Safety Enhanced Design Brief
Making Effective Use of Color

Carefully used colors can dramatically improve the efficiency and safety of health information systems by drawing attention to important items and making it easier to perceive differences and trends.

Incorrectly used colors can make a display hard to use, hard to interpret and misleading.

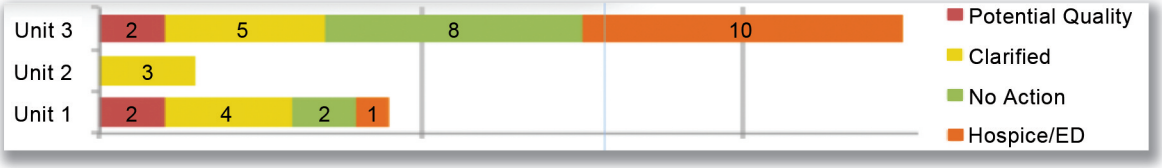
1 To maximize the communication benefits of color, design
-Use gray scale, then add color sparingly

Colors emphasize only title and high (orange) / low (blue) values

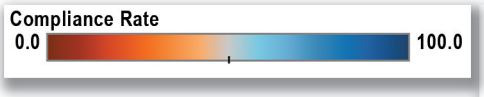
• **Endocrine Events**

BP:	H 178/80 mmHg	(03/02/10)	H 169/84 mmHg	(12/30/09)
Wt:	85.300 kg/188 lbs	(12/30/09)	85.400 kg/181 lbs	(12/29/09)
BMI:	0	(02/08/10)	0	(02/01/10)
Smoking Hx:	Non Smoker/History of Smoking	(03/02/10)	Non Smoker	(12/14/09)
HGB:	14.3 g/dL	(03/02/10)	16.0 g/dL	(12/21/09)
K+:	hemolyzed mmol/L	(03/02/10)	3.8 mmol/L	(12/21/09)
Cr:	0.84 mg/dL	(03/02/10)	0.86 mg/dL	(12/21/09)
MicroAlb/Cr:	18.3 mcg/mg Creat	(10/05/09)	H 52.8 mcg/mg Creat	(11/14/08)
GFR (AA):	112.22 mL/min	(03/02/10)	109.21 mL/min	(12/21/09)
GFR (non AA):	92.59 mL/min	(03/02/10)	90.11 mL/min	(12/21/09)
Glu:	105 mg/dL	(03/02/10)	H 123 mg/dL	(12/21/09)
HbA1c:	5.7%	(10/05/09)	5.8%	(03/18/09)
Total Chol:	H 205 mg/dL	(10/05/09)	193 mg/dL	(09/30/09)
HDL:	L 26 mg/dL	(10/05/09)	L 31 mg/dL	(09/30/09)
Chol/HDL:	7.9	(10/05/09)	6.2	(09/30/09)

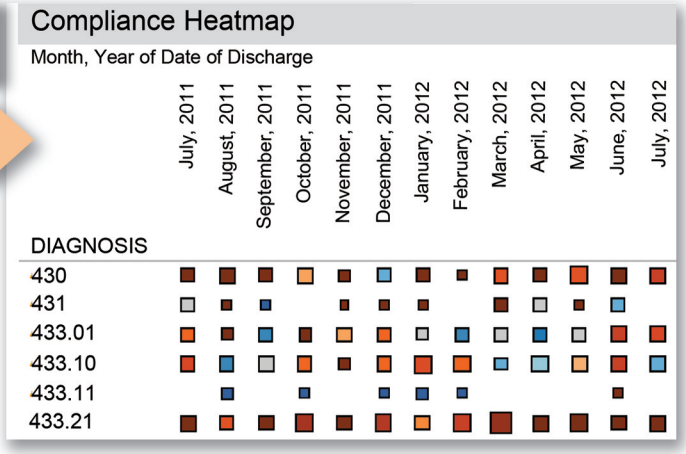
2 To group items into different categories
-Use no more than 7 colors (4 recommended)



3 To show sequential ranges of quantitative values
-Use 1 color (for sequential) and 2 colors (for diverging) values
- Vary color intensity from pale (low values) to darker (extreme values)



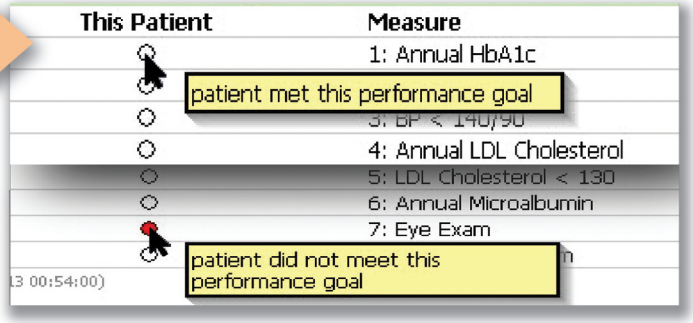
2-color heatmap of varying intensity visualizes sequential ranges



4 To ensure consistency, learnability, and to prevent misinterpretation, create rules for:
- Colors for critical values
- Colors for severity of warnings and alerts, etc.
- Colors for different categories of items
- Colors combined with differentiators (tooltips, symbols, icons, positions)

5 To ease understanding and learnability of colors
-Use text, tooltips or legends

Mouse-over text explains dot coloring



6 Use color-blind friendly colors (10% of men and 5% of women are color-blind). Combine color with an image, shape, position, or text to convey same meaning. In ① prefixes L (low) and H (high) are in separate columns to reinforce color

7 To select appropriate color schemes, use tools that match schemes to data types and support color-blind safe choices (see http://colorbrewer2.org/) Use tools that preview design as it would be seen by a color blind user (see http://www.color-blindness.com/coblis-color-blindness-simulator)

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-G01.htm

Safety Enhanced Design Brief
Effective Table Design

Tables are used exclusively for lists of patients, medications, results, etc.

While tables seem simple, careful design is needed as even small mistakes can have a significant impact on:

- **Patient safety:** e.g. Truncated names will lead to wrong patient selection; column headers scrolling out of view will lead users to read the wrong test result value.
- **Efficiency:** e.g. Users will waste a lot of time scanning and scrolling if no search or sort is provided.

This set of guidelines is just a small sample of the available guidelines for table design.

1 To prevent common errors

- Keep the headers visible at all times *(do not allow them to scroll out of sight)*
- Use multiple lines for long column headers *(do not truncate them)*
- If truncation of a table is unavoidable: Try using multiple lines or tooltips for showing what does not fit in the cell
- Avoid using error-prone abbreviations, and provide a long version in a tooltip (see http://www.ismp.org/tools/errorproneabbreviations.pdf)
- Never truncate patient names (see Color Use Brief https://sbmi.uth.edu/nccd/SED/Briefs/sedb-g01.htm)
- Use alternating shading of rows in wide tables *(every 1 or 2 rows to help track rows across columns)*

2 To improve task efficiency

- Place the most important columns on the left
- Group together columns (or rows) that are used together

3 To help users find data

- Make the important information stand out (https://sbmi.uth.edu/nccd/SED/Briefs/sedb-g01.htm)
- Use light white space between the rows *(instead of heavy gridlines)*
- Use a different style for headers

Patient	Test	Order Date	Review By >>
Evans, Anna	MRI / F	Mar 3, 2011	Mar 10, 2011 1:12 AM
Parker, Amy	MRI / P	Mar 2, 2011	Mar 9, 2011 11:42 PM

4 To make information readable

- Allow user to adjust font size and adjust the table layout accordingly
- Provide tooltips for icons, headers, or abbreviations when pointer is over them
- Avoid leaving any hanging zeros (e.g. 5.0 vs 5)
- Align numeric values to the right while keeping all other values left-aligned
- Align both the time and the date in a date column *(double alignment)*

Mar 10, 2011 1:12 AM
Mar 9, 2011 11:42 PM

Result Due	Status
February 21, 2011 2:22 PM	Sample drawn and sent

The outside facility should complete the processing of the test and send the results back on this date. (You may change this value)

5 To keep the table compact

- Avoid horizontal scrolling if at all possible *(or indicate that there are more columns)*
- Reduce white space by calculating the initial width of each column from the data in that column
- Allow resizing of columns *(but calculate a minimum and maximum)*
- Only the last column should be stretched to fill horizontal space
- Allow enough space between columns to separate them *(but not more)*

Patient	Test More >>
Hayes, Robert	MRI
Kraft, Amber	Blood (BMP)
Masterson, Jane	TSH

6 For large tables

- Provide search functionality
- Permit re-sorting of tables with a click on the column header *(show sort icons and choose the default sorting carefully)*

7 To indicate editable columns

- Change the mouse pointer when the user moves over an editable field, and add an icon in the column header (e.g. a pen icon)

Patient	Test
Morris, Monica	TSH
Parker, Amy	MRI
Peterson, Audrey	Blood (BMP)

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-g02.htm

SHARPC NCCD

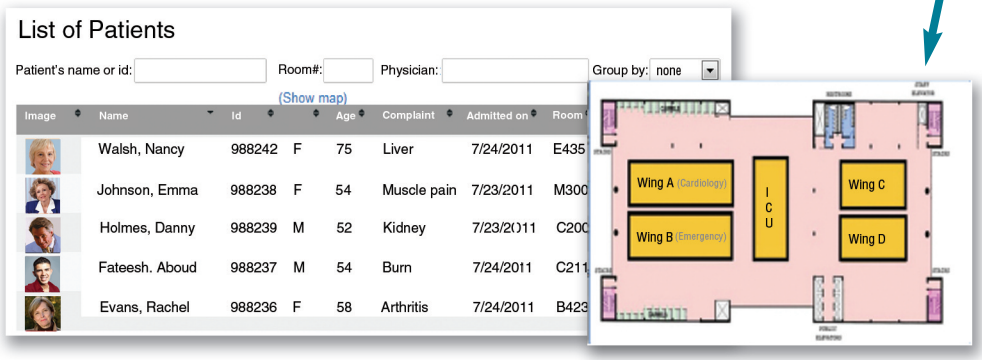
Safety Enhanced Design Brief
Reducing Wrong Patient Selection Errors

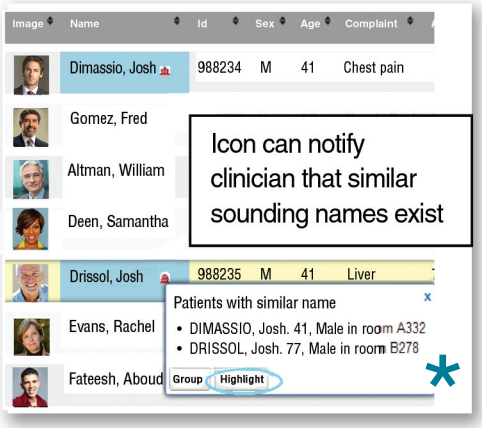
Wrong patient errors are a major issue for patient safety as patients may be harmed from not receiving the test or treatment they need, or from receiving a medication or treatment intended for someone else.

Careful design of the user interface can mitigate the problem by helping providers recall their patients identity, accurately select their name, and realize that an error has occurred before the order is submitted.

1 To help remember patients identity, and locate them in lists

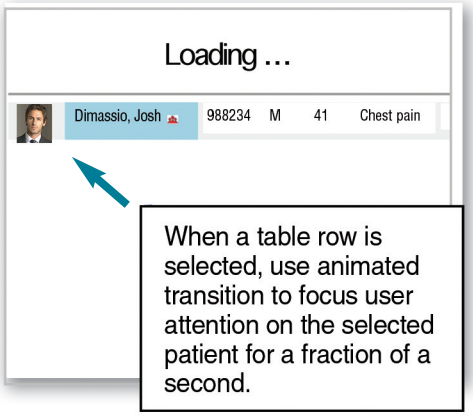
- Never truncate patients' full names
- In addition to the name include photos and/or other patient information (e.g. date of birth, main complaint or diagnosis, etc.)
- Facilitate narrowing list by diagnosis or location e.g. ICU *(could use floor plan)*
- Provide sorting and search (especially for long lists)
- Notify clinicians if similar names exist *





2 To help select a patient in a list

- Maximize font size and contrast to increase readability
- Highlight the row under pointer to make more clear what is selected
- Insert an inactive gap between rows to minimize mouse slips
- Allow selection via keyboard *(e.g. typing "Sm" can filter the list to show only names starting with "Sm". It updates as users type)*
- Provide access to short lists *(e.g. the user's own patients, the patients of other providers the user is covering for, or custom lists created by the user by copying patients from other lists)*
- See https://sbmi.uth.edu/nccd/SED/Briefs/sedb-G02.htm for more information about Effective Table Design

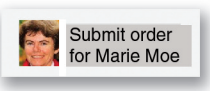


3 To help verify that the correct patient has been selected

- Use animated transitions to focus user attention on the selected patient for a fraction of a second *(e.g. leave the selected row visible on the screen while the screen is being fetched)*
- Detect anomalies as order is being specified *(e.g. Viagra for a young woman?)*
- The banner with patient information should ALWAYS be visible *(i.e. never cover it when opening a window such as order sets or other forms, unless it also includes the banner).*

4 To help verify patient identity again when the order is submitted

- Consider shopping cart metaphor for several orders to be confirmed at once
- Display patient's information in the submit button
- Or place the submit button near the patient information



5 System Design

- Consider allowing only one patient chart opened at a time *(exceptions may be allowed e.g. for comparisons - but you should warn users of danger and provide clear visual differentiation between the records e.g. different background colors)*
- Allow and encourage the reporting of near misses and errors
- Consider identification technology such as barcode or RFID *(Can facilitate login-logout of clinicians, or facilitate selection of nearby patient)*

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-G03.htm

SHARPC NCCD

Safety Enhanced Design Brief
Ensuring Timely Order Results Management

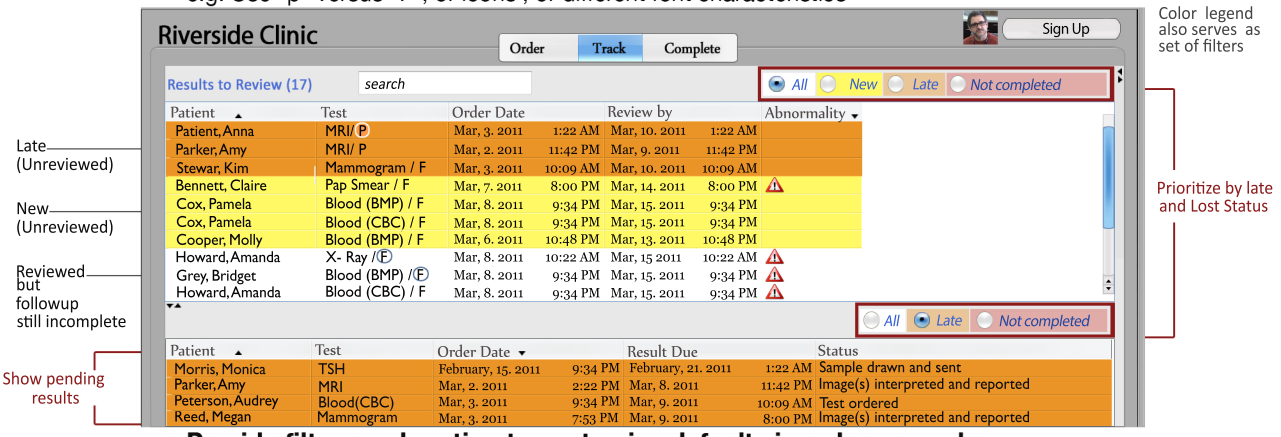
Background: Patient safety concerns arise when results of medical orders are mishandled or lost. Providers need assistance to track their orders in busy and distracting environments, in order to ensure timely medical care. Allowing providers to take action rapidly as they are reviewing results will also increase efficiency and reduce chances of errors (e.g. forgetting to complete the follow-up process).
Institutions need help to track on-time and late processing of tests.

1 To help organizations determine normal and abnormal delays

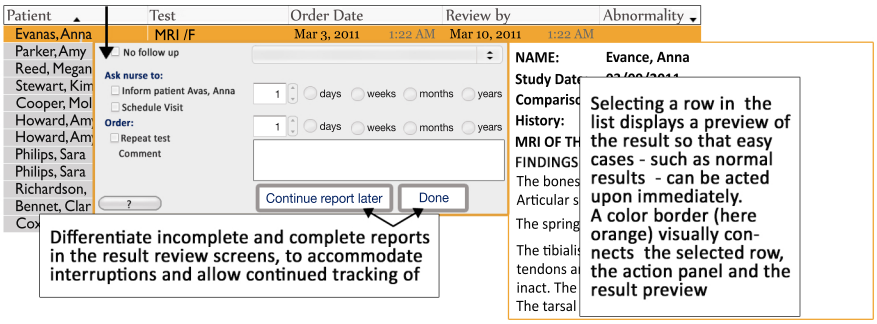
- **Log order completion times per order type, test facilities, operators etc. and provide reports.**
  This will allow organizations to determine what should be considered an abnormal delay. Record at least the time between ordering and return of the results, and when possible record the timing of each step in the process to detect the source of the delays (alternatively consider modeling the multi-step processes)
- **Allow users to define thresholds for abnormal delays**
- **Use those thresholds to tag orders as late or lost**
  (e.g. a blood test sent to an outside facility may be considered late if no results are received after 5 working days, and lost after 10)
- **Allow customization, i.e. not all orders need to be tracked**
  Either allow for manual selection of a few orders for assisted tracking, or track all orders but allow manual de-selection of certain orders or order types that may be tracked "as needed" on a case by case basis

2 To improve safety by improving awareness and reducing missed results

- **Show pending results**
  In addition to the usual list of results to review, give rapid access to a list of pending orders, especially those that have NOT returned after the expected time (i.e. late or lost).
- **Sort tables of results by order of importance for timely management**
  Results that have not been reviewed in a timely manner move to the top of the result list . Next list results that are new, then results that have been reviewed but the follow-up is incomplete.
  Similarly the pending orders that appear to be late or lost move to the top of the pending orders list.
  Support sorting by criticality
- **Distinguish preliminary and final results in the lists of results**
  e.g. Use "p" versus "F", or icons , or different font characteristics



- **Provide filters and sorting to customize default views by user role**
  e.g. while you can support providers by showing only their orders by default, you can support office assistants by showing critical, late or lost results for todays' patients (so they might make appropriate calls to test facilities), or support clinic managers by showing results with late or no follow-up so they could alert providers or reassign results for review.
- **Embed Actions in result tables for quick handling of common/low risk tasks**
  e.g. "inform patient" (while reviewing normal results), or "cancel order" (while reviewing list of pending results)



When possible clarify responsibility
(e.g. indicate the last person or office to take action on the order)
Provide retrospective analysis interfaces to managers
so they can monitor and compare the performance of various order processing facilities, adjust lateness thresholds or take action so late or lost orders can be processed or re-ordered.

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-G04.htm

SHARPC NCCD

Safety Enhanced Design Brief
How to Present Drug-Drug Interaction and Other Alerts

Alerts are broadly used for automated drug-drug, drug-allergy interaction checks and for clinical decision support.

However, alerts are often poorly designed. Users often complain about

- Too many alerts
- Difficulty understanding alerts
- Many steps for responding to alerts
- Difficulty seeking more information or providing feedback about alerts

If alerts are too frequent or are not designed in a meaningful way providers will ignore them.

System Design: Creating a system that utilizes meaningful alerts

1. Reserve interruptive ("modal") alerts only for highest patient risks
2. Classify alerts by their severities (e.g., "Advisory", "Warning", "Danger")
3. Support configuration of who receives alerts (e.g. MD, PharmD, RN)
4. Provide functionalities for the client organization to continually track and adjust alerting policies (e.g. who receives alerts, on what alerts)
5. Provide alerts for at least: drug-drug interactions, drug-allergy interactions, therapeutic duplications, contraindications, dosing error checking, adjuvant therapeutic and monitoring warnings, and formulary status

Screen and Interaction Design: How alerts should look and act

6. Place actionable alerts where users can easily see them:
   a. Near where the potential error was made, or
   b. Near relevant controls (e.g. Order, Cancel)
7. Use consistent formatting to:
   a. Maximize visibility, highlight key information, and
   b. Differentiate types of alerts by color (e.g. red vs. yellow), signal words (e.g. Warning vs. Danger) and/or shape (e.g. inverted triangle vs. rectangle)
8. Provide a list of action options and pre-select recommended or expected provider responses (e.g. cancel order, revise order)

Signal Word

Provide clear visual cues and type of alerts

Nature of hazard

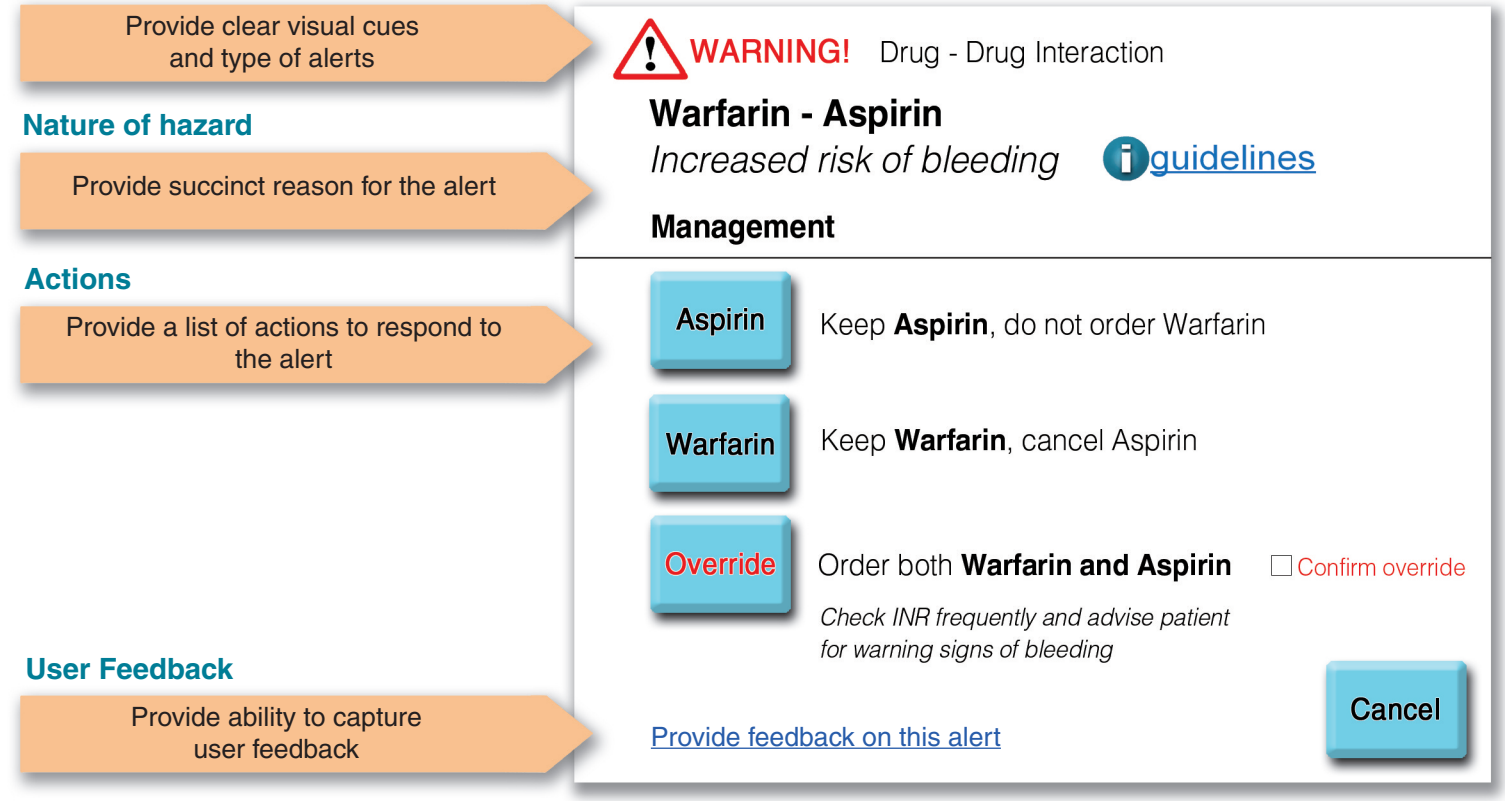
Provide succinct reason for the alert

Actions

Provide a list of actions to respond to the alert

User Feedback

Provide ability to capture user feedback



Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-MU01.htm

SHARPC NCCD

Safety Enhanced Design Brief

Medication Lists

To be effective at improving health, medication lists must give providers a quick holistic view of the patient, but also help them make specific treatment decisions.

Useful medication lists are challenging to design, because of the complexity and time course of medication information and the variety of tasks that they support.

1 Design medication lists to support key user tasks including

- An overview of what the patient is currently taking
- Managing treatment decisions
- Renewing medications
- Reconciling medications
- Reviewing time course
- Managing temporary changes
- Reviewing treatment that was effective or ineffective
- Assessing adherence

2 To give a quick overview, use a simple list of current medications that emphasizes drug names (and then strengths) and de-emphasizes other information:

Bad

Current medications: (selected)
Prescriptions
Ordered
- albuterol HFA prn (90mcg/spray) (ProAir HFA) oral spray; 90 mcg/spray, 2 puffs, oral, every 4 hours as needed, 21.6 mg/1 unit
- beclomethasone HFA (QVAR 40 HFA) oral spray; 40 mcg/spray; 40 mcg/spray, 2 puffs, oral, twice a day, 9.6 mg/1 unit
- carvedilol 25 mg oral tablet; 25 mg 1 tablet, oral, 2 times a day, 180 tablets
- chlorthalidone 25 mg oral tablet; 25 mg 1 tablet, oral, daily, 90 tablets
- citalopram 20 mg oral tablet; 20 mg 1 tablet, oral, daily, 90 tablets
- gabapentin 600 mg oral tablet; 600 mg 1 tablet, oral, 2 times a day, 180 tablets
- insulin glargine (Lantus) 40 units subcut at bedtime, 10 ml
- losartan 100 mg oral tablet; 100 mg, 1 tablet, oral, daily, 90 tablets
- metformin 1000 mg oral tablet; 100 mg, 1 tablet, oral, 2 times a day, 180 tablets

Good

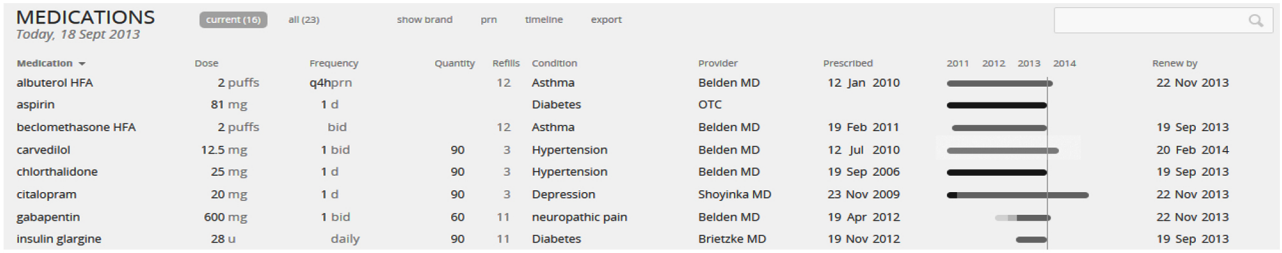
Medications
Last updated 1 month ago

albuterol HFA 90mcg/spray 2 puffs every 4 hr as needed
aspirin 81mg 1 tablet daily
beclomethasone HFA (QVAR 40 HFA) 40mcg/spray 2 puffs daily
carvedilol 25mg 1 twice daily
chlorthalidone 25mg 1 tablet daily
citalopram 20mg 1 tablet daily
gabapentin 600mg 1 twice daily
insulin glargine (Lantus) 40 units 1 at bedtime
losartan 100mg 1 daily
lisinopril 20mg 1 daily
metformin 1000mg 1 twice daily

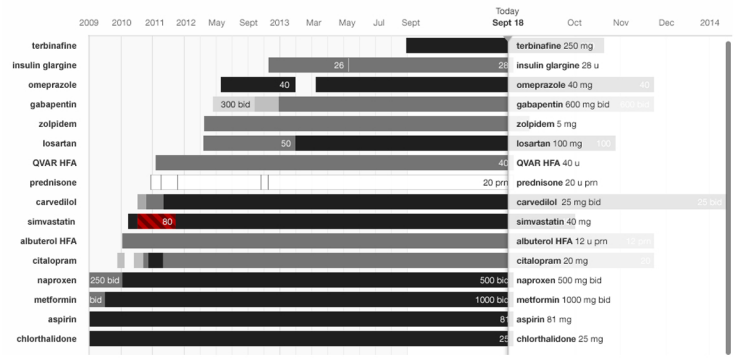
Better

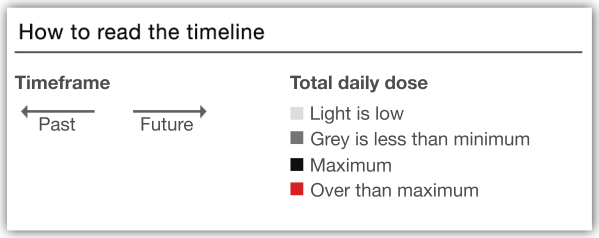
Medication	Instructions
albuterol HFA 90 mg	2 puffs every 4 hours as needed
aspirin 81 mg	1 daily
beclomethasone HFA 40	2 puffs twice daily
carvedilol 25 mg	1 twice daily
chlorthalidone 25 mg	1 daily
citalopram 20 mg	1 daily
gabapentin 600 mg	1 twice daily
insulin glargine 28 units	28 units at bedtime
losartan 100 mg	1 daily
metformin 1000 mg	1 twice daily
naproxen 500 mg	1 twice daily
omeprazole 40 mg	1 daily
prednisone 20 mg	2 daily

3 To support detailed decision making use a detailed interactive table that is compact, easy to read, and quickly sortable and searchable:



4 To support an understanding of the time course of treatment, use an interactive timeline that shows dose (relative to maximum dose) at a glance:





Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-MU02.htm

SHARPC NCCD

Safety Enhanced Design Brief

Medication Allergy Lists

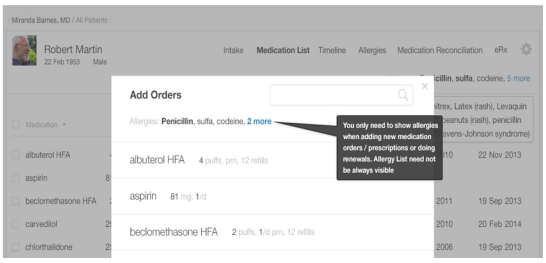
The allergy list contains drug allergies and adverse reactions. An accurate allergy list is a safety net that can prevent allergic reactions that range from minor to fatal.

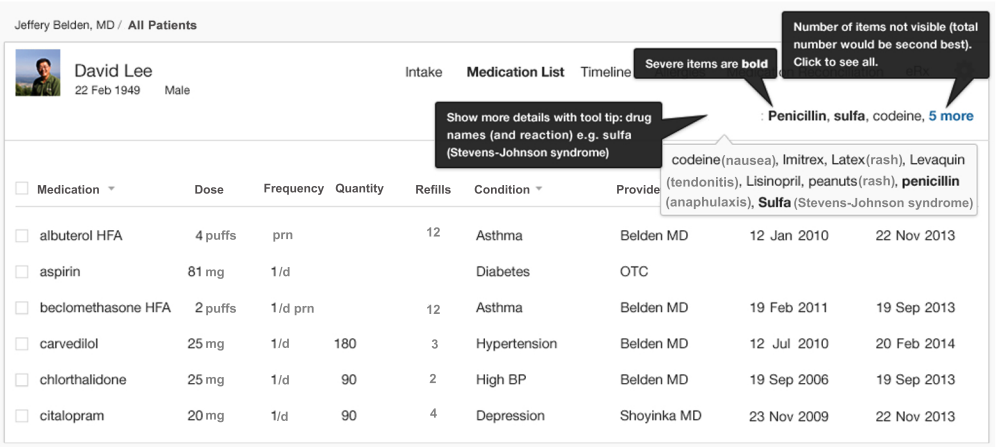
Design challenges include providing a quick overview, providing details on demand, displaying allergy information at the point it is needed, and making it easy to change the list.

1 Design allergy lists to support key user tasks including

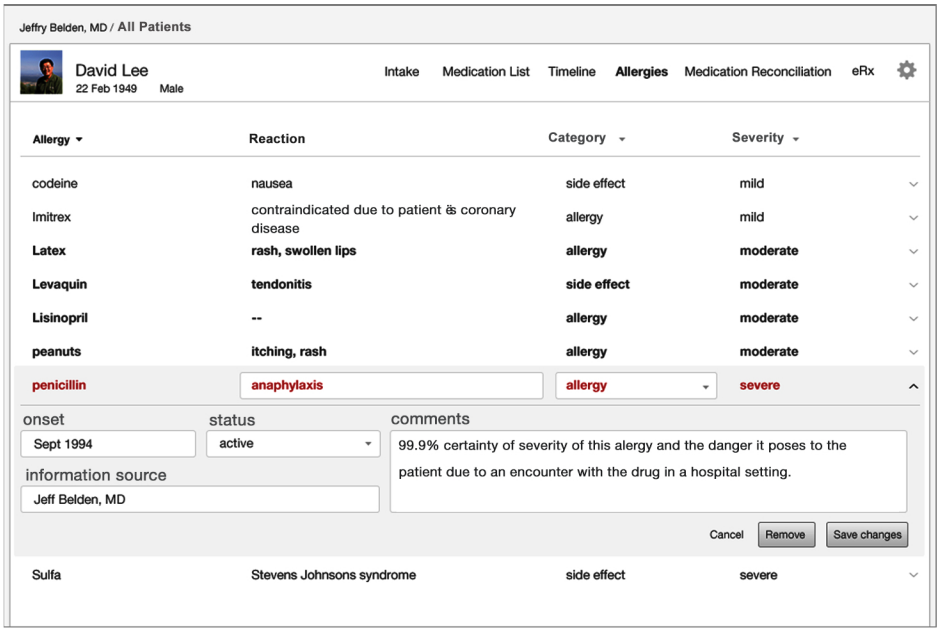
- Quickly determining whether a patient has any known allergies
- Exploring details about an allergy, such as its severity, when it occurred, and how certain we are about it
- Quickly and easily entering that a patient has no known medication allergies
- Quickly and easily changing the list
- Glancing at the list while ordering a new medication

2 To make it easy to see if a patient has allergies, provide a short list of allergies in a location that is always visible when adding new medication orders / prescriptions, such as in ordering / renewing screens, or in the patient banner:

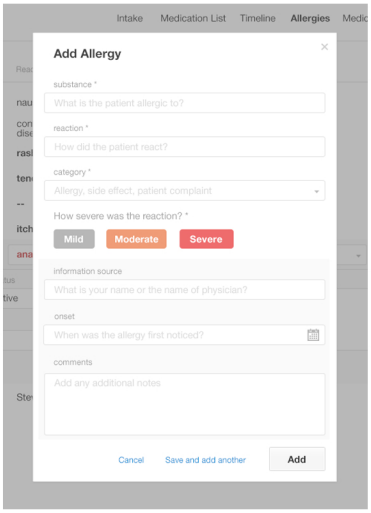




3 To support detailed decision making use a detailed table view that visually highlights the most important information and shows further details on demand:



4 To make the list easy to maintain, make adding and revising entries simple with a clear visual flow and most information optional:



Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-MU03.htm

Safety Enhanced Design Brief
Clinical Decision Support

Clinical decision support (CDS) systems bring relevant information to the clinician at the point of decision making.

Implementing CDS systems presents many challenges such as:

- Complex system constraints
- Complex nature of information to be displayed
- Challenging human-computer interaction design
- Organizational and change management to ensure system adoption

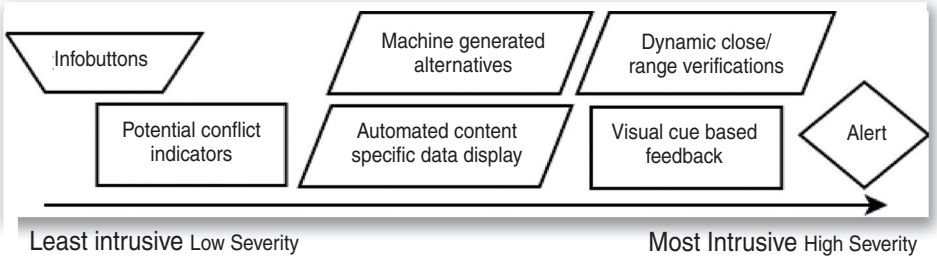
CDS is one of the most complex sub-systems available in EHR systems. This document reviews guidelines to *design useful and usable CDS interventions.*

1 To create useful, consistent and reliable communication of support material to the user

- Ensure your CDS system is capable of identifying preventable errors and informing the user of potential clinical hazards
- Adapt CDS interventions to the clinical workflow and not the opposite
- Create a system that supports human decision making rather than corrects it (e.g. give feed back on entered data as opposed to changing it automatically)
- Clearly differentiate alerts and interventions according to their type
- Show decision support elements near corresponding data entry fields or buttons
- Classify decision support elements (e.g. rules and alerts) by severity levels
- Incorporate insurance coverage information into the CDS scope
- Match the intrusiveness of the CDS intervention to the severity level of the problem

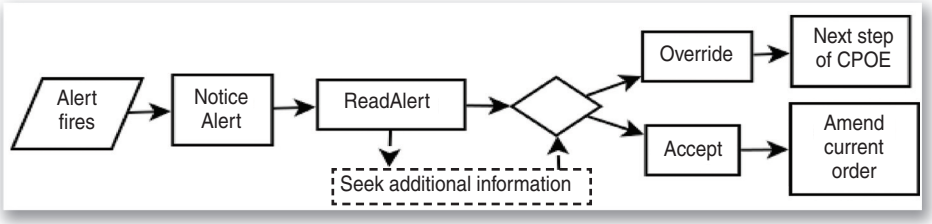
2 To prevent alert fatigue, provide support beyond alerting

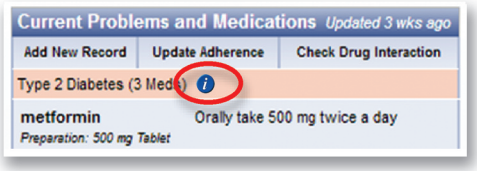
- Use indicators to signal potential conflicts before triggering an alert
- Provide reduced lists of options based on context (e.g. a short list of clinically appropriate painkillers is presented when pain is entered as the chief complaint)
- Consider including automated machine-generated information views and automatic context-specific data display functions



3 Use alerts for high risks to patient safety (https://sbmi.uth.edu/nccd/SED/Briefs/sedb-mu01.htm)

- Ensure alerts allow provider to control alerted order items by providing direct access to order management
- Block *action completion* until critical alerts are reviewed and acknowledged
- Ensure that alerts contain all necessary information to make a sound decision





4 To deliver context information without overwhelming the user, use integrated context aids such as infobuttons

- Present infobuttons throughout the system
- Provide information and links to information sources for all evidence shown
- Provide chronology information on evidence delivered by the system

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-mu04.htm

Safety Enhanced Design Brief
Preventing Electronic Medication Order Errors

Electronic prescribing, or e-Prescribing, allows licensed healthcare providers to electronically generate and submit medication prescriptions to a dispensary.

The data entered by the clinician is key to the safe treatment of the patient as it will be direct and seamlessly transmitted to the pharmacy where it will be verified, then perfected and medications dispensed to the patient. The original data should, therefore, be as clean as possible.

In this document we present guidelines for safer medication ordering and e-prescribing interface design.

1 To support accurate data entry and provide flexible order entry forms

As e-prescribing requires electronic transmission of information, the system should support the following types of orders: ***classic form entry, tapered dose entry, atypical dosage entry, additive, compounding and free text entry*** (equivalent to a semi-structured paper script)

2 To improve ordering flexibility, allow multiple script delivery modes

There are many logistic barriers in clinical field work, therefore multiple pharmacy selection and order routing options should be available to the user when e-prescribing:

- Send to usual pharmacy
- Send to a different pharmacy
- Do not e-prescribe and print order
- Do not e-prescribe and save for later
- Cancel order

3 To support patient-set constraints, allow multiple dispensing locations

Clinicians have reported a frequent need to write two prescriptions under one order due to mail-order pharmacy delays.

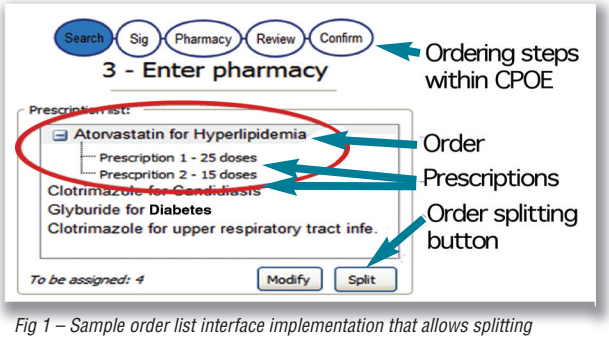


Fig 1 – Sample order list interface implementation that allows splitting medication orders into multiple scripts.

4 To improve context awareness

- Present alerts during medication order entry
- Present alerts at different stages of the ordering process
- Do not present all alert information at the end of the workflow
- Do not interrupt the user with modal alerts unless there are high patient risks

5 To avoid work duplication and streamline order entry

- present early non-intrusive alert indicators with simplified 'traffic light' indicator in real time

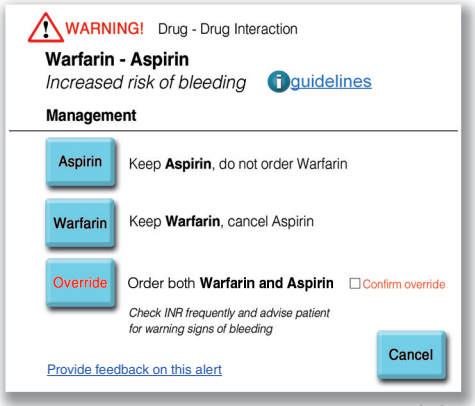


Fig 2 – Example of a drug interaction alert fired during CPOE ordering of Warfarin
(See https://sbmi.uth.edu/nccd/SED/Briefs/sedb-mu04.htm for more information about Alerts)

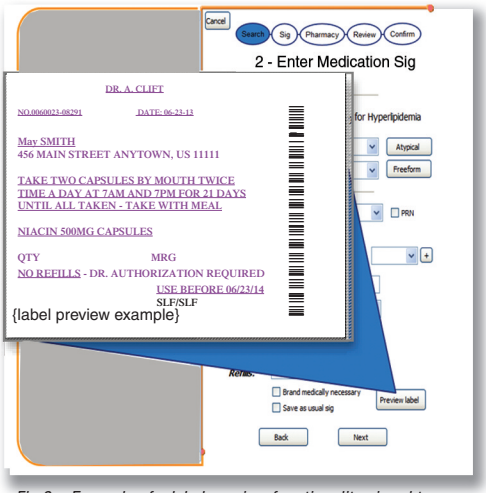


Fig 3 – Example of a label preview functionality aimed to review patient instructions

6 To ensure the clarity of written patient instructions

- Provide label preview functionality

7 To support medication selection present insurance coverage information

- This supports clinician decision making to ensure a viable drug selection that the patient is able to afford and is willing to pay for from the beginning

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/sedb-MU05.htm

Safety Enhanced Design Brief

Clinical Information Reconciliation: Medications

Accurate medication reconciliation at transitions of care can reduce costly adverse events. Reconciliation involves comparing two or more lists of medications to determine the appropriate meds for a patient. Careful user interface design can decrease the cognitive complexity of this task, thereby reducing errors and task time.

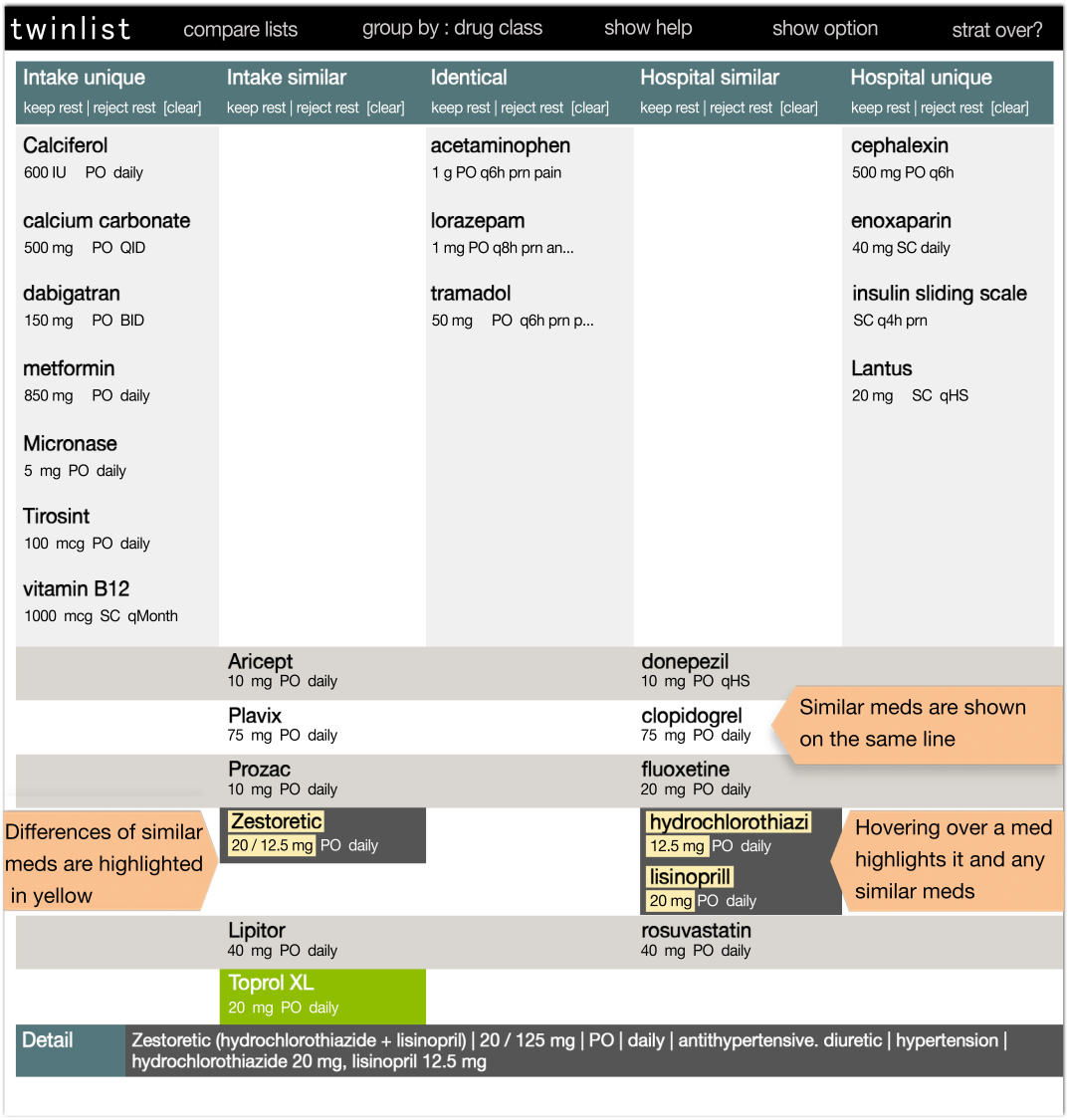
1. Visually indicate unique , similar, and identical from each list

Columns show unique, similar and identical drugs

2. Sparingly use visual properties (such as size, color, and positioning) to make important information stand out

Names are in bold and on a separate line from other details

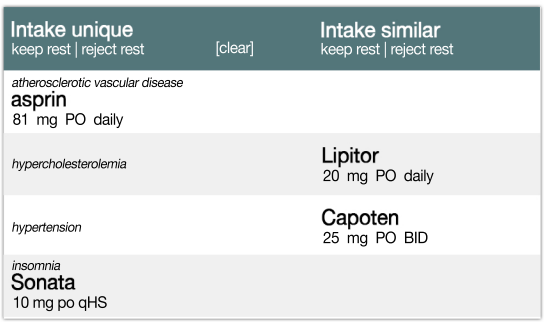
3. Avoid error-prone medication abbreviations (e.g., AD, OD, QD), symbols, and dose designations.



4. Conveniently show complete pharmacological information

http://www.ismp.org/tools/abbreviations/

5. Support grouping by therapeutic intent, class, or associated diagnoses



Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-mu06.htm

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Safety Enhanced Design Brief

Problem List

Problem Lists are a comprehensive record of a patient's health issues and ensure continuity of care between providers.

User challenges with problem lists include keeping problems updated (i.e. adding new, revising current, or removing old) and linking problems with ICD codes for billing and documentation purposes.

Providers use the problem list for three main tasks:

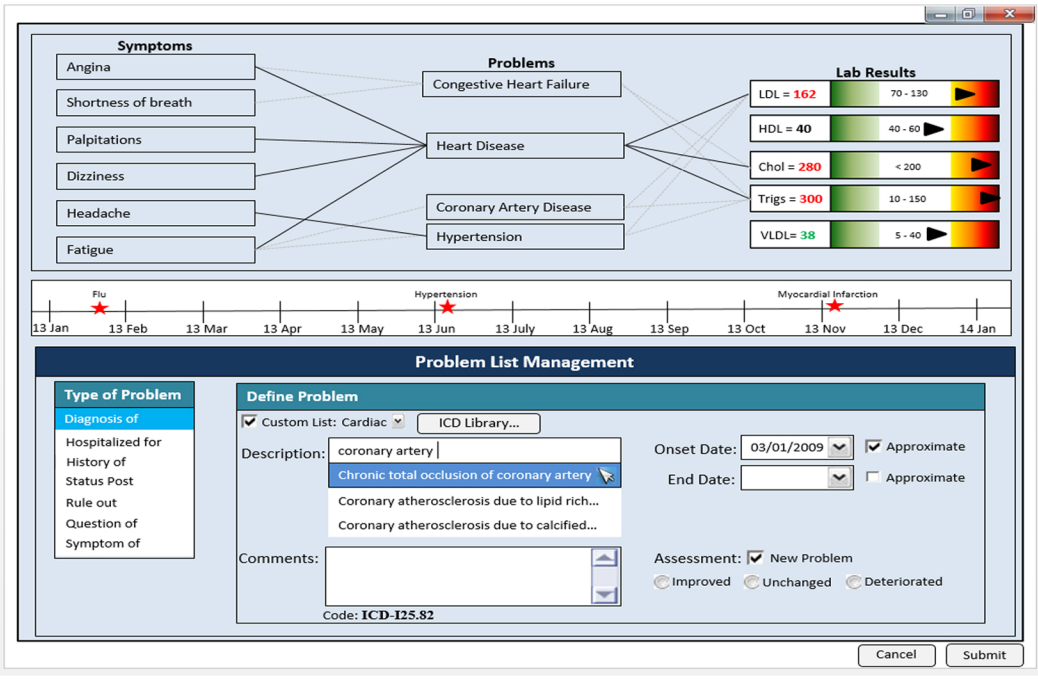
- Understanding the patient's health problems
- Keeping the list up to date and accurate
- Creating links between related documentation (e.g. orders to visit notes or billing).

1 Simplify viewing of **problem lists**

- **Set active problems as the default view**
  but provide easy access to past problems in a list or a timeline format
- **Provide filter and sorting functionality**
  Ex: by specialty, date, bodily system, chronic vs. acute, alphabetical, etc.
- **Provide functionality for customization of sorting**
  Ex: for cardiologists cardiac problems should be first, and orthopedic problems below
- **Provide ability to add uncommon problems via ICD library search and allow the functionality for both keyword and specific code searches**
  Ex: a family practice physician needs to add a problem for a rarely treated hand, foot & mouth disease that doesn't exist on her 'favorites' list

2 Simplify tasks for **efficient problem list management**

- **Allow users to access the patient's chart from the problem list**
- **Allow users to add, update and remove problems throughout their workflow; support different cognitive models (e.g. SOAP note vs. comprehensive listing)**
  Ex: adding a problem during ordering, without losing their place in ordering workflow
- **Consider specialty-specific lists of commonly encountered problems**
  Ex: cardiology, orthopedic, etc.
- **Categorize problems as new, improved, unchanged or deteriorated**
- **Allow providers the ability to add their own comments to problems**
- **Facilitate documentation by:**
  - Automatically populating visit notes with the problem list
  - Suggesting related ICD or billing codes to speed data entry
  - Linking problems to commonly prescribed medications and orders
    Ex: Upper Respiratory Tract Infection linked to Amoxicillin and CBC orders
  - Provide links to recommended protocols (e.g. preventative care)



Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-mu06.htm

Safety Enhanced Design Brief

Computerized Physician Order Entry (CPOE)

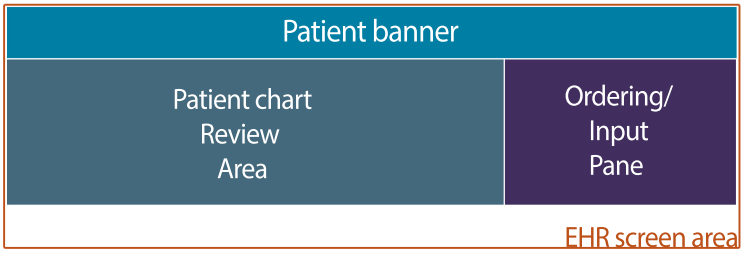
Computerized Physician Order Entry (CPOE) is a functionality for placing, changing, and accessing orders for medications, lab, and imaging at a minimum.

CPOE can improve quality and safety, but design challenges can reduce the positive impact of CPOE and lead to errors and inefficiencies. Some barriers to usable CPOE are:

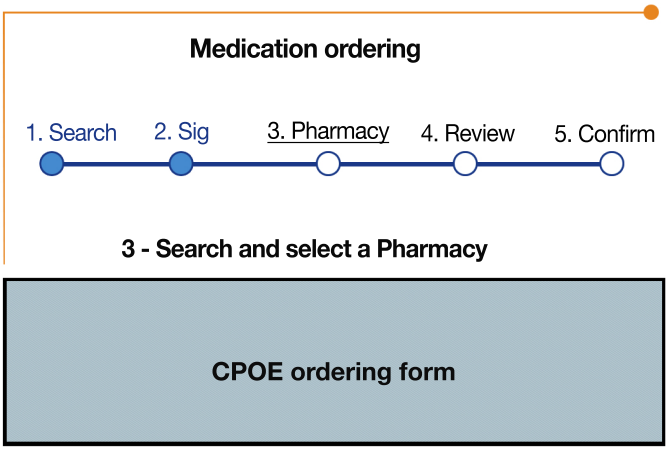
- Limited chart visibility while ordering
- Complex navigation of ordering functions
- Repetitive interactions due to non-automated ordering
- Inconsistent displays and interaction modes

1 Provide key information for CPOE task without the need to navigate to different screens.

- Key information includes patient name, date of birth, allergies, weight, age, lactate status, active medications access to imaging/lab results. *For example*, show the ordering form in a different window, but allow simultaneous interaction with the patient chart window or show patient charts and ordering forms side by side.



2 Provide feedback on which step in the ordering process the user has completed and how many more steps are required.



Example of CPOE interface that provides feedback on ordering process steps

3 Allow streamlined data entry processes with double-checks to ensure safety

- Allow the creation of template or default data entry forms for commonly ordered elements at the enterprise level (e.g. favorites, preferences, saved order sets, etc.)
- Support the creation of pre-approved templates and provider-specific defaults derived from enterprise order sets (e.g. medication typically prescribed together in specific doses, lab order sets, etc.)
- Provide automated Clinical Decision Support to ensure safety and optimal decision making for the use of template and default entries (https://sbmi.uth.edu/nccd/SED/Briefs/sedb-mu01.htm) Potential CDS support for streamlined ordering processes include but are not limited to: dose range checking, medication label previews, and alerts
- Always include an order verification step before order submission (e.g. a screen with all order data as a table along with confirm, modify and cancel action buttons)

4 Ensure interaction design consistency across order entry interfaces for different order types

- Use the same workflow for all order types (e.g. order search, entry form details, selection of dispensing location, full order review, confirmation)
- While searching for orders, include all order types unless searching in a specific context (e.g. for general new order include all orders, for new order launched from the current meds screen include only medication orders)

Learn more at https://sbmi.uth.edu/nccd/SED/Briefs/info/sedb-mu08.htm

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