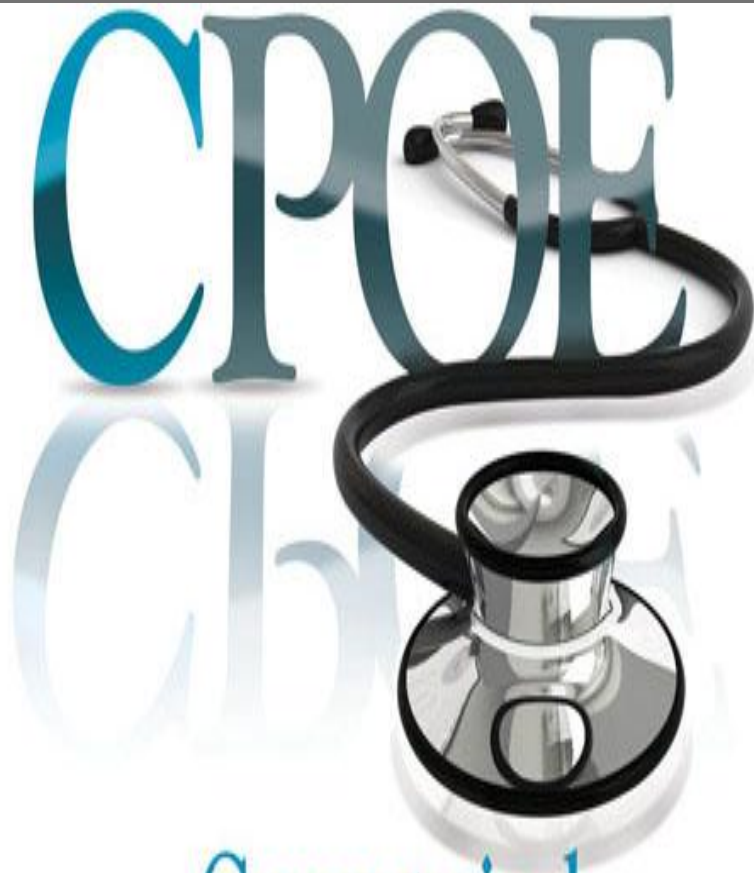


2012



Computerized
Physician Order Entry



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C.P.O.E

1. Introduction

C.P.O.E stands for **Computerized Physician Order Entry** also termed as **Computerized Provider Order Entry**. CPOE is a form of Patient Management Software. It is a process of entering the medical practitioner instructions through electronically for the treatment of patients especially for hospitalized. Mainly these orders are filled in departments such as Pharmacy, Radiology, Laboratory and so on. These orders are transmitted through shared network to the medical staff or to the departments mentioned. CPOE replaces written orders, phone calls and faxes, because it is linked to every other department in the hospital.

One in every 10 patients admitted in hospitals suffered serious and avoidable medication mistakes. This has created a new urgency for all hospitals in the state to install **Computerized Physician Order Entry**. The main advantage of using this *CPOE* is, it decreases delay in order completion and reduces errors related to handwriting or transcription. It allows order entry at point-of-care or off-site, provides error-checking for duplicate or incorrect doses or tests, and simplifies inventory and posting of charges.

The exact word can be termed as **computerized Prescriber Order Entry** or **Computerized Pharmacist Order Entry**. Pharmacists are mainly concerned with this Order Entry because it is the responsibility of pharmacists to verify any entry into the system concerning the use of medications within the hospital or health care system. Order clarification requests are increased by the improved communication and collaboration between the healthcare team. The Agency for Health Research and Quality (AHRQ), a unit of the Federal Department of Health and Human Services (HHS) released grants to various health care providers to implement CPOE.

Computerized Provider Order Entry (CPOE) differs from other forms of computerized order entry in that a provider with decision-making authority directly enters the test request. Computerized order entry systems that allow non-providers (unit secretaries, assistants) to enter testing requests into the system do not permit many of the ordering support functions. Providers in CPOE systems are typically physicians, but in many health systems, nurse practitioners and other authorized providers are also able to enter orders.

2. Reasons why Community of Hospitals are reckoning towards CPOE

- ✓ CPOE impacts almost every clinical process and department.
- ✓ Time for training, personal investment in learning is high.
- ✓ Electronic ordering takes longer.
- ✓ CPOE enables many other desired changes: e.g., care standards, common order sets, and process changes.
- ✓ For community physicians, time invested in CPOE is time away from patient care and revenue.

3. Terminologies in CPOE

1. Filler: The main usage of these **Filler** is to perform a request for Orders or producing an observation. These fillers can also be developed for new orders, add additional services to existing orders, replace existing orders, put an order on hold, discontinue an order, release a held order, or cancel existing orders.
2. Order: A request for a service from one application to a second application. In some cases an application is allowed to place orders with in itself.
3. Order Detail Segment: One of several segments that carry order information. Future ancillary specific segments may be defined in subsequent releases of the Standard if they become necessary.
4. Placer: The application or individual originating a request for order.
5. Placer Order Group: A list of associated orders coming from a single location regarding a single patient.
6. Order Set: Grouping of orders used to standardize and expedite the ordering process for a common clinical scenario. (Typically, these orders are started, modified, and stopped by a licensed physician).
7. Protocol: A grouping of orders used to standardize and automate a clinical process on behalf of a physician. (Typically, these orders are started, modified, and stopped by a nurse, pharmacist, or other licensed health professional).

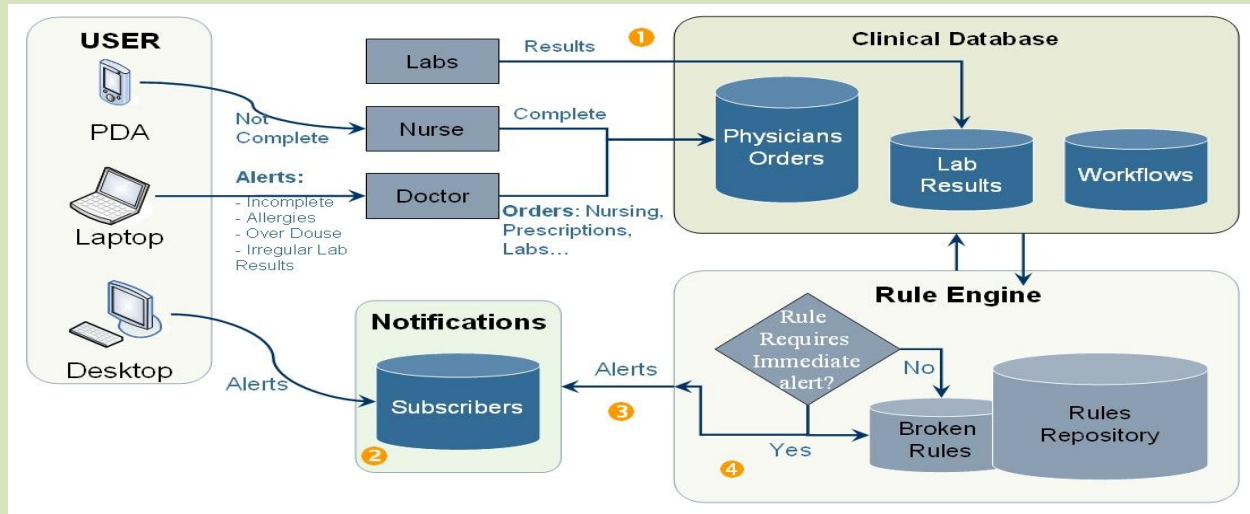
4. Features of CPOE

1. Ordering: All physician orders are similar in the hospitals but it differs from each doctor depending on their specialization in using the order sets. These Orders are communicated to all departments and involved caregivers, improving response time and avoiding scheduling problems and conflict with existing orders.
2. Patient-centered Decision Support: The ordering process includes a detailed display of patient's medical history and current results and evidence-based clinical guidelines to support treatment decisions.
3. Patient safety features: The CPOE system allows real-time patient identification, drug dose recommendations, adverse drug reaction reviews, and checks on allergies and test or treatment conflicts. Physicians and nurses can review orders immediately for confirmation.

4. Intuitive Human interface: The order entry workflow corresponds to familiar "paper-based" ordering to allow efficient use by new or infrequent users.
5. Regulatory compliance and security: A permanent record is created, with electronic signature, access is secure.
6. Portability: The system accepts and manages orders for all departments with a point-of-care, from any location in the health system like physician's office, hospital or home through different types of devices including wireless PCs, tablet computers and so on.
7. Management: The system delivers statistical reports online so that managers can analyze patient census and make changes in staffing, replace inventory and audit utilization and productivity throughout the organization. This data is collected for training, planning, and root cause analysis for patient safety events.
8. Billing: Documentation is improved by linking diagnoses ICD-9-CM or ICD-10-CM codes to orders at the time of order entry to support appropriate charges.

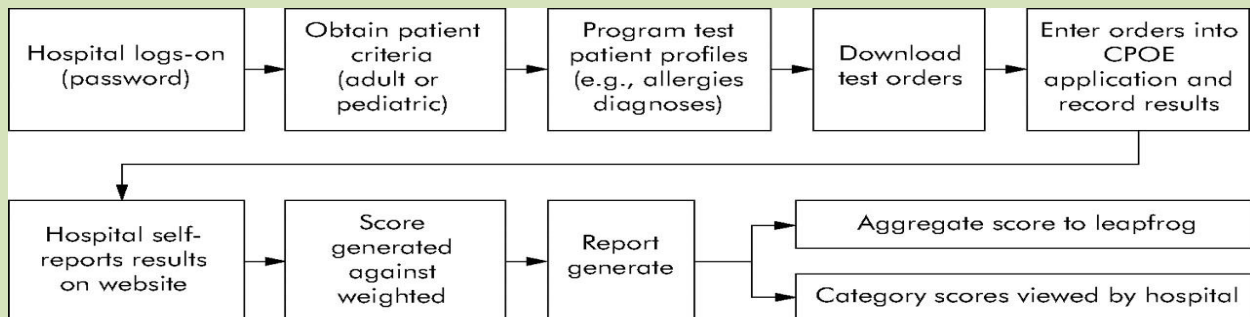
(ICD: International Statistical Classification of Diseases and Related Health Problems is a medical classification that provides codes to classify diseases in a wide variety of signs, symptoms, abnormal findings, complaints, social circumstances, and external causes of injury or disease. Under this system, every health condition can be assigned to a unique category and given a code, up to six characters long. Such categories can include a set of similar diseases).

5. CPOE Architecture



1. Vision eForms captures **Patient's clinical data**, Lab Results and Physician Orders. Each data component captured, evaluated through the Rules Engine. Alerts are issued accordingly.
2. **Subscribers** Database matches Doctors-Nurses-Labs-Hospital Department – Bed.
3. **Alerts** address to user/role, Priority with preferred method of alerting.
4. **Rule Engine** tests rules according to context and policies and records broken rules. Rules alerted according by priorities.

6. Workflow of CPOE



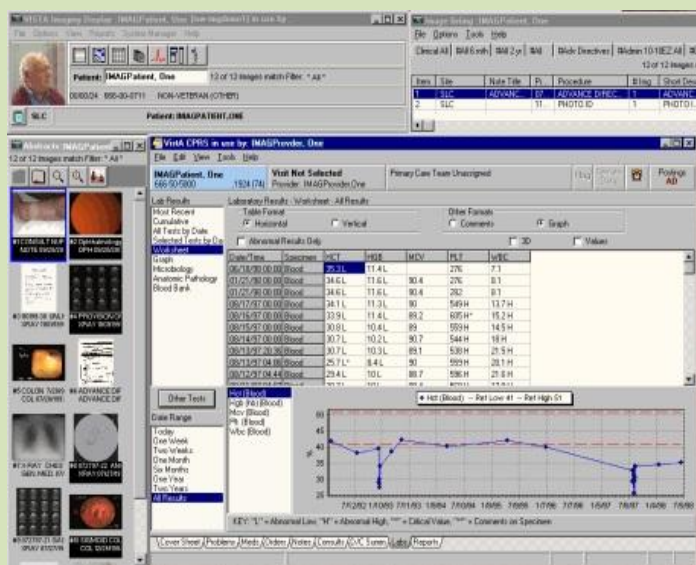
The hospital taking the evaluation downloads a list of test patients with various demographic characteristics, medical conditions, and medication regimens and programs them into their CPOE testing environment. At this point, 4 hours are allotted for the user to program the test patients. If they re-log in within the time frame they are allowed to download a series of test orders to be entered against the test patients. The response of the CPOE system to the entered order is then noted and reported through the online evaluation system within a 2 hour time period. At the conclusion of testing the hospital receives an overall score and scores describing performance in specific clinical decision support categories. This feedback assists the hospital in selecting areas for new implementation of decision support or improvement of their current CPOE system.

7. Implementation of CPOE

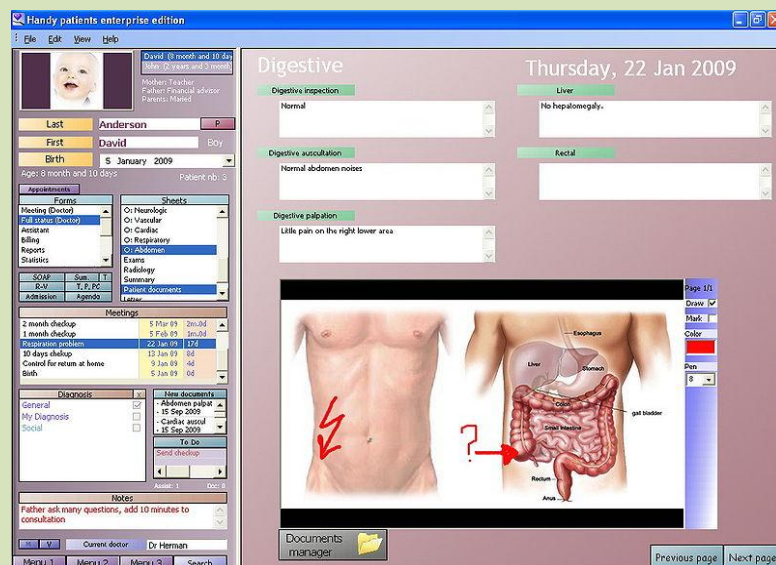
The implementation of CPOE is involved in 3 stages they are:

1. **Physician Incentives:** CPOE was a very high-profile project in every hospital, consistently linked with the need to improve patient safety and quality. Physicians led decision-making groups and participated in system build, and CMIOs and/or other physician champions worked hard to effect the transition. Considerable time was spent seeking feedback from physicians to address their concerns, making sure the system met physician workflow requirements and was easy to use, and providing personalized support and training.
2. **Process Redesign:** Designing new workflows (typically after examining existing ones), reviewing new workflows with each unit/department to ensure they fit and aligning policies and procedures with the new workflow. The study of hospitals developed new workflows with and without physician order entry. This not only addressed the likely situation at go-live and during phase-in but also needed for downtime.
3. **Metrics:** It includes an *Electronic Health Record* (An *Electronic Health Record (EHR)* is a systematic collection of electronic health information about individual patients. It is a record in digital format that is theoretically capable of being shared across different health care settings. In some cases this sharing can occur by way of network-connected enterprise-wide information systems and other information networks or exchanges. EHRs may include a range of data, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal stats like age and weight, and billing information.

It also consist **Physician use of order entry** (system reports detailed percent of orders entered directly by others physicians in specific) and **Physician use of Order Sets** (reports are entered through system only else requires inserting "order").



Sample *Electronic Health Record* based upon *Images*



Sample *Electronic Health Record* based upon *Record*

7.1 Configuration of CPOE

One of the key determinants of the utility and functionality of a given laboratory CPOE is the ability to interact with other portions of the electronic health record. All CPOE systems must interface with other electronic health record systems to receive up-to-date demographics and visit information. A key additional system that the laboratory CPOE system may interface is the Laboratory Information System (LIS). The LIS is the system responsible for laboratory data management, and plays a critical role in coordinating laboratory workflow. An electronic interface from CPOE to the LIS permits the CPOE system, electronically send orders to the LIS. A CPOE system that is electronically interfaced with the LIS is said to have "*order communication*."

7.2 Interface with the Clinical Data Repository and CPOE

CPOE systems may also interface with a variety of clinical information systems, including the clinical data repository (CDR). The CDR is a general term for systems that may alternatively be known as the clinical information system (CIS) or the electronic health record (EHR). The CDR consists of the databases and systems that store patient electronic health records, including electronic reports and results from laboratory, imaging, pathology, and other diagnostic services. Interfaces to CPOE from the CDR are essential in order to provide advanced clinical decision support during the order entry process. Interfacing can permit CPOE systems to display relevant clinical information to the ordering provider at the time of order entry.

7.3 Templates used in CPOE

In most implementations of CPOE, ordering templates play an important role in standardizing care and encouraging adherence to clinical guidelines. Templates typically consist of an integrated order set including medication, laboratory and other orders appropriate for a particular clinical setting or diagnosis. For example, an admission template for myocardial infarction might include specific dietary orders (e.g. low-salt diet), laboratory orders (e.g. serial troponin assays), medication orders (e.g. aspirin, beta blockers), and nursing instructions. When placing orders for a specific patient, clinicians may start with the standard template and then make modifications to address the unique clinical circumstances of the patient. Another advantage of using CPOE templates is that when clinical guidelines change, templates can be readily updated and the change in guideline is thus made immediately apparent to all ordering providers.

7.4 User Interface Modifications in CPOE

One of the most basic effective interventions to alter test utilization is to modify CPOE test ordering screens. A typical screen modification involves making commonly used and often appropriate tests more convenient to order than tests that are only occasionally indicated. Such modifications presumably reduce over-ordering of tests by reducing the "*impulse-buy*" mentality. Another strategy that may be employed is to "*unbundle*" testing panels, requiring providers to select the individual tests instead of ordering the panel.

7.5 CPOE without Order Communication

Laboratory CPOE modules can be configured and installed without connectivity to the LIS. Even without order communication, CPOE systems may offer many of the benefits including the capacity to advise clinicians on test indications, to alert users to redundant orders, and to improve testing workflow. A representative CPOE system lacking order communication is illustrated in the below picture. As shown, providers place orders for laboratory tests in CPOE but there is no electronic transfer of these orders to the LIS. Clinical support staff may generate a paper requisition and tube labels after review of CPOE orders. The paper requisition and labels may be printed from the CPOE system or a nurse, phlebotomist or assistant viewing the order may fill out a pre-printed paper requisition and manually create labels. Following specimen collection, the labeled sample and paper requisition are sent to the laboratory. After arriving in the laboratory, the samples are manually "accessioned," a process whereby specimen information and test orders are manually entered into the LIS. The LIS can then print unique bar-coded labels for the specimen. The samples must be relabeled with the LIS labels before further processing and analysis can occur.

There are several major drawbacks to CPOE implementations lacking order communication. The primary limitation is that the link between the CPOE and the LIS involves paper and numerous manual steps, which are inefficient and error-prone. The total turnaround time (order to result) for such a system, especially one that involves paper requisitions, is considerable, with numerous staff performing tasks such as filling out requisitions or accessioning specimens that are essentially eliminated in interfaced systems. In addition, by not accessioning specimens until they arrive in the laboratory, such systems do not permit the duplicate test checking, minimum volume calculations, and preferred tube logic that are features of the CPOE-LIS order entry interface.

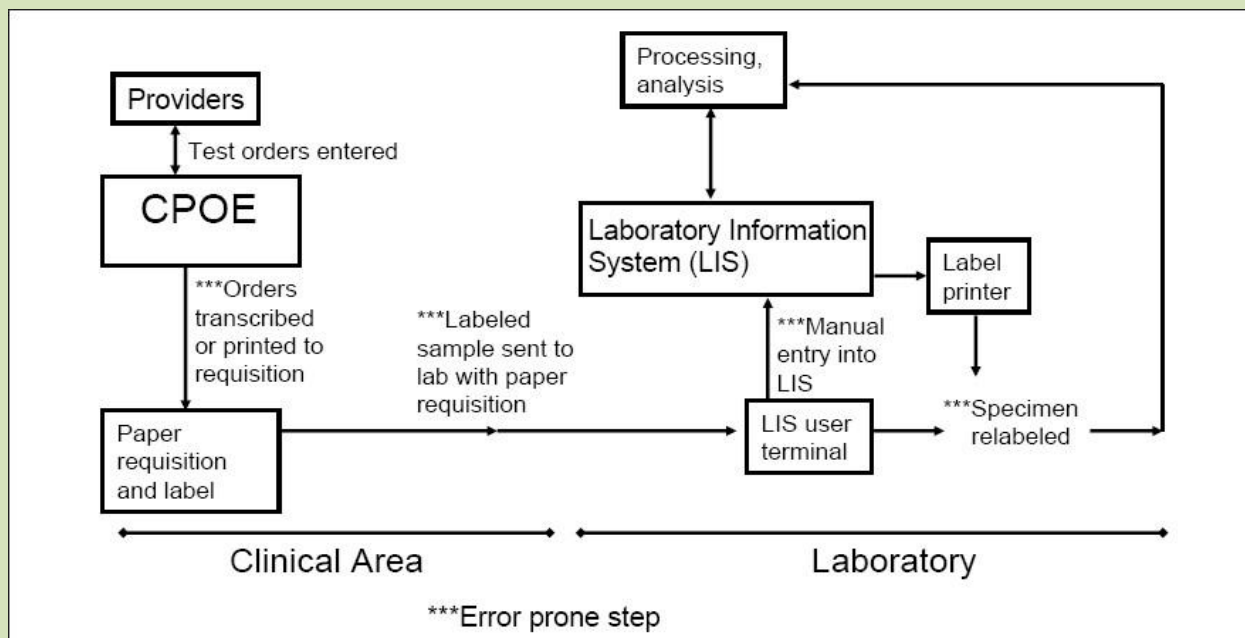


Figure illustrating CPOE without Order Communication

7.6 CPOE with Order Communication

Order communication functionality allows the CPOE system to automatically transmit provider orders to the LIS. An example of a system with order communication is shown in. This is typically accomplished using an electronic interface based on Health Level 7 (HL7) interfacing standards. HL7 messages are of a standard format and are used widely to communicate certain types of laboratory data, including orders and results, between information systems.

Ordering providers may notice few differences between a CPOE system with order communication and a system without order communication. However, many of the downstream steps are different and the efficiency and quality of the process may be dramatically different. In systems with order communication, the CPOE system directly transmits the order into the LIS, creating an LIS order at the time of CPOE test ordering. In addition, the LIS is able to generate bar-coded specimen labels proximate to the time of specimen collection. The labels produced for bedside labeling correspond to the LIS order, so in-laboratory relabeling is not necessary. Label printers can be located in patient rooms, on handheld devices, or at a central nursing station or phlebotomy center. Handheld devices with label printers are available that can download orders from the LIS and subsequently scan a patient's identification wristband to generate LIS specimen labels at the point of care. An advantage of near-patient labeling is that the collection date and time can be automatically captured by the system and transmitted to the LIS. Once samples have been labeled with LIS bar-coded labels, the specimens only need to be scanned as "received" when they arrive in the laboratory, and are then able to be directly loaded onto automated systems for processing and analysis. In some laboratory automation systems, the specimen receipt process can occur automatically on the pre-analytic module of the automated equipment, further streamlining the process. By eliminating manual steps and leveraging the logic and routing capabilities of the LIS, order communication can reduce the risk of mislabeled specimens, incorrect container types, lost requisitions, and incorrect testing.

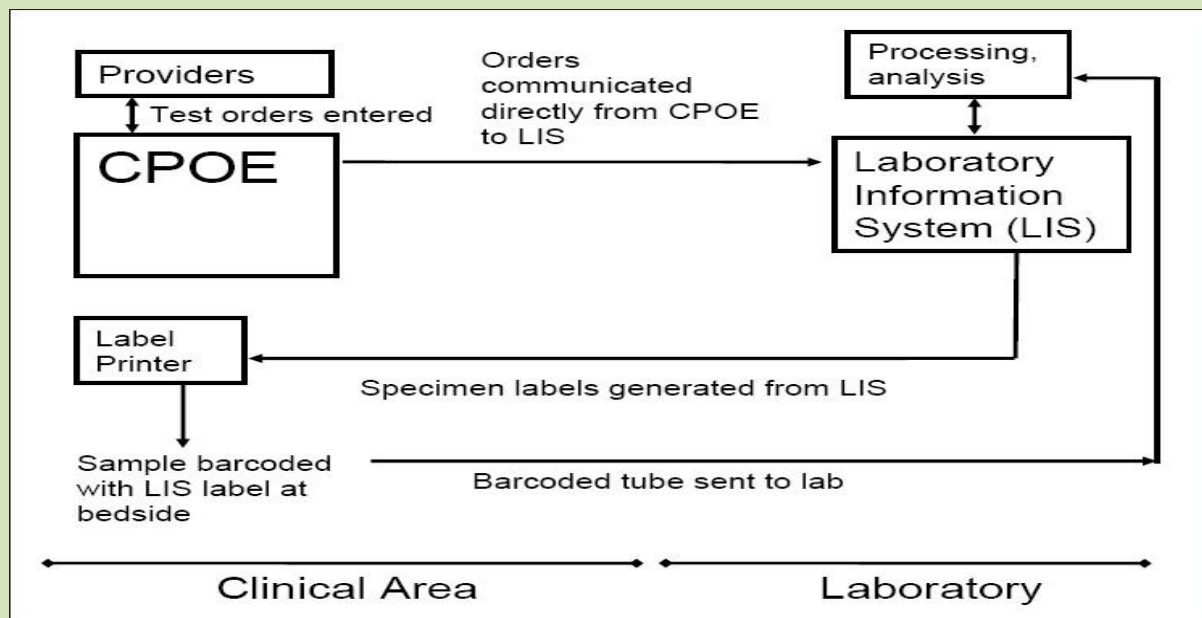


Figure illustrating CPOE with Order Communication

8. Screenshots of Legacy System and live CPOE Screens

8.1. Legacy System to Patient List

The screenshot shows a legacy system interface with a menu on the left and a list of medical services on the right. The menu includes options like PRINTOUTS, UPD SERVICE/MD, HOSP INFO, CALCULATIONS, EMERGENCY PTS, ALL PATIENTS, INC/DEL MR (INPATIENTS), OUTPATIENTS, PREADMITS, TRANSPORT, SIGN ORDERS, ALPHABETIC, BY SERVICE, BY UNIT, BY MD, PHS RESULT, and ERASE-ALL. The medical services list includes ACUTE PAIN, ANESTHESIA, CLINICAL RESEARCH, DERMATOLOGY, EMERGENCY, FAMILY PRACTICE-HAN, FAMILY PRACTICE-NC, INTERNAL MEDICINE, NEUROLOGY, NUTRITION SUPPORT, OB/GYN, OPHTHALMOLOGY, OTOLARYNGOLOGY, PATHOLOGY, PEDIATRICS, PSYCHIATRY, RADIOLOGY, REHAB MEDICINE, and SURGERY. Arrows indicate a transition from the legacy system to the live CPOE screen.

Legacy System Menu:

- PRINTOUTS
- UPD SERVICE/MD
- HOSP INFO
- CALCULATIONS
- EMERGENCY PTS
- ALL PATIENTS
- INC/DEL MR (INPATIENTS)
- OUTPATIENTS
- PREADMITS
- TRANSPORT
- SIGN ORDERS
- ALPHABETIC
- BY SERVICE
- BY UNIT
- BY MD
- PHS RESULT
- ERASE-ALL

Medical Services List:

- ACUTE PAIN
- ANESTHESIA
- CLINICAL RESEARCH
- DERMATOLOGY
- EMERGENCY
- FAMILY PRACTICE-HAN
- FAMILY PRACTICE-NC
- INTERNAL MEDICINE
- NEUROLOGY
- NUTRITION SUPPORT
- OB/GYN
- OPHTHALMOLOGY
- OTOLARYNGOLOGY
- PATHOLOGY
- PEDIATRICS
- PSYCHIATRY
- RADIOLOGY
- REHAB MEDICINE
- SURGERY

8.2. CPOE Entry of Patient's List

The screenshot shows the FirstNet Organizer for ERSKINE MD, ALISTAIR R. The interface includes a menu bar with Task, Edit, View, Patient List, and Help. Below the menu bar is a toolbar with various icons. The main window displays a list of patients under the Patient List tab. The list is organized by medical service and includes columns for Room/Bed/Name, MRN, Attending Physician, Medical Service, and Admitted date.

FirstNet Organizer for ERSKINE MD, ALISTAIR R

Task Edit View Patient List Help

As Of 08:48

Tracking List Patient List Orders to Cosign Orders to Activate In-Box Graphical Overview Schedule Multi-Patient Task List

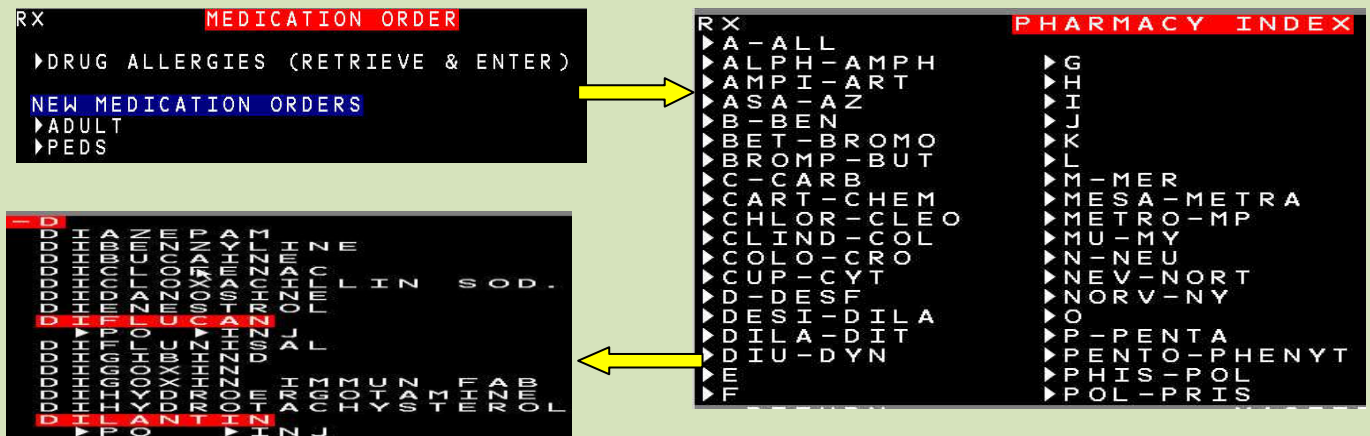
IP-Medicine-Team 2 IP-Medicine-Team 3 IP-Medicine-Team 4 IP-Medicine-Team 5 IP-Medicine-Team 6

GREN-Adult Acute ED YELO-Adult Acute ED IP-Gen Internal Med FAS IP-Cor Cor-Med ICU IP-Med Resp ICU SP-IM Hospitalist 1 SP-IM Hospitalist 2 ICU Pending Transfers IP-Medicine-Team 1

All ED OP, ED Temp and IP type patients

Room/Bed/Name	MRN	Attending Physician	Medical Service	Admitted
G1 1		ED MD, ATTENDING	OP-Emergency Services	9/18/2005 21:13
G2 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 3:12
G3 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 6:19
G4 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 5:25
G5 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 4:04
G6 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 4:55
G7 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 6:08
G9 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 8:31
G10 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 7:17
G11-P 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 5:32
G13-N 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 5:51
G14-N 1		ED MD, ATTENDING	OP-Emergency Services	9/19/2005 7:20
G17-H 1		ED MD, ATTENDING	OP-Emergency Services	9/18/2005 22:01
G18-H 1		GAZONI MD, PAULO M	OP-Emergency Services	9/17/2005 1:22

8.3. Legacy System to Medical Order



8.4. CPOE Entry of Medical Order

The screenshot displays the 'PowerChart Office - (Inpatient Workflow) PowerOrders' interface. The top section shows patient information: 'Person Full Name: WORTH, TEST', 'Birth Date: 8/20/1941', 'Age: 64 years', 'Sex: M', and 'Allergy: Allergies'. Below this, the 'Encounters' section lists '8/6/2004 - 10C - SHEPARD MD, RICHARD K - IP - CONGESTIVE HEART FAILURE' with 'MRN: 6146267 (MRM Pool)' and 'Aliases: FIN NBR - 706800029084'. The 'Orderable search' field contains 'aspirin'. The main area shows a list of 'Problems' including 'Knowledge deficit (specify)' and 'Immobilization'. A 'Medications Order Details' window is open, showing 'aspirin' with a dose of '325 mg, Tab-EC, PO, qd, please give after breakfast, Give first dose: Routine'. The 'Order details' section includes 'PRN Reason', 'Special Instructions', 'Duration', and 'Give first dose: [Routine]'. The 'Order comments' field is also visible. The bottom of the screen shows a 'Ready' status and a timestamp of '19 September 2005 12:10'.

9. Benefits for Patient safety in CPOE

The benefits of CPOE can be categorized in 3 different ways they are:

1. CPOE- Quality
 - a. Patient Safety Error reduction via order detail/sentencing and DS.
 - b. Rules and Alert patient allergies, drug, dose-range checking.
 - c. Improve compliance to EBM guidelines with Order sets.
 - d. Reduction in unnecessary utilization of care.
 - e. Pre-requisite to Bar-coding and closed loop medication reconciliation.
2. CPOE- Order Workflow
 - a. Improved Ordering conversation.
 - b. Legible, sort able, structured, known author.
 - c. Avoids duplicate if the order already exists.
 - d. Allows for future orders.
 - e. Allows entry on-site or remotely.
3. CPOE- Med Orders
 - a. Structured input with required order details.
 - b. Faster Pharmacy verification process.
 - c. Improved formulary compliance.
 - d. Faxing scripts directly to Outpatient Pharmacies.
 - e. Printout Medication Literature for patients.

10. Conclusion

One of the key determinants of the utility and functionality of a given laboratory CPOE system is the ability of the system to interact with other portions of the electronic health record. CPOE systems offer the clinical laboratory a powerful tool to promote appropriate laboratory test selection and enhance the accuracy and efficiency of the entire laboratory testing process. Potential CPOE benefits as outlined in this review include improved test utilization, reduced costs, fewer errors, and better adherence to practice guidelines. Numerous strategies have been employed within the context of CPOE systems to improve workflows and ordering practices. Given the variability of systems and implementations, laboratory directors must carefully plan CPOE implementations to ensure that the system will meet the institution's goals and be compatible with its workflows.