Using an Intranet for Physician Desk Top Data Consolidation

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Abstract

The Information Services Department of Millard Fillmore Health System in Buffalo, NY, developed the InfoClique program as one of the first web-based information delivery systems specific to patient care. Through an Intranet or secure dial-up connection, registered practitioners and staff access patient demographics, laboratory data, radiology results, and dictated reports through a simple “home page” graphical interface consisting of icon buttons and straightforward instructions. Additionally, standard forms and patient educational material are downloadable.

The development team, consisting of programmers, clinical advisors, and physicians, designed and wrote interfaces to existing systems and applications, developed HTML/SQL web server programs, designed security systems, usage policies and procedures, and a name and logo. Since the program’s launch in February of 1997, over 800 users have been registered both in-house and off-site.

1. Introduction

American health care systems are overwhelmed with data. It is being collected, stored, and analyzed by an increasing number of systems including: medical records, biomedical monitoring, ordering, medical staff, human resources, purchasing, laboratory, accounting, quality assurance, home care, and pharmacy. Most systems are supplied by different vendors, run on different platforms, and can only be viewed through unique client (user-side) software. Data is often so scattered throughout an organization that few know where it is or how to retrieve it, especially today’s physicians who have little time to worry about arcane computer systems or how to operate them.

Because the pressures of managed care require more patient services, in less time, with less expense, the modern medical practice must have clinical, billing, and utilization information at its finger tips. Marshall Ruffin, MD [1] predicted in 1996, “Every physician will choose to connect his or her office to a community based on the World Wide Web standards.” An industry has been born to deliver information to the physicians desk-top using internet technology. Companies such as AEQ [2] of Denver Colorado, HNV [3] of Downers Grove, Illinois, and Metis [4] of San Francisco, California, offer systems that deliver a variety of provider and payer information directly to physicians through either the Internet or private Intranets. Hospitals and health system internal information services departments have also developed custom applications of their own. The CPMCnet system of Columbia Presbyterian Medical Center [5] in New York City, New York, and the InfoClique system of Millard Fillmore Health System [6] of Buffalo, New York, were two of the early health system entries. Millard Fillmore has since merged with Buffalo General and Childrens Hospital of Buffalo, New York to become the CGF Health System.

At the CGF Health System approximately 800 physicians and health care administrators rely upon InfoClique as their major source of health care information. This information gives CGF affiliated physicians that extra edge by making it easier to deliver patient care, monitor health system resource utilization, and receive rapid reimbursement. Doctor Barbara Martin of Millard Fillmore Health System’s Inpatient Services department states:

“Because I am asked to consult on so many cases, often on short notice, InfoClique has become central to my practice. It saves me and the hospital a great deal of time and effort faxing records and reports. I also monitor patients from my home without the need of phoning the nursing stations and follow up on my billing without the need to contact the business office. All the insurance and ‘responsible party’ information is right there in the demographic section.”

InfoClique also helps the health system attract and retain medical staff by providing this service to their offices free of charge, which no other local health system does. Rose Soluri, Millard Fillmore’s physician liason officer, says:

“InfoClique adds another reason for me to visit our affiliated physician’s offices. I get to work with the office staff, one-on-one demonstrating the InfoClique system. It’s one more way to show we care.”

It is not only useful in promoting alignment with the health system, it also reduces costs. The faxing of medical records information to physicians’ offices has been cut nearly in half and the rapid reporting of laboratory tests has minimized emergency reorders. Clinical care coordinators now easily recognize and explore ways to improve the care of those patients receiving the most consultations, most lab work, most x-rays, and/or the longest-lengths-of-stay. Some second-shift coordinators do their patient reviews from home.

2. The workings of InfoClique

InfoClique is a custom designed Intranet based system in which automated downloads, throughout the day (see Table-1), keep an SQL Server database current with clinical and business data. Users browse the system using Netscape from within the health system’s facility or from their own location through dial-up connections. Users
access the system through a home page unique to their profession and view either patient data or statistical management information. The beauty of the system is its point and click simplicity along with a common look and feel when retrieving information from subsystems that historically required multiple connections and a broad base of operational knowledge.

The system's "Patient-centric" design allows the selection of one patient from a list of physician's patients. Links are provided from that patient to all other related information. This gives a horizontal view of each patient across six major reporting categories, rather than viewing all patients related to a specific category. The only vertical display is the relationship between physicians and their patients. Ease of information retrieval is enhanced through an additional narrow frame portion of the screen that contains special features and navigational short-cut icons.

When a patient is selected, the medical record number is captured and used as the primary index to find the next layer of information which is contained in one of two computer repositories. Much of the clinical data is archived on a computer operated by the PharmacoKinetics research division of CGF Health System. PharmacoKinetics stores and analyzes individual patient clinical data and therefore archives much of the data of interest to InfoClique users. From a more technical standpoint, all data is stored in either SQL Server tables or text files located on either the Data Server computer or the PharmacoKinetics computer. SQL tables contain displayable data or a reference to the file containing the actual data. Custom interfaces operate continuously loading data from the mainframe, laboratory, and medical records systems to the PharmacoKinetics machine. In turn, the PharmacoKinetics machine periodically transfers files of indexes to the SQL Server, keeping it informed of all newly arrived data and where it is located. Processes on the mainframe also periodically transfer data to the SQL server databases.

Although this architecture may seem awkward, it was expedient. It allowed the development of an operational system in the shortest amount of time and consumed the least amount of resources. It gave the health system a head start in placing the application in physicians' offices before any other local health system even thought of the concept. Ideally, all data sources should be directly available to the web server through ODBC or an HL7 concept. As time goes on, these types of changes can be made behind the scenes without the user ever being aware of them, other than improved performance.

3. Privacy issues

Half the difficulty in designing a medical information system is cultural. Software is one thing, but how it affects people is another. Medical information is a very sensitive issue to both patient and provider. Anyone embarking on a project of this nature must allocate a portion of development time to policy and procedure issues. The biggest issues revolve around making the system very open, yet very private.

3.1 Limiting patient lists

Privacy issues are partially resolved by controlling access to groups of patients based upon the viewer's relationship to the patients. Patient lists are organized by individual physicians, practice groups, and coverage groups. One of the most sensitive issues encountered was a method to display patients not associated with the viewer, such as consultation patients. Numerous suggestions were offered during the design phase, one of which was for consulting physicians to obtain passwords from referring physicians to access their patients. Another suggestion was to e-mail all pertinent data to the consulting physician. The issue became more complex than the existing manual process of:

- a) Receive a consultation request,
- b) Go to the nursing station or order the chart, and
- c) Read the chart.

The manual process has little control over confidentiality, other than that offered through professionalism and the fear of being caught with another physician's chart. This is the exact metaphor now used by InfoClique. All reviews of non-associated patient data are reported to the patient's attending physician through an electronic method known as the "overview log." This approach not only deters improper use; it supports proper use by informing the attending physician when the consulting physician has performed the requested review. When an attending physician logs-in to the system, a flashing red message is displayed if anyone has viewed one of the attending physician's patient's information. Clicking on the message displays a complete list of all those who have viewed. The list contains the viewer's name, their sponsoring physician's name, the patient's name, what part of their record was viewed, and the time and date of the activity. If this is other than an authorized viewing, the physician is instructed to contact the medical ethics office for further action. To date, the medical
3.2 Electronic transmission concerns

The openness of the Internet is another major concern. This is resolved by constructing the system as an Intranet rather than using the public Internet, as some systems have done. The University of Iowa Hospitals [7] are an example of an Internet based system. They use a special calling-card size device (SecureID card) which generates a new secret number every 60 seconds which is required as part of the log-in process. InfoClique does not need this added expense as it is only accessible from within a CGF facility or through a private telephone connection. Dial-up users are challenged twice for password information and internal users once. No data travels through public networks such as the Internet. Even though telephone systems are somewhat public, an intrusion would require an illegal wire tap. This is such an unlikely occurrence that telephone systems are normally considered secure enough for the fax and voice transmission of medical data. Even so, the design team is currently exploring a similar concept to the one used by the University of Iowa Hospitals which is known as "virtual private networking", developed by Digital Equipment Corporation in conjunction with Security Dynamics. This technique uses the Internet to carry encrypted information between the user and server only after identification has been assured through the same calling-card sized device, a user name, and a pin number. It is claimed, that through this technique, the public Internet can be used as a private network. At this point in the development of InfoClique, the expense of a virtual private network is not justified until usage exceeds the limits of the actual private network now in use.

3.3 User identification

The issuance of passwords to all users adds another level of security not found in manual systems. Every user from physician to office worker has a unique user ID and password. Users resist sharing passwords because of the fear that the shared password will appear on a physician's overview log when the illegitimate user explores another physician's information. There has been some evidence that new users, awaiting passwords, have borrowed another's password. This practice stops upon receipt of the new password because of the concerns expressed above. The user which loaned the password normally then changes the shared password to re-obtain a private one. In addition, all users accessing patient care information require a sponsoring physician before a password is issued. Once logged on to the system, user sessions are terminated upon 15 minutes of inactivity to limit unauthorized use during the legitimate user's absence. The confidentiality of passwords is emphasized through hand delivery, which is acknowledged by recipient signature.

3.4 Random data explorations

Normally, electronic records are more secure than manual records because of the ease in which automated systems can be deployed to monitor and police user activity. However, electronic systems may be weaker in the area of random data exploration by legitimate users. One way InfoClique limits exploratory searches is by disallowing name searches. Legitimate system users can only explore an automatically generated list of related patients or they know the patient's medical record or social security number to search for non-related patients. Additionally, social security and medical record number searches only return inpatient data based upon the design committee's belief that there is rarely a proper reason for a non-associated physician to view another physician's outpatients. The reason this type of exploration is allowed at all, is to provide consulting physicians easy access to patient records. At first a number of methods were explored requiring the referring physician to authorize access to the consulting physician. Such authorization would require an interaction with the InfoClique system to establish the approval. The committee felt it would not be convenient and therefore not used by the users. It was best to allow logged access in which user interactions would be reported to the primary physician.

4. The look and feel of InfoClique

The first level of user interface encountered is the browser. Because InfoClique has been in operation for nearly two years, it was important to select the most stable browser of the time, which was Netscape. CGF Health System still targets all development toward Netscape 3.01 and above, although current releases of other browsers appear to also work. Beyond the browser is the application itself which serves many users throughout the health system, not all of them medical. InfoClique had become the Millard Fillmore Health System's common platform to deliver a variety of user specific information. However, the focus of this article is on the patient care sub-system of InfoClique and nothing more than a quick description of the other uses will be mentioned. Users of InfoClique are offered a number of subsystems to explore, based upon their user profile. As of this writing there are
links to financial data, job offerings, departmental business and patient care indicators, JCHO accrediting agency reference manuals, library resource links, and even cafeteria menus. Policy and procedure manuals are soon to follow along with private access to employee data such as personal sick and vacation day availability.

Because patient care is currently the only section with both in-house and off-site users, there are two initial log-in screens that differ based upon user access. Internal users, including those without passwords, are welcomed with a “news” page containing articles of significance to CGF Health System employees and links to other unsecured applications such as the library and phone directory. External users do not see this page. After logging into the system with a proper user ID and password, a confidentiality statement is displayed to all users [appendix A]. Even though the screen is often rapidly dismissed by the user, it satisfies the desire of CGF’s legal department to have all users understand the seriousness of the information provided and to acknowledge they understand the consequences of not treating it such.

4.1 User’s welcoming screen and home page

Upon acceptance of the confidentiality statement, the patient-care user is presented with a standard screen format consisting of three sections or frames. The top frame contains the InfoClique logo. The middle frame, context sensitive shortcuts and navigation aids. The bottom section, a unique “home-page/data-page” based upon one of the six possible user professions: 1 - Health System Administrator, 2 - Clinical Care Coordinator, 3 - Intranet Staff, 4 - Physician, 5 - Physician Office Staff, and 6 - Clergy. Speed of data retrieval is enhanced by keeping graphical images to a minimum and a structure which allows most reports to be retrieved with three mouse clicks or less. Frames help support the three-click approach and provide a standard look and feel for all InfoClique applications. Rapid retrieval is also enhanced through system design, which uses a three-layer screen hierarchy of: type of user, user, and patient. The one of six user types is determined at log-in through user profile data and controls the home page options. The user name (also collected at log-in) is used to filter all patients returned from one of the home page options. Lastly, the user selects a patient from the list, which limits the reports to that patient only. In this way, an active database of approximately 6000 patients is filtered to a very manageable list for each user without the need to navigate through a number of selection options. In addition to patient query options, all home pages contain a user account maintenance section and security message. The maintenance section is used to change a user’s address, telephone number, password, and other personal information. The security section welcomes users by name and informs them of the last time and date their password was used. Should the user recall a time and
date which conflicts with that shown, they are instructed to
change their password and contact the CGF Help Desk with
the telephone number provided. To date, the only instance
of this feature causing a report to the help desk was after the
system administrator had tested the system, using a known
user’s account information. The home page is also used by
system administrators to send and received messages
directly to and from individual users.

4.3 Navigation and shortcut Icons

The middle frame, just above the home page, is a narrow
strip containing six icons.

The telephone icon leads to a medical staff list
categorized by specialty then by either location or last
name. Physician name search capabilities and other
important telephone numbers are also available.

Each one of the six different user types receive a
unique view of the news by clicking the newspaper icon.
Department chairs and the InfoClique staff have access to
the news editor. Articles published include: staff meeting,
scheduled down times, various training classes, and other
announcements.

The file folder points to a list of down-loadable
CGF Health System forms. No longer does the hospital
need to fax or mail surgical consent, advanced directive, or
other forms to the physician’s office. They are now
accessible upon demand through InfoClique.

The stethoscope leads to patient care tools.
Such items as: care plans, clinical pathways, diagnostic
evaluation programs, and more are accessed from here.

The house symbolizes a return path to the home
page from anywhere within the system.

The exit door is used to log-out of the system.

4.4 Unique views by user

Within the patient care subsection of InfoClique, users
have been divided into six different categories:
Health System Administrator, Clinical Care Coordinator,
Intranet Staff, Physician, Physician Office Staff, and Clergy.
Each of these different profiles produces a different style
home page.

Administrators and Clinical Care Coordinators are
concerned with resource utilization and the appropriate
flow of patient care, so their screens provide options such
as: view patients by number of consults, or number of x-
rays ordered. The Intranet Staff’s page is designed for
remote system administration including registering new
users and observing user activity.

The physician’s page is the most comprehensive of all.
Physicians view all inpatient, outpatient, emergency
department, and clinic visit data where views are based
upon the physician's relationship to the patients. A very
valuable view for physicians is the Visit List. It contains
lists of inpatients sorted by location along with either
shared or private electronic notes, created by the physician,
about that patient. Visit lists are printed to help physicians
locate and care for patients during hospital rounds.

The Physician Office Staff home page is similar to the
Physician’s page and treats the office staff user as a proxy
for the sponsoring physician, yet retains a private password
for each user.

Clergy throughout the community have password access to
a single screen which displays patients who have declared
the clergy’s place of worship as their own. No other patient
data is provided other than patient name, sex, age, room
number, and discharge disposition, when appropriate, and
only those who authorize the release of this information
appear on the list.

5. Patient list structure

All patient-related reports are spawned from patient lists.
Once the characteristics of the list are selected from one of
the options on the user’s home page, a standard patient list
structure is returned as shown in Figure 2.
5.1 Patient list sections

The system is "patient-centric" by design. Early designs listed various report types as the entry point. Users clicked upon a report type, such as surgical summary, then when all the current surgical summaries were returned the viewer chose those patient's reports they wished to view. Grouping by department was also explored. The most efficient method was to return patient lists based upon their relationship to the viewing physician. Physician selects whichever element of information is needed from this list. The patient list concept is the central feature of the InfoClique system. Patient lists are organized in a number of ways and offered as options on the user's home page. Lists are returned based upon practice group, coverage group, inpatients only, all associated patients, or even lists of other physician's inpatients by physician. Custom lists can even be created using a "cut-and-paste" type technique where patients are copied from the primary physician's screen and placed into the current viewer's patient list. In this way a consulting physician can track another's patient over time as if it was one of his/her normal patients. All patient lists, other than visit lists, contain links to associated reports and patient information as the underlined words: Demo, Dict, Ord, Res, Meds, and Labs. Clicking on one of these links, in a patient row, returns a list of that report-type for that patient. Users then select particular reports from the returned list by clicking on the report's title. Available reports are maintained indefinitely or until there is a 30-day break in patient activity. Once any one of the six report links is activated, the navigation frame reloads with a new set of icons. This allows navigation from one set of selected patient information to the next set, without the need of returning to the patient list screen.

6. System hardware

InfoClique is a new system interfaced into existing systems throughout the network. Only three of the components in figure 3, the Data Server, the Conversion PC, and the 8235 Dial-In Device, were purchased to implement InfoClique. The specifics of each are as follows:

- Data Server - Digital Equipment Corporation PRIORIS HX5133 with dual Pentium 133 megahertz processors and 27 Gigabytes of Raid technology hard disk.
7. Software components

InfoClique collects data from the following software systems before moving it to the two data repositories, Data Server and PharmacoKinetics:

- IBAX pharmacy - Mainframe - HBOC of Atlanta, Georgia
- Healthquest patient management and accounting systems - Mainframe - HBOC of Atlanta, Georgia
- PathNet laboratory system - DEC Alpha - Cerner Corporation of Kansas City, Missouri
- Dictation systems - Pentium PC - Medical Records Corporation of Cleveland, Ohio

The heart of the system, which collects, stores and displays the InfoClique data, is comprised of custom designed software using:

- Windows/NT - Microsoft
- SQL Server - Microsoft
- Internet Information Server - Microsoft
- Visual Basic - Microsoft
- Quick Basic v4.0 Compiler - Microsoft
- Java Script - Netscape/Sun
- Samba - Samba Team [8]
- Remote Execute - Ataman [9]
- Perl

8. Data transfer and linkage process

The Data Server and Conversion PC support the data transfer and retrieval process between all the source machines and the SQL server database on the Data Server machine. Throughout the day various jobs are run automatically on the Lab, PharmacoKinetics, and Healthquest systems that FTP data between the originating and destination computers as shown in Table 1.

Notice that PharmacoKinetics only transfers index files to the Data Server databases. This is because users of InfoClique see data that resides in either Data Server SQL tables, "Zoo'ed" files (compressed) on the PharmacoKinetics machine, or local text files. In all cases, SQL server tables drive the process. The links between InfoClique and the PharmacoKinetics data are stored in index tables on the Data Server. These linking tables contain patient medical record numbers which point to archived data file names on the PharmacoKinetics machine. The PharmacoKinetics disk containing the archived data is logically attached to the SQL server as one of its drives using Samba to handle the differences between the PharmacoKinetics Unix system and the Data Server's NT file system. From the SQL server's viewpoint it only needs to un-zoo (decompress) the file.
locally and deliver the result to the user. See section 10, below, for future data transfer and acquisition plans.

9. SQL upload process

Data is converted and/or transferred between the Conversion PC and the Data Server PC through a batch file on the Conversion PC which is initiated by the sending system through Ataman's Remote Execute. As previously shown, the Conversion PC is in the main path of data from external systems and the Data Server's SQL databases. It is the purpose of the Conversion PC to structure the data into delimited files in preparation for bulk copy into the appropriate SQL tables. Each external system FTPs its data to the Conversion PC at scheduled times throughout the day. After a successful transfer the source machine externally executes a batch process on the Conversion PC which starts the bulk copy into the proper SQL table. A number of programs were developed to perform the conversion process and report errors. These programs became functions within batch scripts which were in turn made portions of the much larger batch process known as SQL_LOAD.BAT. The SQL_LOAD program is called with a list of parameters which control the type of data to process and what error logs to generate. Errors are recorded on the Conversion PC and also returned to the initiating system. In the case of mainframe processes, errors are displayed on the operator's console. PharmacoKinetics related errors generate pager messages to both the InfoClique and PharmacoKinetics team members because the system often runs unattended.

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Original Source</th>
<th>Stored</th>
<th>Down Loads per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visit information</td>
<td>HBOC</td>
<td>SQL Server table</td>
<td>8</td>
</tr>
<tr>
<td>Demographic data</td>
<td>HBOC</td>
<td>SQL Server table</td>
<td>8</td>
</tr>
<tr>
<td>Orders</td>
<td>HBOC</td>
<td>SQL Server table</td>
<td>8</td>
</tr>
<tr>
<td>Medical Record Indexes</td>
<td>PharmacoKinetics</td>
<td>SQL Server table</td>
<td>1</td>
</tr>
<tr>
<td>Lab Results Indexes</td>
<td>PharmacoKinetics</td>
<td>SQL Server table</td>
<td>9</td>
</tr>
<tr>
<td>Medication Administration Lists</td>
<td>HBOC IBAX system</td>
<td>PharmacoKinetics text files</td>
<td>5</td>
</tr>
<tr>
<td>Cumulative Lab Results</td>
<td>Cerner Laboratory computer FTP'ed to HealthQuest System</td>
<td>Data Server text files</td>
<td>1</td>
</tr>
<tr>
<td>Cardiology reports, Consultations, Discharge summaries, Endoscopies, History &amp; Physicals, Operative reports, Radiology reports</td>
<td>Medical Records MRC systems at 2 hospital sites Radiology &amp; Cardiology dictation systems</td>
<td>PharmacoKinetics zoo files</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 1

10. Future plans

Like all software systems, there are two avenues for future growth: Systems and Applications.

10.1 Systems growth

Systems growth includes new hardware and data transfer techniques that are now being reviewed by the InfoClique design team.

10.1.1 ODBC

As of this writing, another external system, which uses a Sybase database, is being added using ODBC (Open Data Base Connectivity). ODBC drivers, supported by Microsoft and many other vendors, provide a method by which a standard front-end can be attached to a large number of database products. ODBC drivers allow Access, Excel, Visual Basic, Visual C++, or any number of other applications to interact with existing databases using standard SQL queries. ODBC is the preferred method for future growth of the InfoClique system because it provides the Data Server's IIS (Internet Information Server) software a direct connection to most any ODBC compliant database. This eliminates the down-load process and allows InfoClique to instantly access another system’s data without need of conversion. ODBC drivers are often available as freeware or
shareware on the web or through vendors, such as INTERSOLV [10], which provide professional versions for a wide variety of databases.

Database connectivity has become a very important issue in the purchase of new systems. Closed systems must have some extremely valuable feature to even be considered for purchase. If they don't at least have some method to export data, they will normally not even be considered.

10.1.2 HL7

Another technique for data transfer is HL7. HL7 is a data transfer method in which every type of transaction possible within a health care organization has been mapped to some type of message. This is a very ambitious concept and has caused confusion as to which message to use for what. In the grand scheme of healthcare it may never achieve its goal of being a universal standard if for no other reason than different locations and cultures look at things differently. However, once an internal HL7 installation has been added to a particular health system, the universe of possible messages becomes manageable. Manufacturers such as STC (Software Technologies Corporation) of Monrovia, CA, offer devices known as interface engines. These hardware-software combinations capture real-time HL7 output from compatible systems and reformat it into whatever format necessary before loading it into the receiving system's database tables. The InfoClique design team is currently experimenting with using the ADT (Admit, Discharge, and Transfer) and ORDER HL7 messages from the HealthQuest system to provide more current patient information. One concern with using transactions rather than downloads is that of development overhead. The new receiving system needs to contain all the same transaction processing logic that the existing receiving system contains. For some transaction types, this may be very complex and the reason why the original application was purchased in the first place. Another reason HL7 was not used in the original design is because the host systems didn't support it. There was no immediate reason to add more expense or delay when FTP was adequate to move forward and prove the principles needed to continue the growth of the project.

10.2 Features growth

The second area of future growth is features.

10.2.1 Payer links

Physicians and their office staff need insurance information such as eligibility data and approved drug formularies. This data is now available on paper or by telephone and may soon be available through some electronic form supplied by the various payers, but ideally, the physician or staff should access only one application for this information, not each individual payer through some proprietary system. In some areas of the country private software vendors sell this service to both the physician and the payer. With a health system based application such as InfoClique, both parties could receive this service at no charge through proper cooperative arrangement.

10.2.2 Referrals

The referrals process is another feature being explored for future development. A list of participating physicians associated with a patient's insurance company should be readily available to any physician using InfoClique. Selecting a physician from the list, by clicking upon the name, would start a process that informs the insurance company, gets an approval verification number, books the appointment, and opens the patient's InfoClique records for viewing by the receiving physician.

10.2.3 Financial statistics

Managed care contract analysis is another area of interest to physician office managers. Even the best practice management systems have trouble knowing the overall cost associated with a patient's care. Much of the data is maintained in hospital or health system databases, which are inaccessible to the office system. InfoClique is the ideal vehicle for sharing cost information with the physician's office. This area is already under development through interfaces written to CGF's Contract Manager software from Med Stat - DKD of Rocklin, CA.

10.2.4 Direct connection between patients, facilities, and physicians

In the upcoming years, a section of InfoClique will be developed which allows healthcare consumers direct access to medical information and providers. Patients will be able to ask questions 24 hours a day to a staff of nurse or physicians. In some cases, where physicians allow it, patients will contact them directly. Kaiser Permanente [11] is already offering such a service to its subscribers with great success.
11. Lessons learned

11.1 Buy a test system

Part of the beauty of using an intranet based system is that all software updates are done at one location. There is no need to redistribute client software each time an upgrade is made. This can also be a draw-back. Once the system goes live, it is up 24 hours a day, seven days a week. The ability to test new software is very limited because every change is immediately delivered to the users. At first, separate directories were used to separate development from production, but when a new server version needed to be explored the directory concept was of no value. The entire issue became very cumbersome and the best solution was to upgrade a basic PC to the level of a test server. For added benefit, it is a good idea to configure the test machine with two removable hard disk drives so different operating systems can be installed without affecting the application software on the other removable drive.

11.2 Learn HTML, Java script, and SQL

Once the interfaces were running, which required knowledge of COBOL, Visual Basic, Pearl, and QBasic, the rest of the original InfoClique system was written using nothing more than HTML, JAVA SCRIPT, and SQL.

11.2.1 HTML

HTML is not a difficult concept. It is basically a method of formatting text and images on a browser screen and providing links to other screens. Don't invest heavily into HTML development tools, such as editors. They were initially valuable but seem to get in the way more than help after an understanding of HTML concepts were achieved.

11.2.2 Java script

Java Script is a real structured programming language which runs through an interpreter within the browser; therefore, it does not need to be compiled and is written within the page's normal HTML. It is similar to C, but much easier to use. Java Script was selected over ActiveX for InfoClique because of its support by Netscape which is currently the InfoClique standard. Java Script provides the programmer better programmatic control of the web page than IIS or HTML could on its own. However, newer versions of IIS allow "Server-side" scripting with Active Server Pages which look very attractive and generates pure HTML which any browser should handle properly.

11.2.3 SQL

SQL is the heart of the system. It drives all data retrieval. Microsoft's SQL Server uses a form of SQL known as Transact SQL which is a very powerful database programming language designed to work seamlessly with Microsoft's Internet Information Server.

11.2.4 Watch screen formatting

InfoClique is designed to support modem access. With this in mind it is important to limit graphical displays. It is very tempting to create a real work of art, but if it takes more than a few seconds to load, users will not use it. Also the use of frames is very important to maintain control of common areas of the screen, such as menus. Many web sites place menu frames down the side of the screen. Experience proved this limited the horizontal "real estate" of the screen and made reading medical reports more difficult. The patient care subsection of InfoClique only uses horizontal frames thus freeing the user from the need to scroll horizontally.

11.2.5 Beware of computerphobia

Don't underestimate the computerphobia of physicians. As easy as InfoClique is to operate, physicians were slower to adopt its use then their office staff. Modern office workers use computers as everyday tools and, therefore, took to InfoClique rapidly. As unusual as it may sound, physicians have not used computers half as much as the rest of society. The avoidance is amplified by the fact that physicians are very proud people and normally have a firm grasp on technical and scientific matters, and, therefore, avoid exposing their inability to maneuver around a computer system with the same ease they can the human body. Knowing this, CGF offered training classes on the operation of InfoClique, but they were poorly attended by other than clerical support personnel. The best approach is a comprehensive booklet describing the full system's operation. The book is taken home where it can be used in the privacy of the physician's home on his/her own computer with the possible aid of a family member.
11.2.6 Outsource support

Don't get into the support business, at least at first. Before rolling out a product like InfoClique for off-site use find a vendor that is willing to become familiar with it and support it in the physician's office. Ask the vendor to commit to a fixed price for a standard installation and publish it along with the vendor's information in the brochure describing the system. Most vendors welcome the free advertising.

11.2.7 Remember physicians are businesspeople

A great deal of time and effort went into addressing physician/patient confidentiality issues. Like many of us, no one wants someone looking over their shoulder when working, the same is true of physicians. They were concerned that peers would read everything about their patients. They also didn't like the idea that a peer could see how many patients they had. These issues were resolved through the Overview log and by displaying only inpatients when selecting the "View Another Physician's Patients" option. In addition, the Medical Staff Ethics Review Board developed a procedure to handle abuses of the system. After nearly two years of operation, the ethics review procedure has never been used.

11.2.8 Treat it as a product

When a health system plans to develop a system of this nature, think of it as a real product. Give it a name and a logo. Design it through committee with the users, but then minimize the committees involvement. Select one champion of the system and give him/her full responsibility. If it was a product purchased from a vendor, there wouldn't be constant committee meetings with vendors on how to change their product and that shouldn't happen with a locally developed program either. This is not to say that the champion should not ask for input. It just means that one person needs to make the final decisions, not a committee. Along with the product concept comes competition. It should never be forgotten that there are other health systems and other vendors out there that would do anything to be on every physician's desktop. To properly develop a product of this nature the product champion needs to constantly think of new and innovative ways to keep it fresh and usable for physicians as the information age begins to swamp them with more and more resources.

12. Conclusions

The days of single platform, point and click data delivery are here to stay. Health system information officers need to seriously plan how to best implement these concepts throughout their organizations. In addition, vendors must realize that users will soon demand "web-ready" applications. In many cases, this may only mean the selection of an ODBC compliant database at the heart of their application. In other cases, I predict a new software industry segment will evolve, one which doesn't try to offer "the ultimate integrated solution", but one that offers "web-lets" or small applications designed with a single purpose in mind. Web-lets strung together using hypertext links and ODBC database connections, or combinations of Corba and Java [12,13] to create custom applications with pieces from many vendors. In this way, the customers can select the "best of breed" when designing their ultimate data collection and delivery systems.
13. References

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14. Appendix A

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