# Problem Focused Knowledge Navigation: Implementing the Problem Focused Medical Record and the O-HEAP Note

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**Abstract:**

The current organization of most Computerized Medical Records (CMR) is based on the Problem Oriented Medical Record (POMR) and the SOAP (Subjective, Objective, Assessment and Plan) note[1]. The organizational structure of the POMR and especially the SOAP note, does not allow for optimal use of computer capabilities in the follow up note[2]. Since follow up visits are the most common office visit by far, this is a major flaw in the CMR[2]. The authors propose a Problem Focused Medical Record and the OHEAP (Orientation, History, Exam, Assessment and Plan) note to resolve this problem. OHEAP starts with a powerful orientation structure that brings forward the timeline, last Assessment and Plan, and Plan Results for each problem along with the patient's historical tables as the starting point of every follow up visit. The Assessment and Plan portion brings problem specific differential diagnoses and their workups along with other relevant tables such as expert systems, treatments, instructions, medical literature or pathways. This leads to Problem Focused Knowledge Navigation that brings powerful efficiencies to the CMR. By recognizing the true workflow in the longitudinal diagnosis and management of any medical problem, the efficiency of the CMR is maximized. OHEAP allows for optimal use of both personal and external data elements in the medical record. Its powerful orientation attributes minimize the time spent in analyzing the current status of the problem while its connections to problem specific databases help resolve the problem.

## Introduction:

The problem oriented medical record and SOAP note was founded by Weed at the University of Vermont in 1968[1]. At the onset it represented a major change in the organization of the medical record. There were high hopes of a CMR closely following this seminal work. In the following thirty years, almost all medical records have been designed around the POMR and SOAP standard [1,3,4,5.] Despite improvements in computers and programming tools, the CMR has only meager penetration into physicians' practices. Why is this? For starters, one can easily observe that current versions of the CMR are often more complete but not as fast as the handwritten or dictated note. This, along with the effort it takes to change to a new system, has slowed the acceptance of the CMR [5,6].

Why can't the CMR reach the speed needed to make physicians adopt it? We believe that the speed issue relates mainly to follow up notes and comes from following the SOAP standard[2]. Dr. Alan Rubin, from the University of Vermont, admits what is widely known in the medical community, "I agree with your correspondents that the SOAP format is not being widely used" [7,8]. The fact that the vast majority of doctors do not use the SOAP format in the handwritten note speaks volumes against using SOAP as the template for follow up visits, yet it is the standard[5]. Since follow up visits represent the most common office encounter, it stands to reason that having the wrong format for this would have a significant impact on the speed of the CMR. In short, following SOAP for follow up is a fundamental organizational flaw in the design of current CMR's[2].
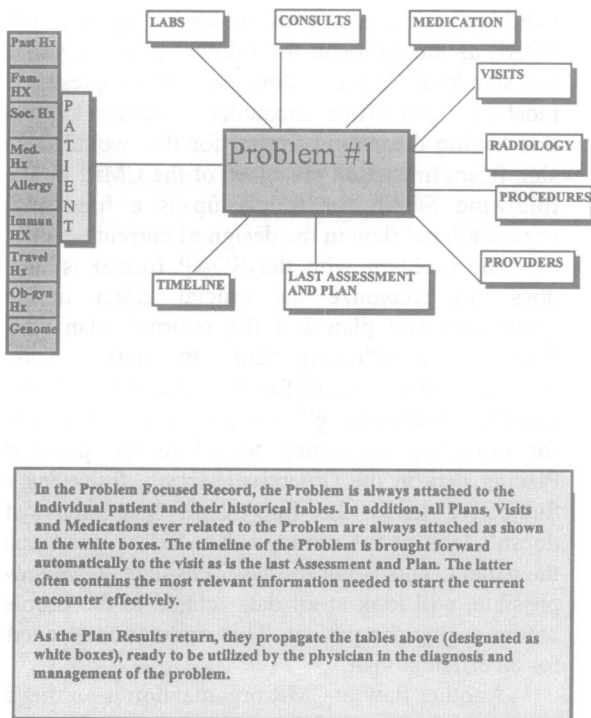
The problem with the SOAP format is that it does not recognize the crucial effect the last assessment and plan and the returned plan results have on the following visit[2]. By starting with a Subjective that searches for "how the patient feels, or what they are thinking"[7], the programmer is at a loss for providing something useful to the physician. Placing data in the Objective Section, following the Subjective gives the impression that the doctor doesn't look at the returned data before questioning the patient. This is not the case. Physicians, whenever possible, will look at all data related to the problem before seeing the patient. This orientation is needed for an efficient visit.

Another flaw in CMR organization is putting the patient as the focus of the medical record. The focus should be on the problem(s) with the patient viewed as one of many attachments to the problem(s). By focusing on the patient, current CMR's force the physician to search for relevant information regarding problems in a piece meal fashion. While faster then manual searching, electronic searching is tiresome and distracting. Proper organization of the record, focused around the problem instead of the

patient, would eliminate this and reduce the work involved in the diagnosis and management of problems.

**Solution:**

We propose a CMR model where the problem is the focal point of the record, the Problem Focused Record. The patients with their personal history tables are an attachment to the problem(s). This does not in any way diminish the focus on the "whole person," rather it maximizes the ability of the clinician to solve the problem with the whole person in mind. It emphasizes the unique characteristics of the patient that impact the problem. The personal history tables, even the human genome when that becomes available, could be dynamically displayed to the physician to help resolve the problem. Chest pain in a 30 year old female with a cholesterol of 150 and a negative family history for heart disease is vastly different than chest pain in a 65 year old, male smoker with hypercholesterolemia. The Problem Focused Record will always present to the clinician all available information relevant to the problem.



In the Problem Focused Record, the Problem is always attached to the individual patient and their historical tables. In addition, all Plans, Visits and Medications ever related to the Problem are always attached as shown in the white boxes. The timeline of the Problem is brought forward automatically to the visit as is the last Assessment and Plan. The latter often contains the most relevant information needed to start the current encounter effectively.

As the Plan Results return, they propagate the tables above (designated as white boxes), ready to be utilized by the physician in the diagnosis and management of the problem.

**Figure 1**

Figure 1 gives an overview of the Problem Focused Record. Every problem is attached to the patient and their historical tables. This information is always available on the screen when the patient is being seen. In addition, all plans for this problem are also attached and available for review. This includes consultations, x-rays, blood tests, procedures,

medications etc. The Timeline of the problem, an essential fact in longitudinal problem solving, is always kept track of by the computer. The last Assessment and Plan, with all available Plan Results is always brought forward to the follow up visit. The latter is perhaps the most powerful "orientator" to the problem that the program can provide since there is always a passage of time between visits. This critical information often defines the reason the patient has returned. Perhaps, most succinctly it allows the physician to "pick up where they left off." It also emphasizes our contention that reviewing the last Assessment/Plan and the Plan results is the minimum work of the next visit. These latter two organizational changes are cornerstones of the Orientation, History, Exam, Assessment and Plan, or O-HEAP note. All of the above maximizes the efficiency of clinical decision making by bringing to the physician all the facts needed to evaluate the problem. Figures 2. and 3. give an example of computerized screens using the Problem Focused Record and O-HEAP format. Organization along this model eliminates the need to leave the current screen to access any additional information.



First Follow up Visit for Weight Loss using Orientation –H.E.A.P. ( O-HEAP).

**Figure 2**

**Figure 3**

Example of OHEAP screen showing how broadly the data is interwoven with the Problem. In this format, leaving the screen to find relevant information is eliminated.
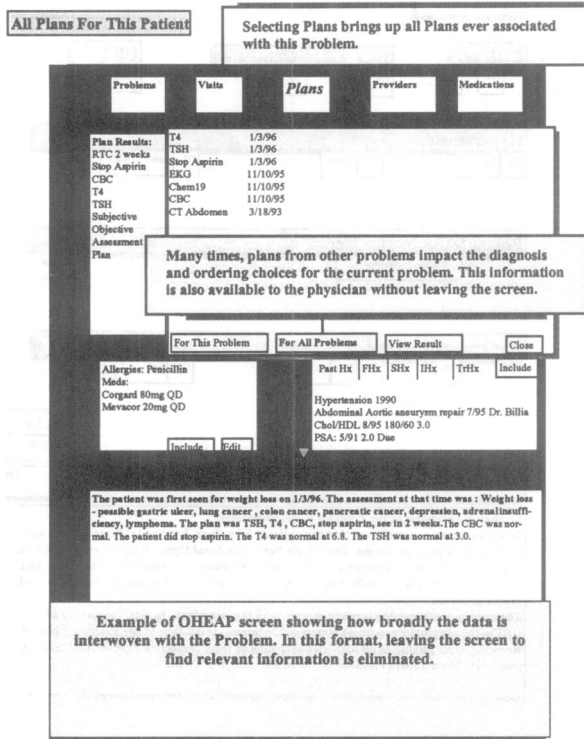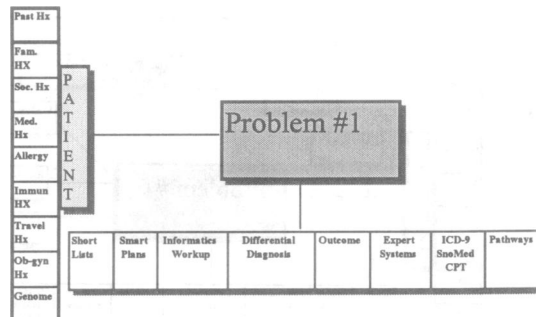


In the Problem Focused Record, Tables can be added that help classify and diagnose the problem. A Differential Diagnosis Table can be attached that lists the likely diagnostic possibilities for the problem. All plans and medications that a doctor logically associates with the problem will be readily available. Outcome terms will be presented to the doctor as part of the normal work flow. The problem can even be used to launch an Informatics workup, Expert System or Pathway. Full data dictionaries like ICD-9, SNOMED will operate in the background for transparent coding.
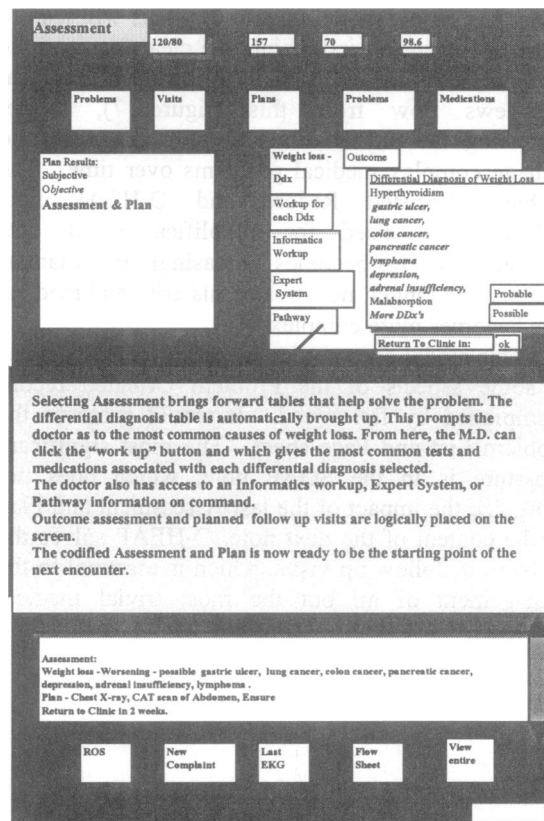
In the Problem Focused Record, this dynamic "toolbar" that aids in the problem's solution. The Assessments and Plans integral to diagnosing and treating the problem are easily accessed. In addition to simplifying the diagnostic process, this creates the substrate of the next encounter. As the plans return, they propagate the white boxes seen in Figure 1. The cycle repeats itself until the problem is resolved or stabilized. This is illustrated in Figure 6.

**Figure 4**

The Problem Focused Record has the additional benefit of logically bringing forward problem specific tables of information that act as tools to help solve the problem, as shown in Figure 4. These can be Differential Diagnosis tables, Common Plan tables, Medical Literature connections, Expert Systems and Pathways that can anticipate the doctors' needs based on the problem. For example, in a Problem Focused Record, one would expect to see the Differential Diagnosis of chest pain on the Assessment screen. In addition, one would find the standard workup for each differential diagnosis attached as well.

Expert systems and Pathways can work in the background and "suggest" options to the physician on demand. The physician is aided by the computer at one of the most critical points in the medical encounter. Figure 5 shows how a computer screen utilizing this format would appear.

Tables that contain outcome terms will be made available to the physician as part of the normal workflow. Standard coding systems such as ICD-9, CPT and SNOMED[9] will work in the background to accomplish the standardization of terms needed for global outcomes analysis. This can be effectively accomplished without burdening the physician in the office who is far more interested in the diagnosis of cholecystitis than the proper coding for it.



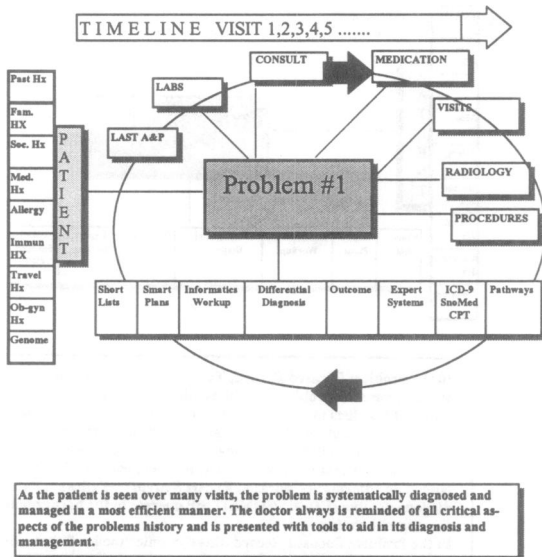Example of Assessment and Plan screen.

**Figure 5**

TIMELINE VISIT 1,2,3,4,5 .......

CONSULT    MEDICATION

LABS

Past Hx
Fam. HX
Soc. Hx
Med. Hx
Allergy
Immun HX
Travel Hx
Ob-gyn Hx
Genome

P A T I E N T

LAST A&P

VISITS

Problem #1

RADIOLOGY

PROCEDURES

| Short Lists | Smart Plans | Informatics Workup | Differential Diagnosis | Outcome | Expert Systems | ICD-9 SnoMed CPT | Pathways |

As the patient is seen over many visits, the problem is systematically diagnosed and managed in a most efficient manner. The doctor always is reminded of all critical aspects of the problems history and is presented with tools to aid in its diagnosis and management.

**Figure 6**

John Barr

OV = office visit
Rx = Treatment

| URI | | | URI | Pneumonia | | | URI | |
| OV | RX | | OV | | ER | RX | | Phone | RX |

Hypertension
| OV | Lab | | | OV | x-ray | | | OV | Lab | RX |

Preventative Health Care
| | OV | Sigmoidoscope | | | | Vaccine |

Hypercholesterolemia
| | OV | | OV | RX | Lab | | OV | Lab |

Weight Loss
| OV | Lab |

| 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 |

Graphical Overview of the Problem Focused Record:
In a glance, one can easily see that the patient, John Barr. has had infrequent visits and tests for his 4 main problems. There have been occasional Upper Respiratory Infections, one which led to an emergency room visit and a diagnosis of pneumonia. The URI's and pneumonia represent episodic illnesses that have been cured. The weight loss is the most recent problem.
The outcome information is much clearer with this approach. In fact, the linking of the URI to the eventual Pneumonia is part of the normal work flow of the Problem Focused Record. Direct linking of all activities over time to their respective Problems is far more powerful then a patient centered or encounter centered CMR.

**Figure 7**

All problems can be diagnosed and resolved using this simple model (figure 6). This will lead to greater efficiencies and maintain a clear focus on the essential work of each visit. Powerful graphical overviews flow from this (figure 7), further enhancing the physician's ability to diagnose and manage complex medical problems over time. The Problem Focused Record and O-HEAP note addresses the need for simplification of data management. This becomes increasingly important as patients live longer, new treatments arise and medical care becomes more complex.

This model does not in any way preclude the use of some aspects of the Problem Oriented record championed by Dr. Weed. It would preserve the Problem List and Face sheet. The most significant departure is in the SOAP note, which does not recognize the impact of the last Assessment and Plan on the content of the next note. O-HEAP solves the problem of follow up visits, which is essential to the management of all but the most trivial medical problems.
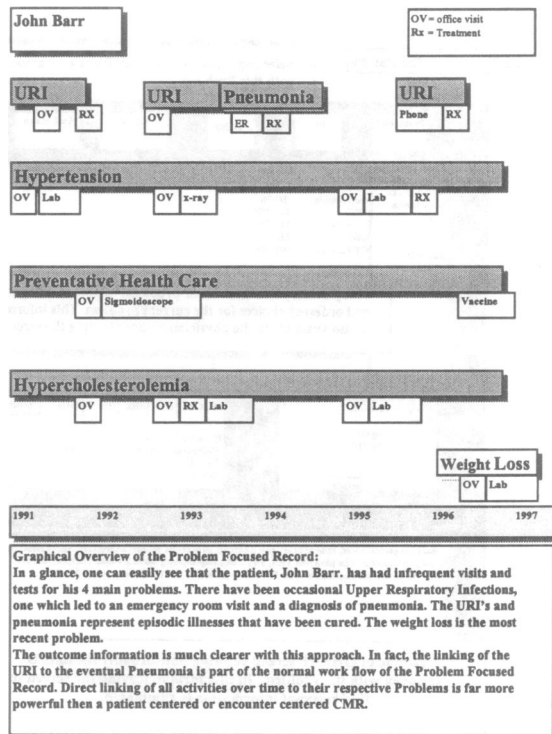
## Data-Grouping Model

RESULT REPOSITORY

PATIENT REPOSITORY

Problem Centric Engine

KNOWLEDGE SERVER
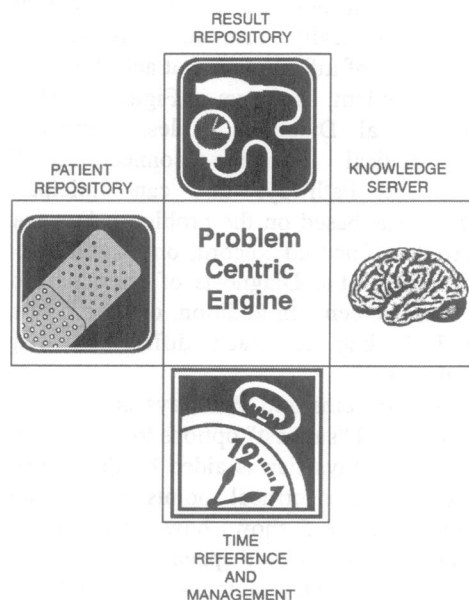
TIME REFERENCE AND MANAGEMENT

**Figure 8**

The diagram above (Figure 8) demonstrates the data-grouping model that would be implemented to support the new paradigm of a problem centric learning machine (or Problem Centric Knowledge Navigation). The tables are grouped under five

328

classes: the patient centric repository, the interface for departmental data sources (some times too large to be moved to patient repository), knowledge repository (knowledge server), and time reference / management tables. The final group, the problem centric engine, orchestrates the access between these sources.

The patient repository should be designed to support the problem-based management. It must support the lumping and splitting of the problem relationship with each plan and corresponding results. The interaction to the result repository (departmental and external) data sources must interface with the problem centric engine to allow the provider, through order table transfer, to connect the result to the appropriate patient problem. The knowledge server connects the care provider to the external, internal, and personalized information and knowledge about the given problem. The other role of the knowledge server is to maintain the standard vocabularies (ICD9, CPT, MESH, SNOMED[9], LOINC[10]) that are used among the disparate systems[11]. The Knowledge server is also the link to other knowledge sources enabling the user to complete an Informatics workup[12]. The time reference is organized to support the time parameters associated with each of these knowledge sources. This reference helps to classify results and documents temporally to its appropriate problem when any explicit links are missing. The problem centric engine allows the provider to navigate through these knowledge sources based on the problem. This engine provides problem management techniques that allow for the generation of explicit links between the note and results to a problem(s). This is done in the context of time which shows when such events have occurred, what knowledge is used, where the information about the problem is stored within the knowledge server and finally the status of external results for a given problem and patient.

## Conclusion:

The POMR and SOAP note were introduced thirty years ago. In the original article, the CMR was predicted to be forthcoming from programmers utilizing this new standard[1]. For the last three decades, most of the major CMR's have been designed around the POMR and SOAP note. It is ironic to conclude that this design fundamentally fails with follow-up visits and has actually slowed development of a CMR that physicians could embrace.

The Problem Focused Record and O-HEAP note provides a higher level of organization for the clinician. It brings forward all historical information regarding the problem and prompts the doctor with relevant information at the most appropriate time. It logically presents problem specific tools that aid in the diagnosis and management of the condition. This will deliver speed and completeness that the handwritten note cannot match. The modeling described in this paper supports organization that can work in harmony with systems that are designed with SOAP, POMR or basic data-warehousing. The key issue in the model is the use of standard vocabulary and problem focused architecture that allows rapid access to the pertinent data for problems at the right time. This model could lead to increased adoption and acceptance of the CMR by busy practicing physicians.

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