

PATIENT INFORMATION SOFTWARE SYSTEM INCLUDING INFUSION MAP
RELATED APPLICATION

5 This application claims 35 U.S.C. § 119(e) priority from US Serial No.
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FIELD OF THE INVENTION

10 This invention relates to patient information software, and more
particularly to software for displaying a patient-specific, interactive, real-time infusion
system map.

BACKGROUND

15 Currently, medication delivery systems are limited due to the number of
parties involved in medicating a hospitalized patient, and a lack of complete,
consistent information provided to all parties. Typically, physicians write
prescriptions for patients. Pharmacists fill and dispense the prescriptions without
knowledge of the patient's infusion setup (route of administration of the various drugs
prescribed is often unspecified or underspecified). Nurses are responsible for
20 administering the prescribed drugs according to instructions from both the physicians
and pharmacists. This leads to nurses making critical decisions about infusion setup
and drug administration, which can lead to errors. In particular, the above workflow
can, among other things, lead to unnoticed drug incompatibilities, inadvertent bolus,
excessive lag time, and errors in the "five rights" of drug administration (ensuring the
25 right patient, right drug, right dose, right time, and right administration route).

 Pharmacists lack the ability to see the physical infusion system as
created by the administering nurses. Accordingly, the pharmacists rely on the
patient's medical record when checking and filling prescriptions. Nurses manually
map, label, and trace the various infusion lines. The nurse also manually selects a
30 route, port, and catheter hub for a newly-added drug deliverable by infusion, and
manually records this information in the patient's medical administration record

(MAR). Typically, a single nurse is responsible for many patients throughout a shift, and is constantly receiving, discharging, and transferring patients. Accordingly, medical records may lack the specificity required for a pharmacist to fully verify that there are no undesired drug interactions.

Accordingly, there is a need to provide a system for health care professionals to view an accurate representation of a patient's infusion map in real time. Likewise, there is a need to provide a system that aids clinicians in accurately recording the patient's infusion map in his or her medical record. Likewise, there is a need to provide a system that models infusion setups to aid decision making and execution by clinicians to reduce medication errors and save time.

SUMMARY

A patient information software system with infusion map addresses these needs. The system provides an accurate and up-to-date representation of each patient's infusion map, and allows clinicians to easily modify the presented map. The system further updates the patient's electronic medical record to reflect changes made to the infusion map, thus assisting the clinicians with their record-keeping requirements. Further, the present system aids clinicians in verifying the infusion setup before administering a drug to a patient, thus helping to reduce errors and save time.

In one aspect there is provided a patient information software system comprising: a memory located in a computerized device storing at least infusion mapping instructions; a processor located in the computerized device that, when executing the infusion mapping instructions, performs operations including: a displaying function that displays at least a portion of an electronic medical record associated with a patient, and graphically displays the electronic medical record as an infusion map interactively illustrating associated infusion system components; a diagramming function that receives the electronic medical record and generates the infusion map showing all intravenous drugs being administered to the patient, wherein, for each of the drugs, the infusion map further illustrating a route of administration for the drug; a building function that builds a graphical representation

of the infusion map using the display device by interactively establishing links between the drug and the associated infusion system components; an order administering function that allows a user to alter the infusion map having the drug and the associated infusion system components using the computerized device; and a
5 record updating function of automatically updating the electronic medical record to correspond to the altered infusion map, and automatically recording a history of the updated electronic medical record in the memory based on the altered infusion map using the computerized device.

In another aspect, there is provided infusion mapping process
10 comprising: retrieving and displaying at least a portion of an electronic medical record associated with a patient on a display device of a computerized device; graphically displaying the electronic medical record as an infusion map interactively illustrating associated infusion system components on the display device generating the infusion map, using the display device, schematically showing all intravenous drugs being
15 administered to the patient based on the retrieved electronic medical record, wherein for each of the drugs the schematic diagram illustrates a route of administration for the drug; building a graphical representation of the infusion map using the display device by interactively establishing links between the drug and the associated infusion system components; receiving a new order that alters the infusion map having the drug and
20 the associated infusion system components; and automatically updating said electronic medical record to correspond to the altered infusion map, and automatically recording a history of the updated electronic medical record based on the altered infusion map using the computerized device.

In still another aspect, there is provided a hospital information system
25 comprising: an electronic medical record server maintaining a plurality of patient electronic medical records; a display device of a computerized device that displays at least a portion of the plurality of patient electronic medical records associated with a patient, and graphically displaying the plurality of patient electronic medical records as an infusion map interactively illustrating associated infusion system components;
30 an infusion mapping device in communication with said electronic medical record server, said infusion mapping device performing operations including: retrieving at

least a portion of one or more of said plurality of patient electronic medical records, including a portion specifying intravenous drugs being administered to the patient and hospital equipment associated with the administration of the drugs; for each of said one or more retrieved medical records, displaying the infusion map that schematically
5 represents said portion specifying intravenous drugs being administered and the associated infusion system components; building a graphical representation of the infusion map using the display device of the computerized device by interactively establishing links between the drug and the associated infusion system components; modifying said infusion map having the drug and the associated infusion system
10 components using the computerized device; automatically updating said electronic medical record based on said modified infusion map using the computerized device; and automatically saving said updated electronic medical record to said electronic medical record server based on said modified infusion map using the computerized device.

15 Herein disclosed is a patient information software system that includes a memory storing at least infusion mapping instructions, and a processor that executes the stored instructions. When the processor executes the infusion mapping instructions, the infusion map system performs a displaying function that displays at least a portion of an electronic medical record associated with a patient, and a
20 diagramming function that receives the electronic medical record and generates an infusion map showing all intravenous drugs being administered to the patient. For each of the drugs, the infusion map further illustrates a route of administration for the drug. An order administering function performed by the system allows a user to alter the infusion map, and a record updating function of annotating the electronic medical
25 record to correspond to the altered infusion map.

Also disclosed is an infusion mapping process includes retrieving and displaying at least a portion of an electronic medical record associated with a patient, and generating an infusion map schematically showing all intravenous drugs being administered to the patient based on the retrieved electronic medical record. For each of the drugs, the schematic diagram illustrates a route of administration for the drug. The process further includes receiving a new order that alters the infusion map, and updating the electronic medical record to correspond to the altered infusion map.

There is also provided a hospital information system that includes an electronic medical record server maintaining a plurality of patient electronic medical records, and an infusion mapping device in communication with the electronic medical record server. The infusion mapping device performs operations including retrieving at least a portion of one or more of the plurality of patient electronic medical records, including a portion specifying intravenous drugs being administered to the patient and hospital equipment associated with the administration of the drugs. For each of the one or more retrieved medical records, the infusion mapping device displays an infusion map that schematically represents the portion of the medical record specifying intravenous drugs being administered and associated hospital equipment. The device modifies the infusion map and updates the electronic medical record based on the modified infusion map. Finally, the device saves the updated electronic medical record to the electronic medical record server.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a patient information software system with infusion map; and

FIGs. 2-46 show example screenshots of the patient information software system with infusion map of FIG. 1.

DETAILED DESCRIPTION

A patient information software system with infusion map is generally designated 10. The system 10 includes a computerized device 12, having at least a memory 14, a processor 16, an input device 18, a network communication interface

20, a display 22, and a power source (not shown). The memory 14 is preferably a non-transitory computer-readable recording medium, such as a read only memory (ROM), random access memory (RAM), hard disk, non-volatile flash memory or other electronically erasable programmable read-only memories (EEPROMs), or optical or magneto-optical memory storage medium. The memory 14 stores instructions that, when executed, perform the infusion mapping. The computerized device 12 also includes the processor 16, which may be, for example, a microprocessor or other central processing unit capable of executing the instructions stored in the memory 14. The display 22 is a device such as a liquid crystal display, cathode ray tube, plasma display, or other device capable of outputting data from the memory 14 and processor 16 in a way that is easily discernible by a user.

The network communication interface 20 allows the device 12 to connect to a network 24, such as a local area network (LAN), wide area network (WAN), and/or the Internet. The interface 20 connects to the network 24 via a wired connection using, for example, the Institute of Electrical and Electronics Engineers (IEEE) 802.3 standard, or a wireless connection using standards such as IEEE 802.11 a/b/g/n/ac, or any newly developed standards that supersede these. The network interface 20 may also connect to one or more cellular data networks using standards such and protocols as Long Term Evolution (LTE), Worldwide Interoperability for Microwave Access (WiMAX), Global System for Mobile Communications (GSM), Code Division Multiple Access (CDMA) standards such as cdmaOne and CDMA2000, High Speed Packet Access (HSPA), Evolved HSPA (HSPA+), General Packet Radio Services (GPRS), and the like.

The computerized device 12 may take many forms, including a laptop or desktop computer, a client computer integrated with a hospital information system to allow for access at multiple locations (e.g., pharmacy, nursing station, emergency department, diagnostic laboratory, and physician offices), a portable device such as a tablet, smartphone, personal digital assistant, or computer on wheels. Additionally, the computerized device may be integrated into bedside equipment such as infusion pumps and/or patient monitors.

The memory 14 on the system 10 stores a patient list that includes a plurality of records listing each current patient, together with patient ID information (ID number, date of birth, room number within the hospital, etc.), an infusion map, a list of pending activities related to the patient's infusion system, a list of past activities
5 related to the infusion system, and optionally a list of personnel authorized to view the patient's record. The patient list is preferably maintained in a central storage location accessible by all users of the infusion mapping system.

Each infusion map stores a list of drugs prescribed and/or being administered intravenously to a patient. One convenient method to maintain this
10 information is to integrate the system with the institution's Computerized Prescription Order Entry (CPOE) system, or other similar institution system, typically centralized in the hospital pharmacy. Preferably each drug is stored in combination with at least a dosage (concentration) of the drug, a volume of liquid in which the drug is diffused, a rate at which the fluid is being administered to the patient, a specific pump (if any)
15 used to facilitate the administration, a catheter port at which the drug is entering the patient's bloodstream, and an indication of what tubing connects the drug container to the catheter. One of skill in the art will recognize that more or different information may be stored as part of the infusion map without departing from the scope of this invention.

When a user interacts with the system 10 through a computerized device, he will be provided with a login prompt, requiring that the user provide authentication credentials for the system. Such credentials may include, but are not limited to a unique username, password, and/or biometric identification such as a fingerprint, voice sample, facial image or the like. The system 10 will verify the
20 provided login credentials and once the system has verified the user, the system displays a user name on screen so that the user can easily verify that he or she is logged in correctly, and can easily distinguish his or her device from other similar devices. The system 10 also uses this username when documenting data input and actions taken.

Once the user logs into the system 10, the system presents a patient list
25 26, as shown in Fig. 2. Alternatively, the user may be presented with a triage list of

required actions corresponding to the patient workload in place of or in addition to the patient list. To present the patient list 26, the system 10 retrieves a list of patient names from the patient table, and displays a list of current patients, as shown in Fig. 2. If the patient table restricts access of the patient records to particular users, the system
5 compares the user ID of the logged-in user to the list or personnel authorized to view the patient record stored in the patient table, and displays only those patient names corresponding to records the logged-in user is authorized to view. Additionally, the patient list 26 preferably includes a notification icon 28 indicating that some action is required for a patient. In the example shown in Fig. 2, the exclamation point icon
10 indicates that there is an action required for patient "John Doe."

The user then selects a patient from among the list of patients displayed. For example, the user may select "John Doe" from the patient list 26. As shown in Fig. 3, when a patient is selected, infusion status of the selected patient is retrieved from the patient table and displayed to the user in an easily-readable manner. The
15 displayed infusion status includes patient identification information 30, a list of all pending actions required for the patient 32, a list of all actions previously recorded for that patient 34, and a link 36 to view the infusion map associated with the patient.

As shown in Fig. 4, when user selects the link 36 to the patient infusion map, the system retrieves the stored infusion map and builds a graphical
20 representation of the map 38, which schematically illustrates the various drugs currently being administered intravenously to the patient, to display to the user. The infusion map 38 preferably shows each of the infusion drugs connected to the patient, together with a graphical representation of several pieces of information related to each drug. In particular, each drug is typically labeled with its name, concentration,
25 volume, and/or amount; a remaining time until that drug is completely infused; a label indicating the specific pump providing the infusion (if any); the rate at which the pump is set; and the site on the patient body to which the drug is connected. As an example, Fig. 4 shows that John Doe is receiving Phenylephrine, in the amount of 40 mg/250 ml; the remaining time before the Phenylephrine is completely infused is 3
30 hours and 5 minutes; the drug is being infused by a single-channel large volume infusion pump set to a rate of 37 ml per hour, and is connected to a peripherally

inserted central catheter (PICC) on the patient's right side. As can be seen in Fig. 4, each drug is similarly labeled.

The system 10 stores and can display additional information regarding each of the elements shown on the infusion map. For example, when the PICC is selected, additional information 40 related to that site is displayed, as shown in Fig. 5. The displayed information includes a list of drugs that are connected to the catheter, an infusion rate for each of the drugs, and a total infusion rate for the catheter. The information also includes data relating to when the catheter was inserted and when the catheter should be changed according to best-practice guidelines or any guidelines specified by the hospital. Closing the additional information panel returns the user to the infusion map display.

Figs 6-10 illustrate one of the various medication delivery workflows the system is capable of facilitating. As shown in Fig. 6, the patient has a pending action item in list 32, indicating that the physician and/or pharmacist has repeated an order for that patient. When a user selects a pending action to repeat an order, the system displays at least a portion of the patient infusion map 38 containing the drug specified in the order, as shown in Fig. 7. Additionally, order information 42 related to the repeat order is shown. The information 42 preferably includes an issuing physician, administration information including amount of drug, amount of fluid, and infusion rate, and compatibility information indicating whether or not the order is compatible with the existing infusion map. Those skilled in the art will recognize that different and/or additional information may be provided without departing from the scope of this invention.

To provide the compatibility information, the system 10 performs a drug compatibility check regarding at least four aspects of drug compatibility. First, the system 10 checks to determine compatibility between the drug and the patient. Specifically, the system determines if the patient has any allergies noted in his medical record that would be relevant to the drug to be administered. Additionally, the system 10 checks for any physical incompatibilities (e.g., precipitation interactions) between drugs prescribed to the patient. Finally, the system 10 includes a mass flow balance model to check for errors in the flow of the drugs into the patient's system. Mass flow

balance errors are generally caused by an incorrect placement of a drug within a patient's infusion system, an unexpected or overlooked interaction between multiple infusion pumps, or other issues with the physical equipment used to administer the drugs. Such errors include, for example, an inadvertent bolus (an unintended increase
5 in flow rate, causing a sudden increase in the drug concentration in a patient's blood stream) or an inadvertent lag (unintended delay in administration or decreased flow rate of a drug). The results of this compatibility check make up the compatibility information provided to the user.

The system 10 also highlights 44 a recommended configuration for the
10 order. Recommendations may be made by, for example, the issuing physician or a pharmacist. As shown in Fig. 7, the system 10 suggests replacing the existing insulin infusion bag with a new bag. The system 10 then prompts the user to either accept the suggested configuration and administer the drug 46, modify the suggested configuration 48, or cancel 50. In response to user indication that the configuration is
15 accepted 46, the system then prompts the user to confirm that the order has been administered 52, as shown in Fig. 8.

User confirmation preferably includes a simple click of a confirmation button 52 presented to the user, as shown in FIG. 8. Alternatively or in addition to this confirmation, the user may be required confirm the dosage administration in other
20 ways. For example, the user may be required to scan a barcode corresponding to the administered drug. This helps to provide additional verification that the order was administered correctly. Once the user indicates that the order was successfully administered, the system 10 displays a confirmation dialog box 54 indicating that the repeat order was successfully administered, as shown in Fig. 9. Additionally, as noted
25 in the confirmation dialog box 54 shown in Fig. 9, when an action is successfully administered, the system 10 automatically annotates the patient's electronic medical record indicating the time the order was administered and the user who administered the order. Once the user clicks OK as shown in Fig. 9, the system 10 returns to the patient infusion status screen as shown in Fig. 10. The screen shows the updated
30 patient history 34 and removes the pending action item.

The system 10 also allows for handling of new orders, as shown in Figs. 11-15. Preferably, the infusion system provides real-time updates regarding incoming orders for a patient under the user's supervision. As shown in Fig. 11, when a new order is received for patient John Doe, a notification 56 is displayed to the user. The user is provided with options to dismiss 58 the notification or to open 60 the patient profile for John Doe.

When the user selects "Open" 60 from the new order notification, the system preferably opens the order. Fig. 12 shows the new order screen. As discussed above, the screen includes order information 42 regarding the physician who issued the order, the ordered drug (e.g., number of units of the ordered drug, volume of liquid to be infused, and infusion rate), and compatibility check information indicating that the drug as ordered is compatible with the existing patient infusion map. The system 10 also displays at least a portion of the patient infusion map 38, and a highlighted recommended configuration 44 for administration of the ordered drug. Again, the user is presented with options to accept the suggested configuration and administer the ordered drug 46, modify the configuration 48, or cancel 50. When the user accepts the configuration 46, the infusion map 38 is updated to include the recommended configuration as shown in Fig. 13. The system then prompts the user to confirm that the order has been administered 52. The user then receives a notification dialog box 54 indicating that the dose has been successfully administered, as shown in Fig. 14. The system 10 also updates the patient's electronic medical record to indicate the time at which the order was administered and the user that administered the order, as indicated by the notification dialog box 54 present in Fig. 14. Fig. 15 shows the updated infusion status screen for patient John Doe, reflecting the updated history 34 in the patient's electronic medical record.

As shown in Figs. 16-25, the system 10 also allows for additional configuration options when a new order is received. When the user selects another patient from the user list, the infusion status screen corresponding to the patient is displayed, as shown in Fig. 16. The infusion status screen lists a pending action 32 for a new order. When the user selects the pending action 32, the system displays a screen showing the infusion map and the new order information.

As shown in Fig. 17, the new order information 42 includes information regarding the physician issuing the order, the drug to be administered, the volume of fluid to be infused, and the infusion rate. However, no configuration has been suggested by the physician or pharmacist for administration of the drug. Accordingly, the user is presented with options to retrieve configurations suggested by the system 62, manually configure the infusion 64, or to configure the drug infusion using a barcode scanner 66.

The system 10 is capable of suggesting one or more configurations for the new order when the user selects item 62. The system 10 uses a compatibility check based on the new order information 42 and the existing infusion map 38 to determine possible ways of connecting the newly ordered drug that are compatible with the existing infusion map, and then suggests one or more of the compatible configurations to the user.

Alternatively, the user may manually configure the setup by selecting item 64. When the user selects a manual configuration, the system 10 first prompts the user to select which catheter or access point the infusion will be connected to at 68. As shown in Fig. 18, candidate access points, including existing catheters and access points, are highlighted 70 on the infusion map 38 to aid the user in selecting a point. Alternatively, the user may select a new catheter 72. Next, as shown in Fig. 19, the user is provided with a list 74 of extension sets for use with the drug. Again, candidate locations 70 are highlighted on the infusion map 38, showing where the extension set can be placed. Similarly, FIG. 20 shows that the user is presented with a list 76 of possible tubing sets and candidate locations 70 within the infusion map 38, and FIG. 21 shows that the user is provided with a list 78 of possible infusion pumps for use with the drug, and highlighted locations 70 where the pump can be positioned. For each of the lists 74, 76, 78, the system 10 provides a list of appropriate equipment options, together with a description and representative image to allow for easy selection by the user. The system 10 preferably displays only the equipment available in a particular hospital or only the equipment available to a particular ward of that hospital. Once the user has selected a configuration for the drug, the system 10 preferably verifies that the configuration is compatible with the existing infusion map

38 using the compatibility checks described above, shows the infusion map 38 with the newly configured portion highlighted 80, and prompts the user to accept the verified configuration 82 or modify the configuration 84, as shown in Fig. 22. The system 10 then displays an updated infusion map 38 and prompts the user to confirm that the dose has been administered 86 as shown in Fig. 23. As shown in Fig. 24, the system confirms that the order has been administered via a confirmation dialog box 88 and updates the patient chart with the time and user administering the order. Fig. 25 shows that the infusion status screen for the patient is updated to include the new order in the history list 34.

Referring now to Figs. 26-30, the system 10 also allows for orders to be discontinued. A pending action to discontinue an order for patient John Doe is shown in action list 32 on the patient infusion status screen, shown in Fig. 26. When the user selects the pending action, the infusion map 38 is shown, and the system highlights the portion of the map 90 affected by the discontinued order. Additionally, order information 42 is shown indicating the physician who issued the order and order text. In the example shown in Fig. 27, the order text reads "Discontinue Vancomycin 1g/250mL." Additionally, as with other orders discussed above, the order information 42 preferably includes compatibility information indicating that the order is compatible with the present infusion map. The user is prompted to accept the new configuration 92 and discontinue administration of the drug as indicated in the order text.

As shown in Fig. 28, the system 10 then prompts the user to confirm 94 that the dose has been discontinued. Once the user confirms that the dose has been discontinued, the system updates the patient medical record to indicate the time at which the physician order was carried out and the user responsible for carrying out the order, and indicates that the discontinuation order was successfully carried out through a confirmation dialog box 96 presented to the user, as shown in Fig. 29. The patient infusion status screen is updated so that the history list 34 includes the current medical record information, as shown in Fig. 30.

Preferably, each item of hospital equipment and each drug container includes a unique identification code 98 registered in a database accessible by the

infusion mapping system 10. Here, an identification code 98 may be any machine-readable representation of data, including visual representations such as traditional parallel-line barcodes, QR codes, or other known systems. Alternatively, the identification code 98 may be stored and read via electronic means, such as RFID tags. As shown in Figs. 31-42, the system 10 also preferably allows a user to configure a portion of an infusion map 38 based on scanning the one or more identification codes 98 corresponding to the drug container(s) and equipment used to administer the order. Additionally, both the patient and user possess also unique identification codes so that the patient and user can also be identified by the system.

Fig. 31 shows that a pending action for a new order appears in the new order list 32 on the patient infusion status screen. In this case, the patient is a new patient with no existing infusion configuration. As shown in Fig. 32, no configuration is specified for the new order. Accordingly, the system 10 displays order information 32 associated with the new order and prompts the user with several options for configuration, including a suggested configuration 62, including system-suggested configurations and/or a pharmacist- or physician-specified configuration, manual configuration 64 by a nurse using a pick-list selection as described previously, or configuration using a barcode scanner 66. When the user selects "configure with barcode scanner" 66, the system prompts the user to scan barcodes attached to the appropriate hospital equipment using the input device 18, which is preferably any known barcode scanner input device. As non-limiting examples, the input device 18 may be a camera integrated into a laptop computer, personal digital assistant, tablet computer, or smartphone, or a separate scanning device. As each barcode is scanned, the corresponding equipment appears in the infusion map 38, and the system 10 identifies the scanned equipment, prompts the user to verify that the correct equipment has been scanned 100, and prompts the user to scan additional equipment 102, as shown in Figs. 34-38. While the example illustrated uses barcodes, any known identification code (e.g., QR codes, RFID chips) may be used without departing from the scope of the present invention, as discussed above. Once a complete configuration has been scanned, the system verifies that the configuration is compatible, and prompts the user to accept the configuration 104, while displaying the infusion map 38

with the newly-added equipment highlighted 106, as shown in Fig. 39. The system then prompts the user to confirm that the dose has been administered 108 as shown in Fig. 40. The patient record is updated to include the time that the order was carried out and the user name of the person who administered the order. This information is presented to the user in a confirmation dialog box 110, as shown in Fig. 41. Finally, as shown in Fig. 42, the patient infusion status screen is updated to show that the order was successfully entered into the patient's chart in the history list 34.

As shown in Figs. 43-46, the system also provides training and instruction for use information related to the equipment used to administer intravenous drugs. Preferably, multiple training and instruction items are available in a plurality of formats, including, for example, videos, instruction manuals, and the like. The items may be stored locally on the user's device (e.g., in the memory of a user's tablet, smartphone, etc.), centrally on a server accessible by all system devices (e.g., a hospital data server), or remotely, such that the training and instruction items are available via the Internet. As shown in Fig. 43, the system 10 provides the user with a menu 112 showing a selection of training and instructional use content. In response to a user selecting an item of video content, the system retrieves the selected video via a known method (e.g., playback from memory, progressive download, streaming, etc.) and begins playback, as shown in Fig. 44. When the video finishes, or in response to a user interaction, the system returns to the training and instruction menu, as shown in Fig. 45. Fig. 46 shows an example of a text-based instruction item. Text based items may be, for example scanned documentation provided by the equipment manufacturer, and are preferably searchable documents.

Additionally, the infusion map system 10 optionally includes more advanced medical record functionality, including notation of non-intravenously administered drugs, notation of laboratory test orders and test results, and additional physician orders and actions taken. The system 10 further optionally includes more advanced patient charting features.

Further, the system 10 is optionally integrated with other medical information systems present at the medical facility including, but not limited to, inventory management systems and billing systems. This integration advantageously

increases accuracy of inventory and billing, while simultaneously reducing duplicative work of noting drugs provided for inventory and billing purposes by hospital staff and health care providers.

Still further, the system optionally includes “personal nursing assistant” (PNA) functionality, planning a nursing schedule based on assigned patients and patient orders. This desirably ensures that nurses are provided with a manageable schedule that allows them adequate time to see to patient needs, while also reducing scheduling time for hospital administration. This functionality preferably includes smart triage functionality, arranging orders for a nurse according to multiple factors such as patient condition, medication criticality, and other competing orders.

The system 10 also may be integrated with patient monitoring and notification systems. This integration provides the user with a triage action item when a notification such as an equipment alarm is received.

While at least one exemplary embodiment has been presented in the foregoing detailed description in connection with specific apparatus and applications, it should be appreciated that a vast number of variations exist. It should also be appreciated that the exemplary embodiment is merely an example, and is not intended to limit the scope, applicability, or configuration in any way. Rather, the foregoing detailed description will provide those of skill in the art with a convenient road map for implementing an exemplary embodiment of the invention. It will be understood that various changes may be made in the function and arrangement of elements described in an exemplary embodiment without departing from the scope of the invention as set forth in the appended claims.

Claims:

1. A patient information software system comprising:
a memory located in a computerized device storing at least infusion mapping instructions;

5 a processor located in the computerized device that, when executing the infusion mapping instructions, performs operations including:

a displaying function that displays at least a portion of an electronic medical record associated with a patient , and graphically displays the electronic medical record as an infusion map interactively illustrating associated infusion system components;

10 a diagramming function that receives the electronic medical record and generates the infusion map showing all intravenous drugs being administered to the patient, wherein, for each of the drugs, the infusion map further illustrating a route of administration for the drug;

15 a building function that builds a graphical representation of the infusion map using the display device by interactively establishing links between the drug and the associated infusion system components;

an order administering function that allows a user to alter the infusion map having the drug and the associated infusion system components using the computerized device; and

20 a record updating function of automatically updating the electronic medical record to correspond to the altered infusion map, and automatically recording a history of the updated electronic medical record in the memory based on the altered infusion map using the computerized device.

2. The patient information software system of claim 1, wherein said infusion map schematically represents a list of drugs being administered to the patient intravenously and, for each of the drugs being administered, stores at least a catheter port at which the drug is entering the patient's body and an indication of tubing
5 connecting the drug to the catheter port.

3. The patient information software system of claim 1, wherein said order administration function further comprises:

receiving order information for a new order that would alter the infusion map;

5 determining compatibility of the new order with the infusion map; and
updating the infusion map as specified in the new order.

4. The patient information software system of claim 3, wherein said determining compatibility comprises:

comparing the received order information with patient allergy information stored in the electronic medical record associated with the patient;

5 determining whether there are any physical incompatibilities between the received order information and the infusion map; and

checking for mass flow balance errors in the received order information.

5. The patient information software system of claim 3, wherein said updating comprises automatically generating one or more changes to the infusion map based on the received order information.

6. The patient information software system of claim 3, wherein said updating comprises:

generating a list of one or more components for use with the new order information;

5 presenting said list of one or more components to a user;

receiving a user selection from among said one or more listed components; and

updating said infusion map to include said selected component.

7. The patient information software system of claim 3, wherein said updating comprises:

receiving bar code information from a code reader;

5 comparing said received bar code information with an equipment database to determine which piece of equipment was scanned; and

updating said infusion map to include said scanned equipment.

8. An infusion mapping process comprising:

retrieving and displaying at least a portion of an electronic medical record associated with a patient on a display device of a computerized device;

5 graphically displaying the electronic medical record as an infusion map interactively illustrating associated infusion system components on the display device

generating the infusion map, using the display device, schematically showing all intravenous drugs being administered to the patient based on the retrieved electronic medical record, wherein for each of the drugs the schematic diagram illustrates a route of administration for the drug;

10 building a graphical representation of the infusion map using the display device by interactively establishing links between the drug and the associated infusion system components;

receiving a new order that alters the infusion map having the drug and the associated infusion system components; and

15 automatically updating said electronic medical record to correspond to the altered infusion map, and automatically recording a history of the updated electronic medical record based on the altered infusion map using the computerized device.

9. The infusion mapping process of claim 8, further comprising checking compatibility of said received new order information with said infusion map, wherein said update is performed if it is determined that there is no

5 compatibility problem between said received new order information and said infusion map.

10. The infusion mapping process of claim 8, wherein, for each of the drugs being administered, said infusion map stores information regarding at least a catheter port at which the drug is entering the patient's body and associated equipment connecting the drug to the catheter port

11. The infusion mapping process of claim 10, wherein said new order includes new order information specifying a drug to be administered to the patient and equipment for connecting the drug to the patient, and wherein said updating comprises adding equipment to the infusion map based on said received new
5 order information.

12. The infusion mapping process of claim 10, wherein said new order includes new order information specifying a drug to be administered to the patient, and wherein said updating comprises:

creating a list of equipment;
5 receiving user input selecting one or more pieces of equipment from said list; and
adding said one or more selected pieces of equipment to said infusion map.

13. The infusion mapping process of claim 10, wherein said updating comprises:

maintaining a database storing a plurality of pieces of equipment and, for each said piece of equipment, associating an identifying code therewith;
5 receiving, input data from a code reader;
comparing the received data with said plurality of identifying codes stored in said database;

selecting a piece of equipment on the basis of said received data
matching said identifying code associated therewith; and

10 adding said selected piece of equipment to said infusion map.

14. The infusion mapping process of claim 10, wherein said new
order includes new order information specifying a drug to be discontinued, and
wherein said updating comprises deleting said drug and said associated equipment
from said infusion map.

15. The infusion mapping process of claim 8, wherein said retrieving
retrieves said at least a portion of the electronic medical record associated with the
patient from a hospital information system.

16. A hospital information system comprising:

an electronic medical record server maintaining a plurality of patient
electronic medical records;

5 a display device of a computerized device that displays at least a portion
of the plurality of patient electronic medical records associated with a patient, and
graphically displaying the plurality of patient electronic medical records as an infusion
map interactively illustrating associated infusion system components;

an infusion mapping device in communication with said electronic
medical record server, said infusion mapping device performing operations including:

10 retrieving at least a portion of one or more of said plurality of
patient electronic medical records, including a portion specifying intravenous
drugs being administered to the patient and hospital equipment associated with
the administration of the drugs;

15 for each of said one or more retrieved medical records, displaying
the infusion map that schematically represents said portion specifying
intravenous drugs being administered and the associated infusion system
components;

20 building a graphical representation of the infusion map using the
display device of the computerized device by interactively establishing links
between the drug and the associated infusion system components;
modifying said infusion map having the drug and the associated
infusion system components using the computerized device;
automatically updating said electronic medical record based on
said modified infusion map using the computerized device; and
25 automatically saving said updated electronic medical record to
said electronic medical record server based on said modified infusion map
using the computerized device.

17. The hospital information system of claim 16, wherein access to
each of said patient electronic medical records stored on said electronic medical
record server is permitted for a particular set of one or more user names,
wherein infusion mapping further performs operations of receiving at
5 least a user name and password, and
wherein said retrieving retrieves only those medical records which the
received username is permitted to access.

18. The hospital information system of claim 16, wherein said
infusion mapping device communicates with said electronic medical record server
using a wireless communication interface.

19. The hospital information system of claim 16, wherein infusion
mapping further performs operations of receiving an order, said order including at
least information regarding a drug to be administered to a patient, and wherein said
modifying modifies said infusion map based on said received order.

20. The hospital information system of claim 16, wherein said
infusion mapping device further facilitates access to training and instructional content.