METHOD, APPARATUS, SYSTEM AND COMPUTER PROGRAM PRODUCT FOR CLUSTER DETECTION

Abstract: Methods, apparatuses, systems and computer program products for detecting a cluster comprising a commonality of events in time and space are disclosed. Data relating to healthcare patients is processed for detecting clusters (310, 320). Detected clusters are reported to an external agency via a communications network (3309). Data reported to the external agency may comprise one or more of identification of the location of the cluster, the number of patients to which the cluster relates, and the starting time of the cluster. A protocol that defines an appropriate action to be performed at a point of care may be received from an external agency. Further events relating to the cluster may also be detected and reported via the communications network to the external agency.
METHOD, APPARATUS, SYSTEM AND COMPUTER PROGRAM
PRODUCT FOR CLUSTER DETECTION

Field of the Invention

The present invention relates to a method and apparatus for detecting clusters of events in time and space from patient data in the healthcare domain and more particularly to reporting such clusters to external entities such as a health agency.

Background

Healthcare professionals or clinicians rely on available information to diagnose and prescribe treatments for patients. Such information typically includes information obtained from patients, historical information, and information from other healthcare professionals and agencies. Accuracy and availability of such information at the point of care greatly assists diagnosis and prescription of appropriate treatment.

Healthcare professionals typically use a Patient Management System (PMS) at a point of care to record, retrieve and manage patient data. A PMS typically comprises at least one patient database and a Decision Support System (DSS). An example of such a system is Medical Director™, provided by Health Communication Network Limited of Level 4, 39-41 Chandos Street, St Leonards NSW 2065, Australia, which comprises a computer software program for execution on a Personal Computer (PC) under an operating system such as Microsoft Windows™ NT or Microsoft™ Windows XP Professional.

United States Patent No. 6,229,918, entitled “System and Method for Automatically Detecting Clusters of Data Points within a Data Space”, issued to Kentaro Toyama on May 8, 2001 and is assigned to Microsoft Corporation. This document relates to an algorithm for detecting clusters within a data space with a radial spanning device.

United States Patent No. 6,283,761, entitled “Apparatus and Method for Processing and/or Providing Healthcare Information and/or Healthcare-related Information”, issued to Raymond Anthony Joao on September 4, 2001. This document relates to providing a healthcare provider with a diagnostic report containing a list of possible diagnoses. The
healthcare provider responds with a final diagnosis and a claim form is generated for
submission to a healthcare payer or a healthcare insurer.

The healthcare domain as a whole is characterised by distributed patient
information over a substantial number of points of care. A need thus exists for methods,
apparatuses, systems and computer program products that enable significant information
to be detected at distributed points of care and reported to external entities for triggering
relevant responses.

**Summary**

An aspect of the present invention provides a method for detecting a cluster
comprising a commonality of events in time and space. The method comprises the steps of:

1. processing data relating to healthcare patients;
2. detecting existence of a cluster based on the data; and
3. reporting detection of the cluster via a communications network to an external
agency.

Another aspect of the present invention provides an apparatus for detecting a cluster
comprising a commonality of events in time and space. The apparatus comprises a
communications interface for transmitting and receiving data, a memory unit for storing
data and instructions to be performed by a processing unit and a processing unit coupled
to the communications interface and the memory unit. The processing unit is programmed
to execute the steps of the foregoing method for detecting a cluster comprising a
commonality of events in time and space.

Another aspect of the present invention provides a computer program product
comprising a computer readable medium comprising a computer program recorded
therein for detecting a cluster comprising a commonality of events in time and space. The
computer program product comprises computer program code for executing the steps of
the foregoing method for detecting a cluster comprising a commonality of events in time
and space.
Another aspect of the present invention provides a computer program product comprising a computer readable medium comprising a computer program recorded therein for detecting a cluster comprising a commonality of events in time and space. The computer program product comprises:

- a Clinical Software Platform comprising computer program code for processing data relating to clinical patients;
- a first Knowledge Object comprising computer program code for automatically detecting existence of a cluster based on the data;
- a second Knowledge Object comprising computer program code for communicating with an external agency via a communication network; and
- a Knowledge Deployment System (KDS) client comprising computer program code for interfacing the Knowledge Objects to the Clinical Software Platform;

wherein a detected cluster is reported substantially without delay to the external agency in response to detection of a cluster.

Another aspect of the present invention provides a method for remotely managing events at one or more points of care. The method comprises the steps of:

- receiving notification of a cluster detected at a point of care via a communications network, the cluster comprising a commonality of events in time and space; and
- sending a protocol via the communications network, the protocol defining an appropriate action to be taken at a point of care.

Another aspect of the present invention provides a system for remotely managing events at one or more points of care that comprises:

- a plurality of remote apparatuses for detecting a cluster comprising a commonality of events in time and space, wherein each apparatus is disposed at a point of care; and
- a central apparatus, comprising:
  - a communications interface for transmitting data to and receiving data from the plurality of remote apparatuses via a communication network;
  - a memory unit for storing data and instructions to be performed by a processing unit; and
- a processing unit coupled to the communications interface and the memory unit, the processing unit programmed to:
receive, via the communications interface and the communications network, notification of detection of a cluster by any one or more of the plurality of remote apparatuses; and

transmit, via the communications interface and the communications network, a protocol to one or more of the plurality of remote apparatuses, the protocol defining an appropriate action to be taken at a location of one or more of the remote apparatuses.

Another aspect of the present invention provides a computer program product comprising a computer readable medium comprising a computer program recorded therein for remotely managing events at one or more points of care. The computer program product comprises:

computer program code for receiving, via a communications network, notification of a cluster detected at a remote point of care, the cluster comprising a commonality of events in time and space; and

computer program code for sending, via a communications network, a protocol to at least one remote point of care, the protocol defining an appropriate action to be performed at the at least one remote point of care.

**Brief Description of the Drawings**

A small number of embodiments are described hereinafter, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a block diagram of an apparatus for detecting clusters in accordance with embodiments of the present invention;

Fig. 2 is a schematic representation of an environment wherein cluster detection according to embodiments of the present invention can be practised;

Fig. 3 is a flow diagram of a method for detecting a cluster;

Fig. 4 is another flow diagram of a method for detecting a cluster;

Fig. 5 is a flow diagram of a method for remotely managing events at one or more points of care; and

Fig. 6 is a schematic representation of a computer system with which embodiments of the present invention can be practised.
Detailed Description

Embodiments of methods, apparatuses, systems and computer program products are described herein for detecting clusters in healthcare patient data.

A cluster is a commonality of events in time and space. In the healthcare domain, for example, existence of a significant cluster may be indicative of an infectious disease or epidemic such as an outbreak of Severe Acute Respiratory Syndrome (SARS), a medical misadventure, medication use, or symptoms of a medical condition.

Fig. 1 shows a block diagram of an apparatus and system for cluster detection. Referring to Fig. 1, a point of care system 100 comprises a Clinical Software Platform (CSP) 110, a Knowledge Deployment System (KDS) client 120, and Knowledge Objects (KO1 and KO2) 132 and 134. The KDS client 120 and the KOs 132 and 134 make up a Knowledge Deployment System that may be hosted by the CSP 110.

A CSP is a Patient Management System (PMS) for use by clinicians or healthcare professionals at a point of care. A CSP may be used to prescribe, prepare/retrieve medication charts, order diagnostic tests, write letters, provide decision support, and store and retrieve medical records from a data repository. The CSP 110 is a software application that comprises a patient database 112, a Decision Support System (DSS) 114, and a product user interface (not shown). The CSP 110 communicates with the KDS client 120 by triggering events and by supplying and updates data when requested through a Product Interface (PI).

The patient database 112 comprises an electronic database for storing information and events relating to patients, which may be structured according to a database format such as Structured Query Language (SQL) or DataBase Format (DBF).

The DSS 114 is an electronic software application or interface for processing and delivering information to clinicians for patient care. The DSS 114 can be used by a clinician to source information by searching knowledge bases such as guidelines, books, and journals. However, the DSS 114 may also be automatically triggered by events and/or patient characteristics such as age, sex, medication history, and disease status to locate and present related information to a clinician. For example, headache symptoms recorded against patients listed in the patient database 112 may cause a clinician to search for possible causes of headaches in electronic guidelines. However, the DSS 114 may automatically generate screen prompts to remind the clinician of the possibility of
meningitis in a current patient. If the point of care system 100 detects a cluster of meningitis then the automatically generated prompt is more relevant and salient than the searching facility. However, if a cluster or outbreak of meningitis is not apparent, the use of automatic prompts in relation to patients with headaches may be irrelevant and thus undervalued by a clinician.

The KDS client 120 is a part of a distributed KDS system comprising one or more KDS servers (not shown) that provide a framework for deploying, executing, exchanging data with, and managing KOs at a point of care. The KDS system employs a standardised data schema and a communication and information/knowledge channel using web services technology. By virtue of a consistent data representation by KDS across CSPs, the KDS system facilitates development of third party software applications (i.e., KOs) without the need for customising each KO to a particular CSP. The need to constantly provide Application Programmer Interfaces (APIs) to third party KO providers is thus obviated. A single PI has to be established for each CSP. A single KO can function across many different CSPs. A CSP can interface with many different KOs through the one PI.

Knowledge Objects (KOs) are software applications that interact through a KDS client with a CSP. Some examples of KOs are a simple prompt, a data extraction routine, a patient management and data collection protocol, a routine for populating a patient’s medical record with clinically relevant data (e.g., pathology results), and a routine for adding additional KOs.

The CSP 110 is interfaced to Knowledge Objects (KO₁, KO₂) 132 and 134 via the Knowledge Deployment System (KDS) client 120. The number of KOs is not necessarily limited to two, as shown in the embodiment of Fig. 1, but may comprise any integer number. KO₂ 134 is coupled to an external health agency 140 via a communications network (not shown in Fig. 1). Examples of external health agencies are the Royal North Shore Hospital in Sydney, Australia and the Centre for Disease Control (CDC) in Atlanta, Georgia, United States of America.

When a healthcare professional or clinician performs an action in the CSP 110, an event occurs (e.g., a patient’s clinical records are opened). Each such event is passed to and processed by the KDS client 120. Processing of an event includes dispatch of the event to all applicable KOs, which are determined from a KO register. The applicable KOs typically perform an appropriate action in response to a particular event.
In the embodiment shown in Fig. 1, the KO_1 132 performs real time monitoring and/or processing 151 of patient data in the patient database 112 to detect clusters that are significant. The KO_1 132 typically comprises statistical algorithms and reference data that are used to determine significant clusters (statistically or clinically) of events at the point of care. The statistical algorithms may use previous data events that occurred at the point of care for comparative purposes and/or predetermined threshold values based on statistical tolerance for specific conditions.

Significant clusters that are detected are reported in real time or substantially without any delay from detection to the CSP 110 and the external health agency 140 by the KO_2 134 via the KDS client 120. Reporting 152 of a detected cluster triggers the DSS 114, which enables a user of the point of care system 100 to be made aware of the cluster and the related patients. Relevant local protocols may also be initiated in the CSP 110, if appropriate. An example of such a local protocol is a recall of patients suffering from headaches, in the case of detection of a meningitis cluster, to undergo further and/or closer examination. Reporting 154 of a detected cluster to the external health agency 140 notifies the location of the cluster and triggers current or update protocols 155 for the duration of the cluster, if appropriate. Current and updated clinical or response protocols 153 and 155 are relayed to the CSP 110 via the KO_2 134 in response to reporting 154 of a cluster. The clinical or response protocols 153 may cause appropriate action at the point of care such as updating of the patient database 112 and a recall of patients for further evaluation.

Fig. 2 shows an environment wherein cluster detection can be practiced. The point of care systems 210, 212..., 214 are coupled to processing systems of one or more external health agencies 230, 232..., 234 via a communications network 220.

The point of care systems 210, 212..., 214 may correspond to the point of care system 110 in Fig. 1. Each of the point of care systems and processing systems of the external health agencies comprise computer systems, examples of which are described in this specification. The numbers of point of care systems and external health agencies are largely unlimited in that any number may participate in a cluster detection system. In certain embodiments, multiple point of care systems are coupled to a single external health agency via a communication network. The communication network preferably comprises the Internet but may comprise any other public or private network linked by a communications medium such as cable, wireless, optical fibre, etc.
Fig. 3 shows a flow diagram of a method for detecting a cluster. In particular, the method of Fig. 3 may be performed by the point of care system 100 of Fig. 1 or any of the point of care systems 210, 212..., 214 of Fig. 2.

At step 310, data relating to healthcare patients is processed to detect any clusters of events. Such processing is typically performed at a clinical point of care (e.g., a doctor’s practice) by a Knowledge Object (KO) software application that interrogates one or more patient databases coupled to a Clinical Software Platform (CSP).

A cluster is detected at step 320 and is reported to at least one remote entity at step 330. An example of a remote entity is an external health agency such as the Royal North Shore Hospital in Sydney, Australia or the Centre for Disease Control (CDC) in Atlanta, Georgia, United States of America.

Information provided with such a report typically comprises identification of the location of the cluster (e.g., the location of the CSP or point of care), the number of patients the cluster relates to, and the starting time of the cluster. The starting time of a cluster is the time of the earliest event that comprises a cluster.

Fig. 4 shows a flow diagram of another method for detecting a cluster. In particular, the method of Fig. 4 may be performed by the point of care system 100 of Fig. 1 or any of the point of care systems 210, 212..., 214 of Fig. 2.

At step 410, a patient database is continuously monitored to detect any significant clusters of events. Such monitoring is typically performed by a Knowledge Object (KO) software application that processes data in one or more patient databases coupled to a Clinical Software Platform (CSP) that is located at a point of care (e.g., a doctor’s practice).

At step 420, a determination is made whether a cluster exists. If a cluster exists (Y), the cluster is reported to the CSP at step 430. The number of patients relating to the cluster and a listing of the patients’ names are typically made available to clinicians or users of the CSP when a cluster is reported. Additional data (e.g., patient details) may also be reported to the CSP over the duration of the cluster. Relevant local protocols may be initiated in the CSP, such as a recall of patients to further investigate a likely cause (e.g., closer examination of headache patients in the case of suspected meningitis). If no current cluster exists at step 420 (N), processing returns to step 410 to continue monitoring the patient database.
The detected cluster is reported to one or more relevant external health agencies at step 440. Relevancy of an external health agency is determined with respect to one or more specialities of the particular external health agencies. Such reporting typically occurs in real-time, that is, immediately after a cluster is detected. Information provided in such a report typically comprises one or more of identification of the location of the cluster, the number of patients the cluster relates to, and the starting time of the cluster. The starting time of a cluster is the time of the earliest event that comprises a cluster.

Current or update protocols may be received from an external health agency over the duration of a cluster as more information comes to hand or decisions are made. If a protocol is received from an external health agency at step 450 (Y), an appropriate action is performed at step 460, if necessary. Examples of such actions are updating of data in the patient database at the point of care and a recall of patients to undergo further testing and/or closer examination.

After the appropriate action is performed at step 460, processing returns to step 420, wherein it is determined whether the cluster is still in existence and whether any other clusters exist. A cluster may be terminated, for example, on the authorisation of an external health agency or local authority.

Fig. 5 shows a flow diagram of a method for remotely managing events at one or more points of care. A notification of a cluster detected at a point of care is received via a communications network at step 510. At step 520, a protocol defining an appropriate action to be taken at a point of care is sent via the communications network. The notification is preferably received substantially without delay after detection of the cluster and the protocol may be sent substantially without delay after receiving the notification. The protocol may define one or more actions to be taken at a point of care such as providing a notification to an operator, providing instructions to an operator, amending rules for cluster detection, executing a software program code, and receiving downloaded software program code. The protocol can define an appropriate action to be performed at more than one point of care, including a point of care that has not detected a cluster. Accordingly, management of events at one or more points of care can be remotely performed by a central KDS server located at an external agency in response to detection of a cluster, thus enabling management of epidemics, potential epidemics and natural disasters. The KDS server can selectively download and/or remotely activate cluster response software programs or systems at multiple sites or points of care, some of which
may not actually be experiencing a cluster. The targeted sites or points of care may relate to a specific geographical area or a specific jurisdictional area controlled by authority rights.

Fig. 6 is a schematic representation of a computer system 600 that can be used to practice embodiments described herein. The computer system 600 is provided for executing computer software that is programmed to assist in performing a method for detecting a cluster comprising a commonality of events in time and space. More specifically, the computer system 600 provides a means for executing software application programs that perform the functions of Clinical Software Platforms, Knowledge Deployment System clients and Knowledge Objects as described hereinbefore. The computer software executes under an operating system such as MS Windows XP™ or MS Windows NT™ installed on the computer system 600.

The computer software involves a set of programmed logic instructions that may be executed by the computer system 600 for instructing the computer system 600 to perform predetermined functions specified by those instructions. The computer software may be expressed or recorded in any language, code or notation that comprises a set of instructions intended to cause a compatible information processing system to perform particular functions, either directly or after conversion to another language, code or notation.

The computer software program comprises statements in a computer language. For example, the Clinical Software Platform (CSP) may be written in a software programming language such as C++, VB.net or Java. The computer program may be processed using a compiler into a binary format suitable for execution by the operating system. The computer program is programmed in a manner that involves various software components, or code means, that perform particular steps of the methods described hereinbefore.

The components of the computer system 600 comprise a computer 620, input devices 610, 615 and a video display 690. The computer 620 comprises a processing unit 640, a memory unit 650, an input/output (I/O) interface 660, a communications interface 665, a video interface 645, and a storage device 655. The computer 620 may comprise more than one of any of the foregoing units, interfaces, and devices.

The processing unit 640 may comprise one or more processors that execute the operating system and the computer software executing under the operating system. The
memory unit 650 may comprise random access memory (RAM), read-only memory (ROM), flash memory and/or any other type of memory known in the art for use under direction of the processing unit 640.

The video interface 645 is connected to the video display 690 and provides video signals for display on the video display 690. User input to operate the computer 620 is provided via the input devices 610 and 615, comprising a keyboard and a mouse, respectively. The storage device 655 may comprise a disk drive or any other suitable non-volatile storage medium.

Each of the components of the computer 620 is connected to a bus 630 that comprises data, address, and control buses, to allow the components to communicate with each other via the bus 630.

The computer system 600 may be connected to one or more other similar computers via the communications interface 665 using a communication channel 685 to a network 680, represented as the Internet.

The computer software program may be provided as a computer program product, and recorded on a portable storage medium. In this case, the computer software program is accessible by the computer system 600 from the storage device 655. Alternatively, the computer software may be accessible directly from the network 680 by the computer 620. In either case, a user can interact with the computer system 600 using the keyboard 510 and mouse 615 to operate the programmed computer software executing on the computer 620.

The computer system 600 has been described for illustrative purposes. Accordingly, the foregoing description relates to an example of a particular type of computer system suitable for practising the methods and computer program products described hereinbefore. Other configurations or types of computer systems can be equally well used to practise the methods and computer program products described hereinbefore, as would be readily understood by persons skilled in the art. For example, the methods and computer program products described hereinbefore can be practiced using a handheld computer such as a Personal Digital Assistant (PDA).

Methods, apparatuses, systems and computer program products have been described hereinbefore for detecting a cluster comprising a commonality of events in time and space. The foregoing detailed description provides exemplary embodiments only, and is not intended to limit the scope, applicability or configurations of the invention. Rather,
the description of the exemplary embodiments provides those skilled in the art with enabling descriptions for implementing an embodiment of the invention. Various changes may be made in the function and arrangement of elements without departing from the spirit and scope of the invention as set forth in the claims hereinafter.

(Australia Only) In the context of this specification, the word "comprising" means "including principally but not necessarily solely" or "having" or "including", and not "consisting only of". Variations of the word "comprising", such as "comprise" and "comprises" have correspondingly varied meanings.
CLAIMS:

1. A method for detecting a cluster comprising a commonality of events in time and space, said method comprising the steps of:
   processing data relating to healthcare patients;
   detecting existence of a cluster based on said data; and
   reporting detection of said cluster via a communications network to an external agency.

2. The method of claim 1, wherein said cluster is reported to said external agency substantially without delay after detection of said cluster.

3. The method of claim 1, wherein said data comprises data in at least one patient database located at a point of care.

4. The method of claim 1, wherein said method is performed at a point of care.

5. The method of claim 1, wherein said step of processing is performed continuously.

6. The method of claim 1, wherein said reporting step comprises reporting one or more data items from the group of data items consisting of:
   identification of the location of the cluster;
   the number of patients to which the cluster relates; and
   the starting time of the cluster.

7. The method of claim 4, comprising the further step of:
   receiving a protocol, said protocol defining an appropriate action to be performed at the point of care.

8. The method of claim 7, wherein said protocol is received from said external agency.

9. The method of claim 1, comprising the further steps of:
   detecting a further event relating to said cluster; and
reporting said further event via said communications network to said external agency.

10. An apparatus for detecting a cluster comprising a commonality of events in time and space, said apparatus comprising:
    a communications interface for transmitting and receiving data;
    a memory unit for storing data and instructions to be performed by a processing unit; and
    a processing unit coupled to said communications interface and said memory unit,
    said processing unit programmed to:
        process data relating to healthcare patients;
        detect existence of a cluster based on said data; and
        report detection of said cluster via said communication interface and a communications network to an external agency.

11. The apparatus of claim 10, wherein said cluster is reported to said external agency substantially without delay after detection of said cluster.

12. The apparatus of claim 10, wherein said data comprises data in at least one patient database located at a point of care.

13. The apparatus of claim 10, located at a point of care.

14. The apparatus of claim 10, wherein said processing unit is programmed to process said data continuously.

15. The apparatus of claim 10, wherein said processing unit is programmed to report one or more data items from the group of data items consisting of:
    identification of the location of the cluster;
    the number of patients to which the cluster relates; and
    the starting time of the cluster.
16. The apparatus of claim 13, wherein said processing unit is further programmed to receive a protocol, said protocol defining an appropriate action to be performed at the point of care.

17. The apparatus of claim 16, wherein said protocol is received from said external agency.

18. The apparatus of claim 10, wherein said processing unit is further programmed to:
detect a further event relating to said cluster; and
report said further event via said communications network to said external agency.

19. A computer program product comprising a computer readable medium comprising a computer program recorded therein for detecting a cluster comprising a commonality of events in time and space, said computer program product comprising:
computer program code for processing data relating to healthcare patients;
computer program code for detecting existence of a cluster based on said data; and
computer program code for reporting detection of said cluster via a communications network to an external agency.

20. The computer program product of claim 19, wherein said cluster is reported to an external agency substantially without delay after detection of said cluster.

21. The computer program product of claim 19, wherein said data comprises data in at least one patient database located at a point of care.

22. The computer program product of claim 19, wherein said computer program product is executed at a point of care.

23. The computer program product of claim 19, wherein said computer program code for processing data is executed continuously.

24. The computer program product of claim 19, wherein said computer program code for reporting comprises computer program code for reporting one or more data items from the group of data items consisting of:
identification of the location of the cluster;
the number of patients to which the cluster relates; and
the starting time of the cluster.

25. The computer program product of claim 22, further comprising computer program code for receiving a protocol, said protocol defining an appropriate action to be performed at the point of care.

26. The computer program product of claim 25, wherein said protocol is received from said external agency.

27. The computer program product of claim 19, further comprising:
   computer program code for detecting a further event relating to said cluster; and
   computer program code for reporting said further event via said communications network to said external agency.

28. A computer program product comprising a computer readable medium comprising a computer program recorded therein for detecting a cluster comprising a commonality of events in time and space, said computer program product comprising:
   a Clinical Software Platform comprising computer program code for processing data relating to clinical patients;
   a first Knowledge Object comprising computer program code for automatically detecting existence of a cluster based on said data;
   a second Knowledge Object comprising computer program code for communicating with an external agency via a communication network; and
   a Knowledge Deployment System (KDS) client comprising computer program code for interfacing said Knowledge Objects to said Clinical Software Platform;
   wherein a detected cluster is reported substantially without delay to said external agency in response to detection of said cluster.

29. The computer program product of claim 28, wherein said second Knowledge Object further comprises computer program code for receiving a protocol from said external agency, said protocol defining an appropriate action to be performed.
30. The computer program product of claim 29, wherein said second Knowledge Object further comprises:

computer program code for detecting a further event relating to said cluster; and
computer program code for reporting said further event via said communications network to said external agency.

31. A method for remotely managing events at one or more points of care, said method comprising the steps of:

receiving notification of a cluster detected at a point of care via a communications network, said cluster comprising a commonality of events in time and space; and
sending a protocol via said communications network, said protocol defining an appropriate action to be taken at a point of care.

32. The method of claim 31, wherein said notification is received substantially without delay after detection of said cluster.

33. The method of claim 32, wherein said protocol defines one or more actions from the group of actions consisting of:

providing a notification to an operator at said point of care;
providing instructions to an operator at said point of care;
amending rules for cluster detection at said point of care;
executing a software program code at said point of care; and
receiving downloaded software program code at said point of care.

34. The method of claim 32, wherein said protocol defines an appropriate action to be performed at a plurality of points of care.

35. The method of claim 34, wherein said protocol defines one or more actions from the group of actions consisting of:

providing a notification to operators at said points of care;
providing instructions to operators at said points of care;
amending rules for cluster detection at said points of care;
executing a software program code at said points of care; and
receiving downloaded software program code at said points of care.
36. The method of claim 32, wherein said protocol is downloaded to at least one of said plurality of points of care that has not detected a cluster.

37. A system for remotely managing events at one or more points of care, comprising:
   a plurality of remote apparatuses for detecting a cluster comprising a commonality of events in time and space, wherein each apparatus is disposed at a point of care; and
   a central apparatus, comprising:
   a communications interface for transmitting data to and receiving data from said plurality of remote apparatuses via a communication network;
   a memory unit for storing data and instructions to be performed by a processing unit; and
   a processing unit coupled to said communications interface and said memory unit, said processing unit programmed to:
      receive, via said communications interface and said communications network, notification of detection of a cluster by any one or more of said plurality of remote apparatuses; and
      transmit, via said communications interface and said communications network, a protocol to one or more of said plurality of remote apparatuses, said protocol defining an appropriate action to be taken at a location of said one or more remote apparatuses.

38. The system of claim 37, wherein at least one of said plurality of remote apparatuses comprises:
   a communications interface for transmitting and receiving data;
   a memory unit for storing data and instructions to be performed by a processing unit; and
   a processing unit coupled to said communications interface and said memory unit, said processing unit programmed to:
      process data relating to healthcare patients;
      detect existence of a cluster based on said data; and
      report detection of said cluster via said communications interface and a communications network to said central apparatus.
39. The system of claim 38, wherein said cluster is reported substantially without delay after detection of said cluster.

40. The system of claim 37, wherein said processing unit of said central apparatus is programmed to send said protocol to at least one of said plurality of remote apparatuses that has not detected a cluster.

41. A computer program product comprising a computer readable medium comprising a computer program recorded therein for remotely managing events at one or more points of care, said computer program product comprising:

   computer program code for receiving, via a communications network, notification of a cluster detected at a remote point of care, said cluster comprising a commonality of events in time and space; and

   computer program code for sending, via a communications network, a protocol to at least one remote point of care, said protocol defining an appropriate action to be performed at said at least one remote point of care.

42. The computer program product of claim 41, further comprising computer program code for sending said protocol to at least one point of care that has not detected a cluster.

43. The computer program product of claim 42, wherein said protocol defines one or more actions from the group of actions consisting of:

   providing a notification to an operator at said at least one point of care;
   providing instructions to an operator at said at least one point of care;
   amending rules for cluster detection at said at least one point of care;
   executing software program code at said at least one point of care; and
   receiving downloaded software program code at said at least one point of care.
Fig. 2
Fig. 3

1. Process Data Relating to Healthcare Patients
2. Detect Cluster Based on Patient Data
3. Report Cluster to Remote Entity
Monitor Patient Database

Cluster Exists?

Report Cluster to Clinical Software Platform (CSP)

Report Cluster to External Health Agency (EHA)

Protocol Received From EHA?

Perform Appropriate Action

Fig. 4
Receive Notification of a Cluster Detected at a Point of Care

Send Protocol Defining Action to be Taken at Point of Care

Fig. 5
computer system 600

video display 690

Internet 680

video interface 645

storage device 655

comms interface 685

processing unit 640

memory 650

I/O interface 660

keyboard 610

mouse 615

computer 620

Fig. 6
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. 7: G06F 17/30

According to International Patent Classification (IPC) or to both national classification and IPC.

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
DWPI, USPTO, Google Scholar, IEEE Xplore (cluster, health, report, record, patient, detect)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category*</th>
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* X Further documents are listed in the continuation of Box C

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Date of the actual completion of the international search
31 August 2005

Date of mailing of the international search report
7 SEP 2005

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX