



By Peter Juhn, MD
George Peredy, MD
Web Integration Team

The Permanente Knowledge Connection: A National Strategy for Clinician Use of Web Technology

Report of The Web Integration Council - Clinical Subcommittee

Introduction

Kaiser Permanente (KP) has a wealth of intellectual capital unmatched by any other health care system. During the recent past, Regions have been capturing this information—cataloging best practices and guidelines on web sites, building electronic data bases, and designing online decision support tools—at a bullish rate that may have outpaced the stock market. But the knowledge is located in regional pockets; finding a way to make this knowledge quickly and easily accessible to clinicians across the Program has been troublesome. In late 1997, the Web Integration Council was formed to explore how to make use of emerging Internet technology and bring consistency to web efforts throughout KP nationally. A Clinical Subcommittee, formed within the Web Integration Council, was charged with the task of developing a unifying strategy that could mine this intellectual wealth and leverage it in a way that would promote the practice of Permanente Medicine and, in turn, support the Kaiser Permanente Promise, focal point of the National Brand strategy. The Clinical Subcommittee produced a position paper and a corresponding business case for its proposal. In August of 1998, the Web Integration Council accepted this proposal and funded the project, to be known as the Permanente Knowledge Connection (PKC).

PKC will be a website accessible to any KP clinician with an Internet connection. The benefits include:

- **A single doorway for accessing all clinical information:** No more confusion will exist about whose site to go to or where to find what is needed. There is now a single location to access everything.
- **Relevant and current information:** No more doubt will arise about what is the most recent guideline or the latest word on congestive heart failure treatment. The website filters out the unnecessary and provides the information clinicians need.
- **Navigation tools:** A national search engine allows access to KP National

Web Integration Team:

Paul V. Biron	Southern California Region
Homer Chin, MD	Northwest Permanente, PC
Bob Dolin, MD	Southern California Permanente Medical Group, National Clinical Information Systems
Ed Dyer	Care Management Institute
Tom Janisse, MD	Northwest Permanente, PC
Peter Juhn, MD (co-chair)	Care Management Institute
Allan Khoury, MD	Ohio Permanente Medical Group, Inc., National Clinical Information Systems
Ric Leopold	Kaiser Permanente Information Technology
David Levy, MD	The Permanente Medical Group, National Clinical Information Systems
Barry Linder, MD	Care Management Institute
John Mattison, MD	Southern California Permanente Medical Group, National Clinical Information Systems
Henry Neidermeier	Kaiser Permanente Information Technology
George Peredy, MD (co-chair)	The Permanente Medical Group, National Clinical Information Systems
John Vogt, MD	Permanente Medical Association of Texas

and Regional clinical resources, including clinical practice guidelines, patient education pamphlets and tipsheets, best practices, key learnings, funding sources, and outcomes studies. The navigation tools also enable distinction between KP national and regional information so clinicians can see at which level each resource has been approved.

- **National online resources:** Not only will there be access to *MEDLINE*, *The Physicians Desk Reference*, *The Merck Manual*, and other top Internet resources, but also to online journals, medical news, medical textbooks, discussion groups, and work groups.
- **National online continuing medical education (CME) testing:** Clinicians can earn credits at home, on the road, or from other sites, while at the same time learning about KP National clinical guidelines for congestive heart fail-

ure, coronary artery disease, asthma, diabetes, and depression. Other computer-based training will follow such as evidence-based medicine tools.

- **KP Intranet employee resources:** Phone directories, *KP Stat*, Kaiser Foundation Health Plan/Hospitals (KFHP/H) and Permanente Medical Group news and communications will be included.

In addition, this position paper outlines increasingly sophisticated functions that will be developed for later versions of PKC. These more advanced versions will make it possible to push information to users so that clinicians can be notified easily of changes in practice and new findings. PKC will eventually link with National Clinical Information Systems to obtain information from patient records, access formularies, view benefits online, make referrals, or write prescriptions.

We outline here the strategy of the Web Integration Council's Clinical Subcommittee for implementing PKC.

(pictured) PETER JUHN, MD, is the Executive Director of Kaiser Permanente's Care Management Institute at the Program Offices. E-mail: peter.juhn@kp.org
GEORGE PEREDY, MD, joined the Emergency Medicine Department, Santa Clara, California, in 1989. He has been a principal developer of several Clinical Information Systems (CIS) for KP. He is currently Director of TPMG CIS and a Director of National CIS.





“The connectivity also creates the ability to quickly disseminate information to Permanente clinicians nationwide.”

Clinical Intranet Strategy

The number of sites on the Internet created by or directed at clinicians has recently exploded. This explosion indicates extreme interest by health care community members in using the Internet to increase knowledge and communicate with each other. Also clear is the opportunity for KP to take a proactive, organized approach to how we utilize this powerful tool.

The recommended approach is to create PKC as a KP National Clinical intranet populated by local components. A set of core KP national requirements will be met with additional functionality left to the discretion of regional Medical Groups and Local Market Areas (LMAs). A LMA lacking sites will be provided technical assistance for developing a site consistent with these KP national standards.

A review of the various applications and content either present or under development on local intranets within KP reveals an impressive array of information, both static and interactive. In addition, information about similar content (ie, clinical practice guidelines, human resource policies, telephone directories, management reports, formularies, data base queries, transaction processing applications, etc) is evolving at exponential rates, utilizing multiple forms of technology, languages, and software.

Consequently, multiple initiatives are underway to produce the same kind of information. These efforts result in unnecessary duplication of effort and unnecessary consumption of vital resources.

A process for leveraging development of content and functionality across KP nationally is highly desirable. The goals of this process are to:

1. Identify best practices in the production of various types of information.
2. Facilitate and underwrite the production costs and deployment of such information from best practice sites to other sites in the PKC environment in an efficient and expedited way.
3. Develop consistency in web information development practices and enhance developer skill sets through KP national-level training support to shorten development timelines.
4. Underwrite and facilitate innovation through deliberate support of research and development of new types of information and communication capability at selected sites around the corporate enterprise.
5. Explicitly measure and report cost-benefit of such development using consistent

measurement tools to justify further robust investment in web technology.

Implementation of a central clearinghouse for web content development funded at the National level will facilitate these goals. Participants will be development champions from various websites around the enterprise. Project demonstrations, code, software capabilities, training modules, and identified future information requirements will be part of this clearinghouse activity.

Because national-regional-LMA-and facility-level content will coexist on the PKC, a hierarchy for classifying content is needed. Documents or other forms of clinical web content will carry this hierarchical classification scheme as part of the meta-data (attached generic description of document components) associated with the content itself. (See Appendix I for more information on the hierarchy classification scheme.)

This strategy both creates national consistency and leverages development done at a local level. Further, nationwide sharing of content will reduce practice variation and facilitate spread of innovation. The connectivity also creates the ability to quickly disseminate information to Permanente clinicians nationwide.

Content and Functionality Recommended Content

The Clinical Subcommittee identified and prioritized a set of 30 content elements, rating them on a scale of 1 (highest priority) to 3 (lowest priority). The following list includes items that have been designated as highest priority because they are considered requirements of an effective intranet/Internet for clinicians and will have a National component to their development.

Clinical Content

- Clinical practice guidelines: both evidence-based and consensus-based guidelines that have been approved by a KP Divisional or National process. These include practice, process, and benefit guidelines.
- Clinical protocols: specific steps that KP staff take in interacting with a patient. Protocols may draw from all types of guidelines (practice, process, and benefit). An example of an appropriate set of protocols for PKC would be National Call Center nursing protocols.
- Case management protocols: for example, outlining for nurse practitioners care for patients post-discharge and before the first clinical appointment.
- Patient education materials: for example, description of exercises for alleviation of back pain.



Interactivity

- “Webside” consults: The use of electronic mail to enable physicians to advise each other in interactive online consultation. A desirable feature for consult capability would be the expectation for a prescribed response. For example, a physician may expect 24-hour response, or even 1-hour response. Another option would be to include chat functionality so that providers could have real-time, informal electronic exchanges. (See Appendix II for greater detail.)
- Interdepartmental clinician communication, or discussion groups: online threaded discussions allowing clinicians to communicate ideas with colleagues in other departments and facilities.

Information

- Utilization information: access to utilization information at facility, department, and provider levels with the ability to graphically compare this information across comparable entities.
- Medical textbooks: access to selected online textbooks that are easily navigable and searchable and that rely upon graphical and other multimedia learning tools.
- Medical news: technology that accesses both intranet and Internet wire news services and provides clinicians with current, relevant news specific to their individual needs. This element could be integrated with a personalized homepage.
- Phone books and organization directories: information, including department and facility name, e-mail and fax number, for all KP employees and clinicians.

Applications

- Population management applications: software to enable case managers to track and manage a patient population, ie, through data collection, decision support, notification.
- Web development applications: online, facilitated website development and hosting that provides clinicians and other site developers with tools and recommendations for creating their own websites or for placing content on the intranet. New content and sites are integrated with dynamic indexing and searching to update the intranet data base.

Recommended Technical Functionality

The list of recommended content gives rise to specific technical functions that are required to access and use content.

Navigability

- Finding the most relevant information can be greatly enhanced by taking advantage of evolving search and retrieval technology. Some of the most efficient document retrieval techniques rely on the use of the attached meta-data describing key aspects of that document, such as AUTHOR, TITLE, DATE-OF-CREATION, KEYWORDS, ORIGINATING-DIVISION, LEVEL-OF-APPROVAL (see Appendix I), and DOCUMENT-TYPE. The values for many of these meta-data items can be constrained to a list of predetermined choices, thus enabling more focused document creation and enhanced retrieval. (See Appendix III for more detail on the document retrieval strategy.)

Web Development Applications

- Online authoring tools, templates, and recommendations should be available to assist clinicians with developing and submitting their own intranet content. Submitted content should be quickly and automatically incorporated into the intranet data base, particularly with respect to meta-data tags and searching and to dynamic indexing. An approval process will determine which submitted content receives Nationally Approved status.

Links to Outside Resources

- Clinical resources will be made available through licensing arrangements with outside vendors. In many cases, allowing access to vendors through the conventional Internet may be advisable rather than mirroring them on the KP Intranet. *The Physicians Desk Reference*, *The Merck Manual*, MEDLINE searching, and journal abstracts from the National Library of Medicine and other reputable publishers are a few examples of content owned by other organizations. A security scheme will maintain the protected intranet environment without unnecessarily limiting access to the breadth of online resources.

“Case management applications: software to enable case managers to track and manage a patient population, ie, through data collection, decision support, notification.”



“Clinicians will have access to threaded, topical discussion groups where they can ask questions, exchange information, and obtain feedback from their colleagues.”

Dial-in Capability

- Many clinicians still do not have access to online materials from their offices. Further, clinicians with computer access may not have time to use online resources due to time constraints of a clinical schedule. Access to intranet materials should be made available, through secure dial-in, to clinicians at home or when traveling. The security scheme, called an extranet, will maintain a protected intranet environment but still provide access from outside the office.

Discussion Functions

- Clinicians will have access to threaded, topical discussion groups where they can ask questions, exchange information, and obtain feedback from their colleagues. A means to consult with colleagues and specialists also should be developed, as well as the ability to communicate online with a patient. (See Appendix II for greater detail.)

Multimedia Functions

Computer-based training, multimedia learning tools, and the ability to earn continuing medical education (CME) credits online will be developed. Such activities will use technology to seamlessly integrate intranet content and resources with multimedia skills-testing and directed learning. A network capable of supporting transfer of multimedia content (large files in a variety of formats) from servers to clinicians' computers will be developed.

Operational Plan

Funding

- The source of funding for the national clinical intranet will be through KP National budgets such as KP Information Technology (KP-IT), NCIS, or CMI. National funds will also be provided for building local sites provided there is agreement to adhere to the KP national standards. Each KP Local Market Area will be responsible for the funds used to expand existing local functionality.

Governance

- PKC, the KP National Clinical Intranet, will be governed by a National Clinical Web Integration Council with representative members from each Medical Group nationally. The Council will determine policy and serve as the deci-

sion-making body for the effort. This group will also have responsibility for approving content. Recommendations for National content will be submitted to the Council from groups of experts in the relevant areas. For example, all KP Health Education Directors might submit a set of patient tip sheets for inclusion.

Staffing

- A webmaster will have responsibility for daily monitoring and maintenance of the PKC, including technical support, user authentication, tracking use, errors, and updates, and troubleshooting. A librarian will oversee content acquisition and the approval process. Responsibilities include working closely with the council on policy to identify priority content areas and contacting appropriate experts for submissions. The librarian will also have responsibility for organizing and indexing approved content.

Risks and Potential Barriers

Political Barriers

- Several political barriers currently impede achieving consensus on national efforts by LMAs. Nationwide consistency has been problematic due to local reluctance historically to abdicate responsibility to a national initiative. Mitigating this tension is the emergence of several important KP national projects such as NCIS and CMI. The success of these initiatives should alleviate some of the historical concerns regarding projects that require national uniformity. The other mitigating factor is the recommendation of an approach which balances national and LMA needs.

Financial Barriers

- The reality of the current financial performance of KFHP/H has resulted in a budget cycle for 1998 in which many initiatives are competing for scarce resources. Despite the strength of the case for building the PKC, obtaining funding may be difficult. However, this barrier is offset by the commitment of senior leadership to move toward greater national consistency and their recognition of the importance of this effort.

Operational Risks

- The accuracy and currency of the information on the intranet is critical to its success.



In a rapidly changing organization and health care industry, information quickly becomes outdated. To avoid this potential barrier, a process to ensure that the information is credible, current, and relevant will be established.

Technical Risks

- Like the rapidly changing content, the technical aspects of the intranet also quickly become obsolete. To avoid building a tool with a limited life span, we will use flexible architecture and conduct constant surveillance regarding trends in the industry.

User Barriers

- Numerous barriers exist to clinician use of the PKC. For example, access to the intranet and some basic level of computer competence are minimum requirements. Once those requirements are met, clinicians must be educated in the capabilities of the tool. Demonstrations of the value of the content and its ready accessibility create an incentive for use. Communication and education are crucial, as is the ability to customize the tool to the needs of each user.

A final potential risk is of user malfeasance, for example, the submission of harmful applications or inappropriate content. To limit the extent of potential damage, we will limit the types of files that users can submit and install antivirus software. To limit the risk of inappropriate content, we will implement a content monitoring process and encourage accountability for content submissions. To mitigate risks from former, disgruntled employees, a process for maintaining the data base of current users and revoking access privileges when necessary will be established.

Outstanding Issues

A process should be established to identify, investigate, and manage future outstanding issues. The issues identified to date include the following:

Support

- The support process for the PKC will differ from the local support mechanisms, but the source and structure of support remains an outstanding issue. On both the national and LMA level, the questions of how and by whom support will be provided need to be

addressed. One consideration is how much of the national support will fall within the scope of NCIS.

Clinical Data

- If and how clinical data will be incorporated into the PKC remains to be resolved. An investigation of the feasibility and necessity of pulling data from the clinical data repository will need to be undertaken.

Quantification of Benefit

- For a comprehensive business case, more thorough analysis is necessary of the impact of a national solution to identifying factors that drive KP's business. Although this position paper identifies some key benefits, we have not attempted to assess the magnitude of the impact of an intranet.

Security

- A web security policy is currently being created by the KP National Web Integration Team that will cover a range of security subjects, including authentication, authorization, revocation, nonrepudiation, acknowledgment, privacy, and encryption. The Web Integration Council Clinical Subcommittee recommends that the PKC include these web development recommendations when they are made available.

Meta-data

- Meta-data can be used in a number of ways, depending on how the intranet and its information is to be used. We have given some examples of meta-data (Appendix III) in this position paper, but a more detailed strategy will need to be determined.

Summary

A national website, such as Permanente Knowledge Connection, is a complex undertaking that strives to make it simple and easy for clinicians to find clinically useful information. That the content is carefully chosen and refined, that the information will be immediately up-to-date, that the links and associations to the site will be highly functional, that the visual design is pleasing and engaging, all demonstrate the dedication and superior capability of Permanente clinicians to meet each other's needs to improve our members' healthcare experience. ❖

“Communication and education are crucial, as is the ability to customize the tool to the needs of each user.”



Appendix I: Hierarchy of Content Approval for the Permanente Knowledge Connection (PKC) Intranet Web Environment

We recommend that clinical web content be classified according to the highest level of Kaiser Permanente (KP) approval that has been designated for that content. Advantages include:

- **Maintaining and updating content that can be attributed to the appropriate sponsor of that content.** These designations will ease tracking and will facilitate maintenance and updating processes.
- **Filtering and focusing search and retrieval of desired content to allow the user to control the levels of content being searched.** For example, if the national web environment contained at least content approved at the national and regional levels, then the user should be able to configure a search engine to first find relevant documents that are approved both nationally and by the user's home Region. If that failed, the user could then ask the search engine to search for relevant content approved by any KP Region.
- **Encouraging consensus by promotion of content to the next highest level of approval.** As different versions of similar clinical material are presented to users at one level (eg, at the Facility level or at the Regional level), then there may be an opportunity to recognize these differences and arrive at a consensus position. This process will be dynamic: a consensus document could then be relegated to either a higher or a lower level of the content hierarchy.

The following definitions are offered as a starting point for delineating useful designations:

- **National**—This designation would apply to clinical content that has been approved at the highest level of the entire KP organization by a body charged with setting standards for the organization. An example would be the National Health Education core documents that have been approved for all Regions to use by representatives from health education departments throughout the Program. Some other examples of bodies that could designate national approval of clinical content would include the Care Management Institute, National Clinical Information Systems, and The Permanente Federation, among others.
- **Regional**—This designation would apply to clinical content that has been approved by regionally sanctioned groups within a particular geographic region (eg, Southern California, Southwest, Hawaii, etc). Examples of bodies that could determine this designation include Regional Clinical Chiefs Groups, Regional Staff Education, Regional Health Education, and Regional Administration, among others. Current clinical practice guidelines for a variety of clinical problems are examples of content that currently is usually approved at the Regional level. Content designated Regional must be further subclassified according to which Region has approved this material. So a cholesterol management guideline from the Southern California Region may be designated *Regional-Southern California*.
- **Local Market Area (LMA)**—In the larger Regions, where the organization has been divided up into geographic business units called Local Market Areas (LMA), this classification may be applied. Again, this would need to be subclassified according to the particular LMA. *Policies and Procedures* for the North East Bay Local Market Area of the Northern California Region may be designated as being approved at the level of *Local Market Area-Northern California, North East Bay*, for example.
- **Facility**—In areas where KP staff is affiliated with a particular facility (in California, often a hospital and its satellite clinics are considered one facility), content may be approved at the facility level by Facility administration or at the departmental level. These may be subclassified according to Facility name (probably central Facility, not satellites) and Region. An example might be a referral guideline for referring patients from internal medicine to urology for diagnostic evaluation of hematuria that had been agreed to by both local departments. In this example, the referral guideline may be designated as approved at the *Facility-Northern California, Walnut Creek* level.

Appendix II: PKC Web Discussion Groups and Consults

A Web area on the KP Clinical Intranet, or Permanente Knowledge Connection (PKC) for interaction and exchange among clinicians could have two component areas: discussion groups and "websites" consults. The discussion group capability would be more of a web-based function, and the consultation capability would be more of an electronic mail function.

- **Discussion Groups:** *KP Exchange*, the existing KP clinical research bulletin board group discussion already exhibits this capability. After registering with *KP Exchange*, a physician can identify and create a subgroup of physicians (ie, interregional asthma experts or guideline directors) who are given password access to a protected area where they can communicate electronically and post draft documents or works-in-progress for discussion.
- **Websites Consults:** In Regions with electronic mail capability, physicians can advise each other via an interactive consultation function. When e-mail is integrated with the electronic medical record (as in the Northwest Region with EpicCare), then you have a true electronic clinical consultation function.

This form of integration, however, does not require web-based utility. Even if this consult were accomplished on the web, it would require a secure and protected environment to function well, or at all, especially if patient information or clinical decision-making occurred.

A desirable feature for consultation capability would be a prescribed response time. For example, a physician might expect 24-hour response, or even 1-hour response. This function would require on-call capability and continuous monitoring of an electronic mailbox.

Another option would be to include chat functionality so that providers could have real-time, informal exchanges.



Appendix III: Optimal Document Retrieval over the PKC Intranet

The Permanente Knowledge Connection, or KP National Clinical Intranet can potentially become a mini-Internet, containing millions of online documents that must be waded through to find those most relevant to the user's information requirements. Providers need to find relevant documents among the millions that will be present on the Intranet, and they need to find them quickly. We want to direct providers to those documents that the KP organization feels are most important. Hard-wiring the links between the Electronic Health Record and all potentially relevant documents can be costly and will require ongoing maintenance. In many cases, this linkage can be dynamically determined by a sufficiently intelligent search engine that relies in part on the use of meta-data.

The amount of work necessary to associate meta-data with each document or document collection will vary. In some cases, we may apply meta-data to an entire document collection in a single automated step. In other cases, more extensive meta-data may be applied to individual documents. These meta-data elements (and sometimes the list of possible values) must be agreed upon for each document collection. An intranet search engine with the intelligence to use the meta-data elements agreed upon by KP will be required. User-friendly tools and templates will be created to make it as easy as possible for people to add meta-data elements to their documents. In many cases, document authors will create their content using their favorite word processor, and the computer will automatically extract meta-data. Such a process is illustrated by the Southern California Clinical Practice Guideline website (<http://Kpweb.kpscal.org/CPG/>)