Safety Enhanced Design Brief **Making Effective Use of Color**

Endocrine Events

Smoking Hx:

MicroAlb/Cr:

GFR (non AA):

GFR (AA):

Wt:

BMI: 0

HGB:

K+:

Cr:

Glu:

HbA1c:

BP: H 178/80 mmHg

14.3 g/dL

0.84 mg/dL

85.300 kg/188 lbs

hemolyzed mmol/L

18.3 mcg/mg Creat

112.22 mL/min

92.59 mL/min

105 mg/dL

5.7%

Non Smoker/History of Smoking

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.

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

high (orange) / low (blue) values

To group items into 2 different categories

values

6

-Use no more than 7 colors (4 recommended)

- Vary color intensity from pale (low values) to darker (extreme values)

A To ensure consistency, learnability, and to prevent misinterpretation, create rules for: - Colors for critical values items

- Colors for severity of warnings and alerts. etc.
- Colors for different categories of

differentiators (tooltips,

symbols, icons, positions)

- Colors combined with

Mouse-over text explains dot coloring



patient did not meet this

performance goal

(03/02/10) H169/84 mmHg

0

85.400 kg/181 lbs

Non Smoker

16.0 g/dL

3.8 mmol/L

0.86 mg/dL

H 52.8 mcg/mg Creat

109.21 mL/min

90.11 mL/min

H123 mg/dL

5.8%

(12/30/09)

(02/08/10)

(03/02/10)

(03/02/10)

(03/02/10)

(10/05/09)

(03/02/10)

(03/02/10)

(03/02/10)

(10/05/09)

-Use text, tooltips or legends

To ease understanding

and learnability of

colors

- 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
- 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)



-~~~

w

2012 2012 2012

May, une, July,

 (12/30/09)

(12/29/09)

(02/01/10)

(12/14/09)

(12/21/09)

(12/21/09)

(12/21/09)

(11/14/08)

(12/21/09)

(12/21/09)

(12/21/09)

(03/18/09)

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



430

431

3 00:54:00)

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/errorprone abbreviations.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	<u>/</u> >>
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 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)

More >>

The outside facility

5 To keep the table compact

- Avoid horizontal scrolling if at all possible (or indicate that there are more columns)

Test

MRI

TSH

Blood (BMP)

- 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)

	_		
6) For	large	tables
•		iui go	Labio0

Patient

Hayes, Robert

Kraft, Amber Masterson, Jane

- Provide search functionality
- Permit re-sorting of tables with a click on the column header (show sort icons and choose the default sorting carefully)
- 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)
- PatientTestIMorris, MonicaTSHParker, AmyMRIPeterson, AudreyBlood (BMP)





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.

Image 🎙	Name	● Id ● Sex ● Age ● Complaint ● /						
B	Dimassio, Josh 🛓	988234 M 41 Chest pain						
R	Gomez, Fred	Icon can notify						
B	Altman, William	clinician that similar						
<u>@</u>	Deen, Samantha	sounding names exist						
25.	Drissol, Josh 🏻 🛔	988235 M 41 Liver						
	Evans, Rachel	Patients with similar name × • DIMASSIO, Josh. 41, Male in room A332 • DRISSOL, Josh. 77, Male in room B278						
	Fateesh, Aboud	Group Highlight						



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 +

List of Patients

Patient's nan	ne or id:		Room#:		Physician:		Group	oy: none 💌		
Image 🎈	Name	ld 🕈	(Show ma	ap) Age •	Complaint 🎈	Admitted on [©]	Room	All the second s		
(2)	Walsh, Nancy	988242	? F	75	Liver	7/24/2011	E435			
9	Johnson, Emma	988238	F	54	Muscle pain	7/23/2011	М300 •	Wing A (Cardiology)	I C	Wing C
	Holmes, Danny	988239	м	52	Kidney	7/23/2()11	C20C	Wing B (Emergency)	U	Wing D
S	Fateesh. Aboud	988237	м	54	Burn	7/24/2011	C211		-	
	Evans, Rachel	988236	F	58	Arthritis	7/24/2011	B423			
										644790

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)

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)

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

- Consider shopping cart metaphor for several orders to be confirmed at once

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)

- 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
- 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).
- Display patient's information in the submit button
- Or place the submit button near the patient information
- 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

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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.

When possible clarify respon-

(e.g. indicate the last person or

interfaces to managers

office to take action on the order)

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

Provide retrospective analysis

sibility

or re-ordered.

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

	Diverside Clini	~								Sign Up	Co	lor legend
	Riverside Clini	L	C	Order	Track	Comp	lete				set	t of filters
	Results to Review (17	search						💿 All 🔘 N	New 🔘 Late 🔘 Not com	pleted		
	Patient 🔺	Test	Order Dat	e	Review	/ by		Abnormality				
	Patient, Anna	MRI/P	Mar, 3. 201	1 1:22 Al	M Mar, 10	0. 2011	1:22 AM					
Late	Parker, Amy	MRI/ P	Mar, 2. 201	1 11:42 PI	M Mar, 9.	2011	11:42 PM					
(Unreviewed)	Stewar, Kim	Mammogram / F	Mar, 3. 201	1 10:09 Al	M Mar, 10). 2011	10:09 AM					
	Bennett, Claire	Pap Smear / F	Mar, 7. 201	1 8:00 PI	M Mar, 14	. 2011	8:00 PM	Δ			Pri	oritize by late
New	Cox, Pamela	Blood (BMP) / F	Mar, 8. 201	1 9:34 PI	M Mar, 15	5. 2011	9:34 PM				an	d Lost Status
(Unreviewed)	Cox, Pamela	Blood (CBC) / F	Mar, 8. 201	1 9:34 PI	M Mar, 15	. 2011	9:34 PM				- L - L	
(011101101104)	Cooper, Molly	Blood (BMP) / F	Mar, 6. 201	1 10:48 Pl	M Mar, 13	3. 2011	10:48 PM					
	Howard, Amanda	X- Ray /🕑	Mar, 8. 201	1 10:22 Al	M Mar, 15	5 2011	10:22 AM					
Reviewed	Grey, Bridget	Blood (BMP) /E	Mar, 8. 201	1 9:34 PI	M Mar, 15	5.2011	9:34 PM			<u> </u>		
followup	Howard, Amanda	Blood (CBC) / F	Mar, 8. 201	1 9:34 PI	M Mar, 15	5. 2011	9:34 PM			•		
still incomplete	~								🔵 All 💿 Late 🔵 Not	completed		
	Patient 🔺	Test	Order Date	•	Res	ult Due		Status	s			
Chausenaling	Morris, Monica	TSH	February, 15.	2011 9:3	4 PM Feb	ruary, 21	. 2011	1:22 AM Sampl	e drawn and sent			
Show pending	Parker, Amy	MRI	Mar, 2. 2011	2:2:	2 PM Mar	, 8. 2011		11:42 PM Image	(s) interpreted and reporte	d		
results	Peterson, Audrey	Blood(CBC)	Mar, 3. 2011	9:3	4 PM Mar	, 9. 2011	1	10:09 AM Test c	ordered			
	Reed, Megan	Mammogram	Mar, 3. 2011	7:53	3 PM Mar	, 9. 2011		8:00 PM Image	(s) interpreted and reporte	d		

· 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)	Patient	Test	Order Date	Review by	(Abnormality 🗸	
	Evanas, Anna	MRI /F	Mar 3, 2011 1:22 AM	Mar 10, 20	11 1:22 A	M	
	Parker, Amy	No follow up		=	NAME:	Evance, Anna	
	Reed, Megan	Ask nurse to:			Study Date		
	Stewart, Kim	Inform patient Avas, Anna	1 days weeks mo	onths vears	Study Date		
	Cooper, Mol	Schedule Visit			Compariso	Selecting a row in the	
	Howard, Am	Order:	1 davs weeks m	onths vears	History:	list displays a preview of	
	Howard, Am	Repeat test			MRI OF TH	the result so that easy	
	Philips, Sara	Comment			FINDINGS	cases - such as normal	
	Philips, Sara				The bones	results - can be acted	
	Richardson,		Continue report later	ne	Articular c	upon immediately.	
	Bennet, Clar	?	Continue report later		Articulars	A color border (bere	
	Cox				The spring	orange) visually con-	
	Differe	entiate incomplete	and complete reports		The tibiali	nects the selected row	
	in the	result review scre	ens, to accommodate		tendons a	the action papel and the	
	interri	uptions and allow (continued tracking of		inact The	the action parter and the	
	L				macc. The	result preview	
					The tarsal		

SHAF



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
- Classify alerts by their severities (e.g., "Advisory", "Warning", "Danger")
- Support configuration of who receives alerts (e.g. MD, PharmD, RN)
- Provide functionalities for the client organization to continually track and adjust alerting policies (e.g. who receives alerts, on what alerts)
- Provide alerts for at least: drugdrug 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)

Provide clear visual cues WARNING! Drug - Drug Interaction and type of alerts Warfarin - Aspirin Nature of hazard **guidelines** Increased risk of bleeding Provide succinct reason for the alert Management Actions Aspirin Keep Aspirin, do not order Warfarin Provide a list of actions to respond to the alert Keep Warfarin, cancel Aspirin Warfarin Override Order both Warfarin and Aspirin Confirm override Check INR frequently and advise patient for warning signs of bleeding **User Feedback** Cancel Provide ability to capture Provide feedback on this alert user feedback

SHARPC

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

Signal Word

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.

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	Good	Better	
 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, 140 mblate 	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	Better Medication albuterol HFA 90 mg aspirin 81 mg beclomethasone HFA 40 carvedilol 25 mg chlorthalidone 25 mg	Instructions 2 puffs every 4 hours as needed 1 daily 2 puffs twice daily 1 twice daily 1 daily
 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, 2 times a day, 180 tablets metformin 1000 mg oral tablet; 100 mg, 1 tablet, oral, 2 times a day, 180 tablets 	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	citalopram 20 mg gabapentin 600 mg insulin glargine 28 units losartan 100 mg metformin 1000 mg naproxen 500 mg omeprazole 40 mg prednisone 20 mg	1 daily 1 twice daily 28 units at bedtime 1 daily 1 twice daily 1 daily 1 daily 2 daily

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

MEDICATIONS Today, 18 Sept 2013	current (16)	all (23)	show brand p	im	timeline export					q
Medication -	Dose	Frequency	Quantity	Refills	Condition	Provider	Prescribed	2011 2012 2013	2014	Renew by
albuterol HFA	2 puffs	q4hprn		12	Asthma	Belden MD	12 Jan 2010		•	22 Nov 2013
aspirin	81 mg	1 d			Diabetes	отс				
beclomethasone HFA	2 puffs	bid		12	Asthma	Belden MD	19 Feb 2011			19 Sep 2013
carvedilol	12.5 mg	1 bid	90	3	Hypertension	Belden MD	12 Jul 2010		-	20 Feb 2014
chlorthalidone	25 mg	1 d	90	3	Hypertension	Belden MD	19 Sep 2006			19 Sep 2013
citalopram	20 mg	1 d	90	з	Depression	Shoyinka MD	23 Nov 2009		_	22 Nov 2013
gabapentin	600 mg	1 bid	60	11	neuropathic pain	Belden MD	19 Apr 2012	-	•	22 Nov 2013
insulin glargine	28 u	daily	90	11	Diabetes	Brietzke MD	19 Nov 2012	_		19 Sep 2013

4 To support an understanding of the time course of treatment, use an interactive timeline that shows dose (relative to







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.

Robert Martin

Add Orders

albuterol HFA

beclomethasone HFA 2 pulls, 1/d pm, 12

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:

Jeffery Belden, MD / All Patie	ents							Number of ite	ems not visible (tota Id be second best).
David Lee 22 Feb 1949 M	lale			Intake	Medication List	Timeline	vere items are bol	d Click to see a	all. on eRx
				Sh	ow more details with mes (and reaction)	n tool tip: drug e.g. sulfa		Penicillin, sulfa	, codeine, 5 mor
Madlardan -	Deer	Frequency	Quantity	(St	evens-Johnson sync	lrome)	codeine(nause (tendonitis), Lis	ea), Imitrex, Latex sinopril, peanuts(i	(rash), Levaquin rash), penicillin
Medication *	Dose	Frequency	Quantity	Refills	Condition *	Provide	(anaphulaxis),	Sulfa (Stevens-Jo	hnson syndrome
albuterol HFA	4 puffs	prn		12	Asthma	Belden	MD 12	2 Jan 2010	22 Nov 2013
aspirin	81 mg	1 /d			Diabetes	OTC			
beclomethasone HFA	2 puffs	1/d prn		12	Asthma	Belden	MD 19	9 Feb 2011	19 Sep 2013
carvedilol	25 mg	1 /d	180	3	Hypertension	Belden	MD 12	2 Jul 2010	20 Feb 2014
chlorthalidone	25 mg	1/d	90	2	High BP	Belden	MD 19	9 Sep 2006	19 Sep 2013
citalopram	20 mg	1/d	90	4	Depression	Shoyin	ka MD 23	3 Nov 2009	22 Nov 2013

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

Jeffry Belden, MD / All Patients							
David Lee 22 Feb 1949 Male		Intake	Medication List	Timeline	Allergies	Medication Reconciliation	eRx 🐇
Allergy 👻	Reaction			Category	•	Severity -	
codeine	nausea			side eff	ect	mild	
Imitrex	contraindi disease	cated due to patier	nt ës coronary	allergy		mild	
Latex	rash, swol	len lips		allergy		moderate	
Levaquin	tendonitis			side eff	ect	moderate	
Lisinopril				allergy		moderate	
peanuts	itching, ra	sh		allergy		moderate	
penicillin	anaphylax	is		allergy		- severe	
onset	status	comn	nents				
Sept 1994	active	• 99.99	6 certainty of sev	verity of this	alergy and	d the danger it poses to th	е
information source		patier	nt due to an enco	ounter with	the drug in	a hospital setting.	
Jeff Belden, MD							
						Cancel Remove S	Save changes
Sulfa	Stevens Jo	hnsons syndrome		side eff	ect	severe	

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

Add Allergy subtance * What is the patient allergic to? reactor * How did the patient react? adjoy.* Allergy, side effect, patient complaint How severe was the reaction? * Mid Moderato Severe What is your name or the name of physician? ocide When was the allergy first noticed? Add any additional notes		Intake	Medication List	Timeline	Allergi
substance * Substance * What is the patient allergic to? reactor * How did the patient react? Allergy, side effect, patient complaint How severe was the reaction? * Mid Moderato Severe What is your name or the name of physician? ocset When was the allergy first noticed? Add any additional notes	Add Aller	gy			
What is the patient allergic to? What is the patient allergic to? What is the patient react? How dd the patient react? How dd the patient react? How severe was the reaction?* Mild Moderate Severe Information source What is your name or the name of physician? onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset What is your name or the name of physician? Onset Add any additional notes	substance *				
reaction * r					
How did the patient react? How did the patient react? Category* Allergy, side effect, patient comptaint How server was the reaction?* Mid Moderate Servere What is your name or the name of physician? Conset When was the allergy first noticed? Comments Ad any additional notes	reaction *				
category * Allergy, side effect, patient comptaint How severe was the reaction? * If the Moderate Severe Indemation source What is your name or the name of physician? onset What is your name or the name of physician? onset Add any additional notes	How did the				
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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 subsystems available in EHR systems. This document reviews guidelines to *design useful and usable CDS interventions.*

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)

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



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
- Consider including automated machine-generated information views and automatic contextspecific data display functions





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

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

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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.



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

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 semistructured 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



6 To ensure the clarity of written patient instructions

- Provide label preview functionality

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.

Intake unique	Intake similar	Identical	Hospital similar	alaari	Hospital unique
Calciferol 600 IU PO daily		acetaminophen 1 g PO q6h prn pain		clearj	cephalexin 500 mg PO q6h
calcium carbonate		lorazepam 1 mg PO q8h prn an			enoxaparin 40 mg SC daily
dabigatran 150 mg PO BID		tramadol 50 mg PO q6h prn p			insulin sliding scal
metformin 850 mg PO daily					Lantus 20 mg SC qHS
Micronase 5 mg PO daily					
Tirosint 100 mcg PO daily					
vitamin B12 1000 mcg SC qMonth					
	Aricept 10 mg PO daily		donepezil 10 mg PO qHS		
	Plavix 75 mg PO daily		clopidogrel 75 mg PO daily	Simil on th	ar meds are show e same line
	Prozac 10 mg PO daily		fluoxetine 20 mg PO daily		
Differences of similar meds are highlighted in yellow	Zestoretic 20 / 12.5 mg PO daily		hydrochlorothia 12.5 mg PO daily lisinoprill 20 mg PO daily	azi	Hovering over a miniphlights it and a similar meds
	Lipitor 40 mg PO daily		rosuvastatin 40 mg PO daily		

Visually indicate unique, similar, and identical from each list

Columns show unique, similar and identical drugs

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

 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

Intake unique keep rest reject rest	[clear]	Intake similar keep rest reject rest
atherosclerotic vascular disease asprin 81 mg PO daily		
hypercholesterolemia		Lipitor 20 mg PO daily
hypertension		Capoten 25 mg PO BID
<i>insomnia</i> Sonata 10 mg po qHS		



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

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 formatProvide 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

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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

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)

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)

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



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