographic areas), such that patients managed by one facility **3**, can be served by health care providers **4** that are in communication with a different facility based on interfacility communications. In this way, the PHN **1** is capable of managing millions of patients **2** and health care providers **4** by appropriate individual identification, addressing and messaging, which communication techniques and protocols are known to those of ordinary skill in the art.

The message device **20** is a portable device, of suitable shape and size to be carried in the pocket, purse or briefcase of a patient. Preferably, the form factor and industrial design of the message device **20** are optimized for acceptance by the intended user, including children and senior citizens. In a preferred embodiment, the message device **20** is powered by a rechargeable power source. The message device **20** receives information from the host computer **30** when the message device is placed in communication with the processor **10**. Preferably, the message device **20** and processor **10** have complementary physical structures so that on physical contact, a connection is formed, for example, via male and female connectors, such that information transfer in one or both directions can occur. It is known to those skilled in the art how to implement such devices and their interconnection.

In one embodiment, the message device **20** provides a medication alarm. A patient's entire medication regimen, including dosing intervals, can be downloaded from the host computer **30** to the data processor **1 0** via communication line **31**. This information is transferred to the message device **20** when it is in communication with the data processor **10**. At the appropriate times, the patient is prompted by audible or tactile alerts. In a preferred embodiment shown in FIG. **2**, the message device **20** includes a large-area backlit LCD display **21** so that the name of the medication and dose may be displayed. The patient turns off the alert by activating a switch **22** which also causes a programmable memory **23** to store the date and time the switch was activated. Hence, the message unit **20** stores a record of the so-called compliance data, including the date and time the switch was activated and the medication and dosage that the patient was scheduled to take. In this regard, if the patient's regimen is to take more than one medication at the same time, then each other medication will appear on the LCD display, e.g., one at a time after the switch is activated, e.g., in response to an alarm which occurs for each medication. Alternatively, multiple medications may appear in the LCD display such that activating the switch enters the time and date data for each medication displayed.

When the message device **20** is in communication with the data processor **1 0**, the compliance data can be uploaded to the host computer **30**. Compliance data can then be evaluated through appropriate software and a report thereof generated and transmitted to one or both of the computer **40**

of the appropriate primary health care provider **4** and the processor **10** of patient **2**. The report may be electronically transmitted via a suitable communications port **50** over PHN **1**, or printed on paper and mailed to the intended recipient. In a further embodiment, the message device **20** may receive other alarm information from the primary health care provider **4**. For example, patients can be reminded about a scheduled visit or to schedule a visit.

In a second embodiment of the present invention, shown in FIG. **3**, the PHN **1** is also in communication with another health care facility **5** such as a diagnostic laboratory, a pharmacy, a clinic, or a hospital, of which only one is shown for clarity. Thus, in addition to the medication regimen and other information from each primary health care provider **4**, the message device **20** may receive information from other health care facilities **5**, which is transmitted to host computer **30** via communications line **53** and then downloaded to the data processor **1 0** and the message device **20**. Through such a network, patients **2** and doctors **4** can receive the results of tests performed at a lab or hospital **5**. Such information from the other health care facilities **5** can also be either directly, via communication line **54**, or indirectly, via the host computer **30** through communication lines **53** and **34**, communicated to the primary health care provider **4**. In addition, statistical reports of the activities of a number of patients can be generated. Such reports are of value to health care management organizations and pharmaceutical manufacturers.

In a further embodiment, the message device **20** can be enhanced to incorporate two-way message capability when coupled to data processor **10**. For example, by adding one or more switches **24** (two are shown in FIG. **2**), patients can respond to query-type messages, enhancing the ability of providers **4** to track the status of their patients **12**. The electronics required to provide the two-way message capability over wire-based coupling and radio frequency based coupling are well known to those skilled in the art. Advantageously, providing the switches **24** on message device **20** ensures that the stored data can be uploaded to the host computer. Alternatively, the switches **24** could be located on processor **10**.

In a further embodiment of message device **20**, software and adapters can be developed so that personal digital assistants, such as the devices model Wizard available from SHARP Electronics, Inc., device model HP 100LX available from Hewlett Packard, and device model Newton available from Apple Computer, Inc., can communicate with the data processor **10** to receive information from, and deliver information to, the host computer **30** and to generate the alerts for medication regimen, store the patient compliance data, and to provide a display of sales information downloaded from data processor **1 0** and for two-way communication with data processor. Standard data communications can be used and these can be easily created by persons of ordinary skill in the art.

In a further embodiment of data processor **10**, a patient-owned computer such as a personal computer (or workstation) or personal digital assistant could be used in place of a dedicated data processor, provided that the host computer **30** is provided access to the personal computer and can establish communications therewith in a similar manner as the data processor **10** described herein.

FIG. **4***a* shows a further embodiment of the PHN **1** wherein the host computer **30** is in communication with a wireless carrier **60** to provide medication reminders and messaging capabilities for patients who own/lease paging devices **61**. Wireless carrier **60** thus receives instructions form host computer **30** to deliver particular messages to specific patients **2** at predetermined times. Wireless carrier **60** then "telephones" the patient's pager **61** in a conventional manner, or under control of an automatic operator and delivers the message, activating the pager **61** alarm mechanism. The patient **2** then responds to the pager alarm by pressing the switch. For paging devices **61** having 2-way communication, pressing the switch can provide an acknowledgement of the message delivered, which can be recorded by the wireless carrier **61** as compliance information, which information is then communicated to the host computer **30**. Thus, the wireless carrier **60** functions as the data processor **10** and the paging device **61** performs the messaging functions of the message device **20**.

In a preferred embodiment shown in FIG. **4***b;* a modified paging device **61'** is used which includes a non-volatile memory **62**, real-time clock **63**, antenna **66** and suitable software **64** for storing a medication regimen or other data within the paging device **61** and for causing a message to appear in an alphanumeric display **65** based on the medication regimen or other data in the non-volatile memory **62**. In this regard, medication reminders are likely to be repeated daily for a period of time. Instead of having the wireless carrier **60** send the medication alert for each alarm, at an extra cost for sending the same message over and over, the clock **63**, software **64** and memory **62** within the paging device **61'** can be used to generate the medication alert. This is achieved by sending a message over the wireless carrier **60** that includes the complete dosing regimen, which message is recognized by software **64** and which stores the regimen in memory **62**. The software will then actuate the alarm and display the appropriate message as the stored regimen is executed, without prompting by wireless carrier **60**. This will reduce communication costs. If the medication regimen is changed, the wireless carrier **60** can re-program the paging device **61'** as appropriate. Further, the clock **63** in the paging device **61** is preferably resettable by a general broadcast of a time control signal by the wireless carrier **60**. This embodiment is better suited for paging devices having two-way communication capabilities so that safe receipt of the downloaded regimen can be confirmed.

As previously noted, the message device **20** is placed in a communication with the data processor **10** to receive information from, or send information to, the host computer **30**. The data processor **1 0** may also incorporate a charger **1 60** for charging the rechargeable power source (not shown) of the message device **20**.

Referring to FIGS. **1** and **2A**, one particular embodiment of processor **10** is shown. Processor **1 0** communicates with the host computer **30** by communication link **31** and preferably incorporates a telephone **120** and a modem **130**. Information transfer from the host computer **30** to the data processor **10**, and the processor **10** to the host computer **30** can occur without patient interaction with the incorporation of suitable electronics and software known to those skilled in the art. In a preferred embodiment, shown in FIG. **2A**, one such processor includes a switch **110**, a telephone **120**, a modem **130**, a microprocessor **140**, a memory **152** and **154**, a charger **160**, a dock/cradle **170** and a data port **180**. Although not shown, processor **10** may also include a status lamp to indicate whether or not it is properly operating. In a further embodiment, not shown, the data processor **1 0** may include an alphanumeric display and printing capabilities.

The dock/cradle **170** is shaped to receive message device **20** (or a hardware interface unit for a personal digital assistant) so that it couples securely to the charger **160** and

data port **180**. Once coupled, charger **160** can monitor the power supply of message device **20** and recharge it if necessary. Similarly, the electronics monitor the coupling of the data port **180**, and after identifying the message device **20**, data transfer can begin. The coupling to charger **160** and data port **180** is preferably a male/female plug interface (not shown) and may be separate components, interfaces or a unique custom interface. In this regard, data sent to device **20** may be stored in memory **154** and data uploaded from device **20** also is stored in memory **154**. Memory **152** is shown to represent storage of software instruction for processor **10**, but the memory configuration can be adapted based on design preference to have one or multiple memory devices. Switch **110** is used to discriminate incoming voice telephone calls from incoming data telephone calls so that the communication between processor **10** and host computer **30** can occur automatically without patient involvement. Preferably, such communications are scheduled for a time, e.g., at night, when telephone tariffs are least expensive and the user is likely to be at home with message device **20** coupled to processor **11**.

In a preferred embodiment as shown in FIG. **5**, the data processor **10** is adapted to accept information input **71** from a medical device **70** that is network compatible. Tracking patient response to medical treatments outside of a health care setting (hospital, hospital, doctor office, clinic) require patients to monitor their blood pressure, blood sugar, pulse rate and other important physiological parameters. A clinician will rarely receive such data, and, even when it is received, it is subject to errors in reporting by the patient. Further, because the data is usually handwritten and previously recorded, it may be difficult to interpret and/or reconstruct accurately.

Accordingly, through the use of a custom interface to translate a signal of the medical device **70** corresponding to the measured parameter into a signal form acceptable to processor **10**, the data obtained from basic medical devices **70**, such as blood pressure, pulse, blood glucose meters, pulmonary function, cholesterol, etc., can be stored whenever the data is obtained, and then uploaded to the host computer **30** through the data processor **1 0** and/or message device **20**. The design of such interfaces and the incorporation of such interfaces into devices **70** are straightforward and within the capabilities of those skilled in the art.

The host computer **30** receives data from the various information sources previously discussed, such as the message device **20**, PHN compatible medical devices **70**, the primary provider **4**, and other health care facilities **5** (e.g., lab, pharmacy, hospital, or a secondary care provider (e.g., a medical specialist such as a surgeon, etc.)). Using appropriate software, the host computer **30** analyzes data received from the various sources noted above, generates a report and forwards it to the primary provider **4**, or to some other location **5** as appropriate. In this way, the primary provider **4** can receive periodic reports indicative of the patient's well-being and access the efficacy of the prescribed therapy without consuming the provider's office visit time or the patient's time for a personal visit.

Though appropriate software, the host computer **30** provides a variety of other network-related functions including communications, network management, database manager, error/reliability manager and message/mail manager. The host computer **30** is preferably a main frame computer, although other hardware platforms are acceptable.

In place of the host computer **30**, one or more employees/representatives of the third party **3** may collect information, generate and maintain a record of information pertaining to a patient's health and transmit information either directly or indirectly to the patient **2**, health care provider **4**, or other location via telephone, facsimile transmission, electronic mail, or other communication means.

In an alternate preferred embodiment of the PHN **1** shown in FIG. **6**, a case manager nurse **80** may be used to provide additional patient management. The case manager nurse **80** communicates with the patient by communications line **82**, which may be a voice telephone, data facsimile or other means. Preferably, the case manager nurse has access to a computer and a modem for receiving information from computers at other health care facilities **5**, for example, via communication line **58**, and receive information from and provide information to a computer of the primary provider **4** via communication line **84**, and host computer **30** via communication line **83**. Alternately, the case manager nurse **80** can communicate with health care provider **4** and facility **5** indirectly through host computer **30**. The case manager nurse **80** can be an employee of the third party **3** as illustrated in FIG. **6**, or of the health care provider **4**. Alternatively, the function of the case manager **80** can be handled by an existing nurse-based case management organization, such as Access Health located in Rancho Cordova, Calif.

In some of the above-described embodiments, patient information including physiological data obtained from medical devices **70** is collected over a period of time, e.g., days, and then analyzed and reported to the primary provider **4**. The primary provider **4** reviews such data and then may adjust the patient's treatment regimen as appropriate. In certain instances, however, a much quicker response to changes in a patient's condition is necessary. In a further preferred embodiment of the present invention, the PHN **1** can be used to provide a customized patient management program **110** that provides an immediate response to changes in a patient's condition.

In one embodiment of a customized patient management program **110**, logic sequences or algorithms **115** are developed based on a treatment plan or guidelines for a specific patient, which plan is provided by the primary provider **4**. Such algorithms **115** can be converted to code suitable for implementation in a processor. In a preferred embodiment, the code corresponding to the algorithm can be stored in an appropriately configured message device **20** that can be accessed as required by the patient. The algorithm **115** accepts as input at least one indicia of the patient's then current health status. Such indicia can include a measurement of a physiological parameter such as pulse rate, peak flow, blood pressure and the like. The input is processed according to the algorithm, and the results of the processing are delivered to the patient **2** as a message. The information content of the message can be medical advice, i.e., a directive for the patient to take a specific action, or more general information directly or indirectly related to the health status of the patient at a given time based on the data inputted to the algorithm **115**. Since the treatment plan is developed specifically for the patient, and since the algorithm **11 5** based on the treatment plan accepts an indicia of the patient's then current health status, message content is thus customized for the patient and responsive to changes in the patient's health status. An example of such a customized patient management program **110** is described below and in conjunction with FIGS. **10***a* and **10***b*.

EXAMPLE 1

A primary provider **4** has two asthma patients, **2***a* and **2***b*. The primary provider **4** has transmitted the following exem-

plary treatment parameters to the third party facility **3** for monitoring under the customized patient management program **110**:

Parameter	Patient 2a	Patient 2b
Baseline peak flow (BPF)	650	600
Peak flow checks	9 AM	7 AM & 5 PM
Asthma triggers	Pollen	Cold temperature
Prevent medicine	None	Azmacort ™ 2 puffs 9 AM & 6 PM
Yellow Zone threshold	≦80% of BPF	≦70% of BPF
Yellow Zone treatment	Albuterol ™ 3 puffs Wait 30 minutes Repeat peak flow; if ≦80%, then 4 puffs Albuterol ™ and call Primary Provider	Albuterol ™ 4 puffs plan Wait 15 minutes Repeat peak flow and call Primary Provider
Red Zone threshold	≦50% of BPF	≦60% of BPF
Red Zone treatment plan	Albuterol ™ 4 puffs and call Primary Provider	Albuterol ™ 4 puffs and go to emergency room

The third party facility **3** develops algorithms **115***a* and **115***b*, as illustrated by the exemplary flow charts shown in FIGS. **10***a* and **10***b*, based on the treatment parameters. A sequence of steps corresponding to these algorithms **115***a*, **115***b* are then programmed into either the host computer **30**, the processor **10** or an appropriately configured message device **20**, preferably the latter.

Referring to FIG. **10***a*, patient **2***a* is prompted in step **122** to measure and enter her peak flow at **9** A.M. In step **124**, the logic checks to see if the measured peak flow is greater than eighty percent of patient **2***a*'s baseline peak flow (BPF). If it is, a message will be displayed indicating that no further action is required. If it is not, a second check is performed to see if the measured peak flow is greater than fifty percent of patient **2***a*'s baseline peak flow. If it is not, step **138** causes a message to be displayed on the message device **20** directing the patient to administer 4 puffs of Albuterol™, and step **140** causes a message to be displayed directing the patient to call her primary provider **4**. If the measured peak flow is greater than fifty percent of the baseline peak flow, step **132** checks to see if this is the first time (for that day or for some other time period) that the measured peal flow has been less than or equal to eighty percent of the baseline. If not, processing continues with step **138** and then **140**, directing the patient to talk 4 puffs of Albuterol™ and call her primary provider **4**. If this is the first time that the peak flow was measured at less than or equal to eighty percent of the baseline, step **134** causes a message to be displayed directing the patient to administer 3 puffs of Albuterol™. After 30 minutes, patient **2***a* is again prompted to measure her peak flow, and the steps of the algorithm are repeated.

A different algorithm is developed for patient **2***b* based upon the specific treatment plan supplied for this patient by the primary provider **4**. The algorithm developed for patient **2***b* is illustrated in FIG. **10***b*.

Referring to FIG. **10***b*, a check is performed in step **150** to see if it is 7 a.m. or 5 p.m. If it is not 7 a.m. or 5 p.m., a check is performed in step **174** to see if it is 9 a.m. or 6 p.m. If it is either 9 a.m. or 6 p.m., step **176** causes a message to be displayed directing patient **2***b* to administer 2 puffs of Azmacort™. At 7 a.m. or 5 p.m., step **152** causes the patient **2***b* to be prompted to check and enter her peak flow. A check is performed in step **1 54** to see if the measured peak flow is greater than seventy percent of the baseline peak flow. If it is, step **156** causes a message to be displayed indicating that no further action is required. If it is not, a check is performed in step **160** to see if measured peak flow is greater than sixty percent of baseline. If it is, step **162** causes a message to be displayed directing the patient to administer 4 puffs of Albuterol™. After fifteen minutes, the patient is prompted to again measure her peak flow and further prompted to contact her primary provider **4**. If measured peak flow is less than sixty percent of baseline, step **170** causes a message to be displayed directing the patient to administer 4 puffs of Albuterol™ and step **172** prompts the patient to go to the emergency room.

It should be understood that the foregoing example is provided for the purposes of illustration; algorithms based on other treatment parameters for asthma, as well as other health conditions such as congestive heart failure, diabetes, pregnancy care and the like can be developed and implemented according to the present invention. Further, it should be understood that in other embodiments, other indicia of the patient's health status can be used as input to the algorithm.

Thus, the customized patient management program **110** provides a rapid response to changes in a patient's health. The algorithm **115** is preferably programmed into an. appropriately configured message device **20**, rather than the host computer **30** or processor **10**, so that the message device does not need to be in communication with such devices to access the treatment protocol. In this context, the message device **20** is preferably a personal digital assistant. Use of a personal digital assistant having suitable programming capabilities facilitates portability. Further, with appropriate ancillary equipment, a communication link can be established with the primary provider **4** so that results can be sent to the provider via facsimile or e-mail. In a further preferred embodiment, the message device **20** is configured by means known to those skilled in the art such that the algorithm can be programmed into the message device **20** at the third party facility **3** or remotely via the various communication links previously described in this specification. If the message device **20** is remotely programmable, the primary provider **4** or the third party facility **3** can conveniently modify the treatment algorithm as appropriate. In the case of less sophisticated message device **20**, it can be updated or reprogrammed as necessary from time to time during the time it is connected to processor **10**.

Data entry, e.g., the peak flow measurements called for in Example 1, may be entered manually by the patient or by using the compatible medical devices **70** previously described. Alternatively, the requirement to enter the peak flow can be omitted in the simpler, less expensive message devices, which instead display the suitable options for the patient to self-medicate. Although a less desirable operation

is achieved by this latter technology, it will nonetheless work sufficiently well to be useful.

In a further embodiment, the customized patient management program **110** utilizes data other than the patient's physiological data, e.g., data pertaining to environmental conditions. The host computer **30**, processor **10** or message device **20** is appropriately programmed to receive such data and/or deliver messages to the patient. Returning to Example 1, the asthma of patient **2***a* can be triggered by pollen. Thus, when the pollen count exceeds a certain threshold, which threshold may be unique to a patient **2***a,* a message warning patient **2***a* of a high pollen count in her geographic area can be displayed. Patient **2***a* can then be prompted to administer Albuterol™ prophylactically. Similarly, patient **2***b* can be alerted to cold weather days.

Compliance with prescribed therapy is the first requirement for reducing health care costs. Currently, providers have no objective way to track medication consumption in a meaningful way, complicating their ability to determine whether the therapy is working. Compliance is especially challenging when patients must take a plurality of medications several times per day. Medication types and dosing schedules are often changed based on the patient's response to treatment. Insuring compliance with the new or revised schedule further complicates medication management. The lack of meaningful data makes it difficult for pharmaceutical manufacturers to know which dispensing schedule, e.g., once, twice or three times a day, is more likely to be successful from both the patient compliance standpoint and the successful therapy standpoint. This information is useful not only for the form and/or architecture of the medication (capsule, caplet, pill, liquid, aerosol, time release microcapsule, etc.) and production planning, but for educating doctors as to how best to prescribe a medication for a patient, in view of the patient's lifestyle and the available dosing regimens. In this regard, the pharmaceutical companies have assumed an important role in educating doctors as to the benefits and cost of medications, but do not always have adequate information to suggest the best program.

In another embodiment shown in FIG. **7**, a pharmaceutical dispensing and tracking system **4** is included in the PHN **1**.

The pharmaceutical dispensing and tracking system **9** comprises a filling facility **90** for filling prescriptions and a dispensing package **95** for storing and dispensing medication. Preferably the filling facility **9** includes a computer **91** for receiving prescription information from the host computer **30** and suitable computer controlled equipment to fill automatically the dispensing package **95**. The design and implementation of such equipment are known to those skilled in the art. Of course, the filling facility **90** also can use a prescription directly ordered by the doctor, by telephone, fax or original slip, and the filling could be manually assisted or completely manual. In addition, the dispensing of medication could be by conventional pill bottles such that the patient is responsible for loading the dispensing device **95**. Although the alternate systems are less reliable, each will satisfy the requirements of the systems. It is contemplated however, that the prescription information is at some point provided to host computer **30** and to the filling facility **90** for electronic storage in respective databases.

In the preferred embodiment as shown in FIG. **8**, the provided dispensing package **95** has a plurality of small compartments collectively numbered **97**, each of which has a volume that can hold up to five pills. Preferably there are 28 compartments, corresponding to medication for a week. The dispensing package may contain a multiplicity of different medications distributed among the compartments **97**. The dispensing package **95** is sized to fit in a pocket, purse, or briefcase and allows medications to be combined in any order and dispensed in a sequence corresponding to a patient's prescription.

The dispensing package **95** includes a memory **96**, which is programmed with a patient's medication regime, at the time of filling. More preferably, package **95** includes all of the aforementioned structure and functions of message device **20**. The memory **96** provides a timing/alarm function, which, in conjunction with other suitable electronics, alerts the patient to take his or her medication. The memory **96** also records the time and date the medication was dispensed.

The pharmaceutical dispensing and tracking system **9** in the preferred embodiment operates as follows. The patient's prescription information is transmitted to the filling facility **9**. Once the data regarding the medication regime is received by computer **91** at the filling facility **90**, the dispensing package **95** is filled automatically with the medication. Information concerning how to use the dispensing package **95**, the drugs it contains, and other relevant information is placed in a mailer with the dispensing package **95** and mailed to the patient **2**.

In a further embodiment of the pharmaceutical dispensing and tracking system **9**, the patient retains possession of dispensing package **95** and receives from the filling facility the cartridges **98**, containing the medications, to be loaded into the dispensing package **95**. Each cartridge **98** preferably is encoded using a one or two dimensional bar code or a magnetic record, e.g., stripe **99**, or other data storage medium such as a memory device or a resistor code, which contains data indicative of the medication contained in the cartridge **98** and optionally the complete medication regimen. This data is interpreted by a reading device associated with the processor **10**, located at the patient's home, so that the data processor **10** then programs the dispenser **98** or the dispensing package **95**. Alternatively, the reading device could be incorporated in the dispensing package **95**.

At each dispensing interval, the patient is alerted. At an alarm, the patient presses a button on the dispenser that permits the release of medication to be taken at that time. As previously noted, pressing the button also stores, in memory **96**, the time and date medication was dispensed as a compliance record. Pressing the button also may cause the medication to be released, e.g., into a holding tray.

For inhaled medications, an aerosol dose inhaler **100**, shown in FIG. **9**, may be used. The dose inhaler **100** comprises a memory **101** and suitable electronics for recording the number of times the patient activates the dose inhaler **100**. Dosing intervals can be programmed into a device **100** equipped with an alarm function (i.e., when the dose inhaler **100** includes the structure and functions of message device **20**) via the processor **10**. In addition, in one embodiment, the memory **101** may be a simple counter incremented by actuation of a microswitch which can be interrogated by processor **10** and reset.

In a preferred embodiment, the dose inhaler **100** incorporates suitable flow sensors **102** to monitor and/or track a patient's lung function and dose delivery as are known to persons of ordinary skill in the art.

The memories **96** and **101** can be interrogated when the dispensing package **95** or inhaler **100** is returned to the filling facility **90** by the patient, e.g., by a prepaid return mailer. The memory contains patient identifying information as well as compliance data. Alternatively, the memories can

be interrogated by the data processor **10**. Thus, the dispensed pharmaceuticals can be readily tracked.

Although it is preferred to use a host computer **30**, a data processor **10** and a message device **20** to practice the present invention, other arrangements of elements that provide comparable functions are within the contemplated scope of the present invention. One such arrangement is described in the Example below.

EXAMPLE 2

The elements of this embodiment of a PHN according to the present invention include a wireless paging service, an alphanumeric pager, an electronic blood pressure cuff, a scale, a touch-tone telephone, a toll-free 800 telephone number and appropriate software for accepting and storing information transmitted using the keypad of the touch-tone phone, and a third party **3**, e.g., not the patient or health care provider.

The alphanumeric pager, the electronic blood pressure cuff, the scale and touch-tone telephone are all in the possession of a patient **2**. A representative of the third party **3** contacts the patient **2** and health care provider **4** and generates a database containing patient information including the patient's medication regime, scheduled office visits, etc. The third party **3** conveys information from the database to the paging service. Based on this information, the paging service "telephones" the patient's pager which delivers messages and/or reminders to the patient, e.g., medication reminders (e.g., 9:00 a.m.—FUROSEMIDE 2 PILLS (40 mg)), reminders to check their weight, blood pressure and pulse, and reminders for scheduled office visits and laboratory tests and telephone contact with the third party.

According to schedule, the patient obtains his or her weight, blood pressure and pulse using the scale and electronic blood pressure cuff. The patient **2** then calls the 800 number and transmits the data via the keypad.

Further, there is scheduled telephone contact between the third party **3** and the patient **2**. During the phone call, the patient's health is discussed and the information is preserved in a record. At regular intervals, the third party generates a status report based on the information contained in the records. The status report is transmitted via e-mail, facsimile or mail to the patient's primary provider **4**. Based upon the subject's reported clinical status, the primary provider may, for example, alter the patient's treatment regime. These changes are transmitted to the third party, where the patient's database is updated. The change in the regime is then transmitted to the paging service.

Thus, the paging service and the **800** number provide some of the two-way communication functions of the processor **10**, the pager provides some of the functions of the message device **20**, the scale and electronic blood pressure cuff in conjunction with the 800 number provide some of the functions of the network compatible medical device **70**, and the third party **3** provides some of the functions of the host computer **30**. This embodiment also includes a case manager nurse **80** who is supplied by the third party.

One skilled in the art will appreciate that the present invention can be practiced by other than the described embodiments, which are presented for purposes of illustration and not of limitation.

I claim:

1. A method for providing a customized out-patent management system comprising:

(a) providing a central station facility with a medical treatment plan specific to a patient, said medical treatment plan comprising a schedule of at least one patient self-directed activity to occur at a corresponding time of action;

(b) determining an occurrence of said time of action within said central station facility;

(c) providing a messaging device associated with said patient wherein said messaging device is equipped with bi-directional communications capability;

(d) providing said messaging device with an event indicator having an active state and an inactive state, the active state corresponding to an indicator of the at least one patient self-directed activity;

(e) transmitting a wireless signal to said messaging device in response to an occurrence of said time of action;

(f) receiving said wireless signal at the messaging device; and

(g) placing the event indicator in the active state in response to said received wireless signal to prompt the at least one patient self-directed activity.

2. The method of claim **1** wherein steps (c) and (d) further comprise providing said patient with a paging device having a sound output, and wherein step (g) further comprises generating an audible sound.

3. The method of claim **2** further comprising providing said paging device with a display and wherein step (e) further comprises providing a text message indicating the patient selfdirected activity to be performed, and step (g) further comprises displaying said text message on said display.

4. The method of claim **1** wherein step (d) comprises providing said messaging device with a display, and step (g) comprises displaying a predetermined message in response to said received wireless signal.

5. The method of claim **1** further comprising providing a predetermined message indicating a medication to be taken.

6. The method of claim **1** further comprising providing a predetermined message that is a graphical information for display.

7. The method of claim **1** wherein step (d) comprises providing said messaging device with a tactile sensor, and step (g) comprises actuating said tactile sensor in response to said received wireless signal.

8. The method of claim **1**, further comprising performing the patient self-directed activity and obtaining a result thereof, and transmitting from the messaging device for delivery to the central station facility an information corresponding to the obtained result.

9. The method of claim **8** wherein transmitting information further comprises operating a telephone having a touch tone key pad to transmit said information to said central station facility.

10. The method of claim **8** wherein transmitting information further comprises transmitting a wireless signal containing said information.

11. A method for providing a customized out-patent management system comprising:

(a) providing a central station facility with a medical treatment plan specific to a patient, said medical treatment plan comprising a schedule of at least one patient self-directed activity to occur at a corresponding time of action;

(b) determining an occurrence of said time of action within said central station facility;

(c) providing a messaging device associated with said patient wherein said messaging device is a paging device having a sound output with a bi-directional communication capability;

(d) providing said messaging device with an event indicator having an active state and an inactive state, the active state corresponding to an indicator of the at least one patient self-directed activity;

(e) transmitting a wireless signal to said messaging device in response to an occurrence of said time of action;

(f) receiving said wireless signal at the messaging device;

(g) placing the event indicator in the active state in response to said received wireless which generates an audible sound signal to prompt the at least one patient self-directed activity; and

(g) transmitting, in response to receipt of the wireless signal, an acknowledgment signal from said paging device, and recording at the central station facility a response acknowledged signal in response to said acknowledgement signal.

12. A method for providing a customized out-patent management system comprising:

(a) providing a central station facility with a medical treatment plan specific to a patient, said medical treatment plan comprising a schedule of at least one patient self-directed activity to occur at a corresponding time of action;

(b) determining an occurrence of said time of action within said central station facility;

(c) providing a messaging device with a bi-directional communication ability;

(d) providing said messaging device with an event indicator having an active state and an inactive state the active state corresponding to an indicator of the at least one patient self-directed activity wherein said messaging device is further provided with a display;

(e) transmitting a wireless signal to said messaging device in response to an occurrence of said time of action;

(f) receiving said wireless signal at the messaging device;

(g) placing the event indicator in the active state in response to said received wireless signal by displaying a predetermined message in response to said received wireless signal to prompt the at least one patient self-directed activity; and

(h) transmitting, in response to receipt of the wireless signal, an acknowledgment signal from said messaging device, and recording at the control station facility a response acknowledgment signal in response to said acknowledgement signal.

13. A method for providing a customized out-patent management system comprising:

(a) providing a central station facility with a medical treatment plan specific to a patient, said medical treatment plan comprising a schedule of at least one patient self-directed activity to occur at a corresponding time of action;

(b) determining an occurrence of said time of action within said central station facility;

(c) providing a messaging device associated with said patient;

(d) providing said messaging device with an event indicator having an active state and an inactive state, the active state corresponding to an indicator of the at least one patient self-directed activity;

(e) transmitting a wireless signal to said messaging device in response to an occurrence of said time of action;

(f) receiving said wireless signal at the messaging device;

(g) placing the event indicator in the active state in response to said received wireless signal to prompt the at least one patient self-directed activity;

(h) performing the patient self-directed activity and obtaining a result thereof;

(i) transmitting from the messaging device for the delivery to the central station facility an information corresponding to the obtained result;

(j) providing a case management nurse;

(k) having the case management nurse contact the patient at a predetermined time; and

(l) monitoring thereby the patient's self-directed activities.

14. A method for providing a customized out-patent management system comprising:

(a) providing a central station facility with a medical treatment plan specific to a patient, said medical treatment plan comprising a schedule of at least one patient self-directed activity to occur at a corresponding time of action;

(b) determining an occurrence of said time of action within said central station facility;

(c) providing a messaging device associated with said patient;

(d) providing said messaging device with an event indicator having an active state and an inactive state, the active state corresponding to an indicator of the at least one patient self-directed activity;

(e) transmitting a wireless signal to said messaging device in response to an occurrence of said time of action;

(f) receiving said wireless signal at the messaging device;

(g) placing the event indicator in the active state in response to said received wireless signal to prompt the at least one patient self-directed activity;

(h) providing a case management nurse;

(i) having the case management nurse contact the patient at a pre-determined time; and

(j) monitoring the patient's self-directed activities in response to step (i).

15. A system of customized out-patient management comprising:

a wireless carrier having a wireless signal output, each wireless output signal having a patient specific code;

a programmable patient specific medical treatment plan comprising at least one patient self-directed activity to occur at a corresponding time of action;

a central station facility containing said patent specific medical treatment plan, the central station being operatively connected to said wireless carrier to issue a patient specific wireless output signal in response to an occurrence of said time of action; and

at least one messaging device capable of bi-directional communication associated with said specific patient having a prompt output and an identification code, said messaging device being responsive to said patient specific wireless signal output code corresponding to said identification code to prompt said patient to perform said at least one patient self-directed activity.

16. The system of claim **15** wherein the messaging device prompt output further comprises a visual prompt.

17. The system of claim **16** wherein said visual prompt further comprises a graphic message.

18. The system of claim **16** wherein said visual prompt further comprises an alphanumeric message.

19. The system of claim **16** wherein said messaging device further comprises a paging device.

20. The system of claim **15** further comprising a telephone having touch tone key pad to input data, wherein said central station facility further comprises an input and means for recording data input by a telephone touch tone keypad, said data corresponding to a result of said patient self-directed activity.

21. A system of customized out-patient management comprising:

a wireless carrier having a wireless signal output, each wireless output signal having a patient specific code;

a programmable patient specific medical treatment plan comprising at least one patient self-directed activity to occur at a corresponding time of action;

a central station facility containing said patent specific medical treatment plan, the central station being operatively connected to said wireless carrier to issue a patient specific wireless output signal in response to an occurrence of said time of action; and

at least one messaging device associated with said specific patient having a visual prompt output and an identification code, said messaging device being responsive to said patient specific wireless signal output code corresponding to said identification code to prompt said patient to perform said at least one patient self-directed activity said messaging device further comprising a paging device wherein said paging device further comprises a bi-directional messaging capability with said wireless carrier, an actuable switch, and a wireless message received output signal, wherein the wireless carrier further comprises means for receiving a wireless message received output signal from said messaging device and means for transmitting a receipt acknowledged signal to said central station facility; and wherein the central station facility further comprises means for recording a response acknowledged signal in response to said receipt acknowledged signal and associating said response acknowledged signal with said wireless signal output.

22. A system of customized out-patient management comprising:

a wireless carrier having a wireless signal output each wireless output signal having a patient specific code;

a programmable patient specific medical treatment plan comprising at least one patient self-directed activity to occur at a corresponding time of action,

a central station facility containing said patent specific medical treatment plan, the central station being operatively connected to said wireless carrier to issue a patient specific wireless output signal in response to an occurrence of said time of action; and

at least one messaging device associated with said specific patient having a prompt output and an identification code, said messaging device being responsive to said patient specific wireless signal output code corresponding to said identification code to prompt said patient to perform said at least one patient self-directed activity wherein said messaging device further comprises a bi-directional messaging capability with said wireless carrier, an actuable switch, and a wireless message received output signal, wherein the wireless carrier further comprises means for receiving a wireless message received output signal from said messaging device and means for transmitting a receipt acknowledged signal to said central station facility; and wherein the central station facility further comprises means for recording a response acknowledged signal in response to said receipt acknowledged signal and associating said response acknowledged signal with said wireless signal output.

23. The system of claim 22 wherein said wireless received output signal further comprises an obtained result responsive to said at least one patient self-directed activity.

24. A system of customized out-patient management comprising:

a wireless carrier having a wireless signal output, each wireless output signal having a patient specific code;

a programmable patient specific medical treatment plan comprising at least one patient self-directed activity to occur at a corresponding time of action;

a central station facility containing said patent specific medical treatment plan, the central station being operatively connected to said wireless carrier to issue a patient specific wireless output signal in response to an occurrence of said time of action; and

at least one messaging device associated with said specific patient having a tactile prompt output and an identification code, said messaging device being responsive to said patient specific wireless signal output code corresponding to said identification code to prompt said patient to perform said at least one patient self-directed activity, said messaging device further comprising a paging device wherein said paging device further comprises a bi-directional messaging capability with said wireless carrier, an actuable switch, and a wireless message received output signal, wherein the wireless carrier further comprises means for receiving a wireless message received output signal from said messaging device and means for transmitting a receipt acknowledged signal to said central station facility; and wherein the central station facility further comprises means for recording a response acknowledged signal in response to said receipt acknowledged signal and associating said response acknowledged signal with said wireless signal output.

25. A system of customized out-patient management comprising:

a wireless carrier having a wireless signal output, each wireless output signal having a patient specific code;

a programmable patient specific medical treatment plan comprising at least one patient self-directed activity to occur at a corresponding time of action;

a central station facility containing said patent specific medical treatment plan, the central station being operatively connected to said wireless carrier to issue a patient specific wireless output signal in response to an occurrence of said time of action; and

at least one messaging device associated with said specific patient having an audible prompt output and an identification code, said messaging device being responsive to said patient specific wireless signal output code corresponding to said identification code to prompt said patient to perform said at least one patient self-directed activity, said messaging device further comprising a paging device wherein said paging device further comprises a bidirectional messaging capability with said wireless carrier, an actuable switch, and a wireless message received output signal, wherein the wireless carrier further comprises means for receiving a wireless message received output signal from said messaging device and means for transmitting a receipt acknowledged signal to said central station facility; and wherein the central station facility further comprises means for recording a response acknowledged signal in response to said receipt acknowledged signal and associating said response acknowledged signal with said wireless signal output.

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UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,827,180

DATED : October 27, 1998

INVENTOR(S) : David E. Goodman

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, line 23, after "patient" delete "talking," and insert therefor --taking--;
Column 2, line 14, after "version of" insert --the--;
Column 2, line 60, after "flow" delete "etc," and insert --etc.,--;
Column 3, line 51, after "is" delete "show" and insert --shown--;
Column 4, line 42, after "processor" delete "1 0" and insert --10--;
Column 4, line 64, after "processor" delete "1 0" and insert --10--;
Column 5, line 18, after "processor" delete "1 0" and insert --10--;
Column 5, line 53, after "processor" delete "1 0" and insert --10--;
Column 6, lines 1-2, after "instructions" delete "form" and insert --from--;
Column 6, line 36, after "can" delete "re-program" and insert --reprogram--;
Column 6, line 46, after "processor" delete "1 0" and insert --10--; and after "charger" delete "1" and insert --1-- with "60" on line 47;
Column 6, line 50, after "Processor" delete "1 0" and insert --10--;
Column 6, line 63, after "processor" delete "1 0" and insert --10--;
Column 7, line 26, after "(hospital," delete "hospital"; and after "clinic)" delete "require" and insert --requires--;
Column 7, line 41, after "processor " delete "1 0" and insert --10--;
Column 8, lines 57-58, after "algo-rithm" delete "11 5" and insert --115--;
Column 9, line 43, after "measured" delete "peal" and insert --peak--;
Column 9, line 45, after "patient to" delete "talk" and insert --take--;
Column 9, line 64, after "step" delete "1 54" and insert --154--;
Column 11, line 33, after "but" insert --also--;
Column 11, line 58, after "contemplated" insert --,--;

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,827,180

DATED : October 27, 1998

INVENTOR(S) : David E. Goodman

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 14, line 24, after "patient" delete "selfdirected" and insert --self-directed--;
Column 15, line 26, after "inactive state" insert --,--;
Column 16, line 32, after "at a" delete "pre-determined" and insert --predetermined--;
Column 16, line 35, after "customized" delete "out-patient" and insert--outpatient--;
Column 16, line 43, after "said" delete "patent" and insert --patient--;
Column 17, line 8, after "said" delete "patent" and insert --patient--;
Column 17, line 41, after "said" delete "patent" and insert --patient--;
Column 18, line 8, after "said" delete "patent" and insert --patient--;
Title Page, after "David" delete "F." and insert --E.--;

Signed and Sealed this

Seventh Day of December, 1999

Attest:

Q. TODD DICKINSON

Attesting Officer

Acting Commissioner of Patents and Trademarks