University of Missouri-Columbia

EHR Usability Style Guide
Update: First Chapter – Med List

Friday October 18

Noon Central Time

EHR Usability Style Guide

- Audience: EHR Vendors, other HIT
- iBook (or PDF)
- Design workshops include EHR vendors
- Reviews in progress
  - Expert advisors
  - Target audience readers

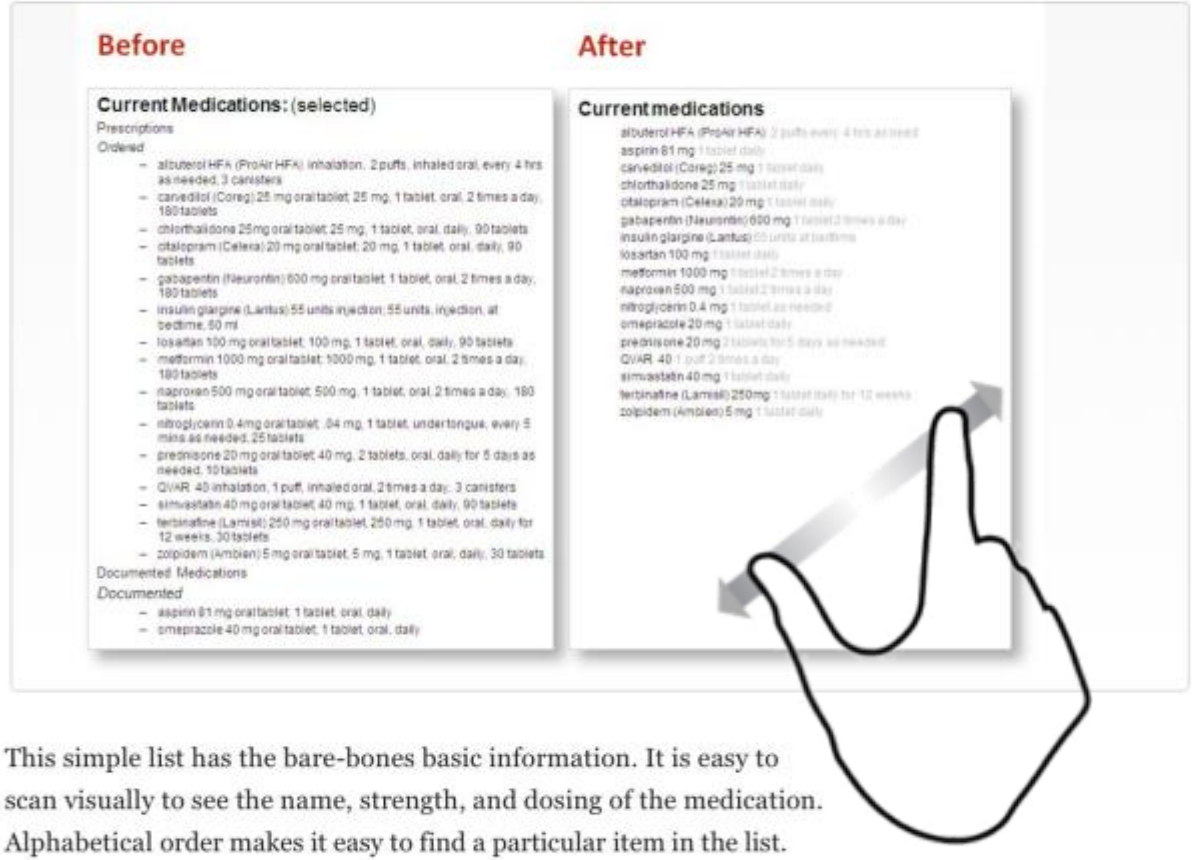
Since our last call

- Thanks your letter of support
- Thanks to those offering to attend workshops
- Design began in August
- First chapter being reviewed now: Medication List
- Coming next: Allergy List, Med Rec, eRx, Drug Alerts
- Next draft: March.

Here’s a taste

The Simple List

INTERACTIVE 1.1 **Simple Medication List Makeover (list displayed in an office progress note)**



This simple list has the bare-bones basic information. It is easy to scan visually to see the name, strength, and dosing of the medication. Alphabetical order makes it easy to find a particular item in the list.

You can probably intuitively see that one looks cleaner than the other. That simplicity makes it easier to see the drug names, which are more important for getting a quick overview. The list shown here would work

Before

Current Medications: (selected)

Prescriptions

Ordered

- albuterol HFA (ProAir HFA) inhalation, 2 puffs, inhaled oral, every 4 hrs as needed, 3 canisters
- carvedilol (Coreg) 25 mg oral tablet; 25 mg, 1 tablet, oral, 2 times a day, 180 tablets
- chlorthalidone 25mg oral tablet; 25 mg, 1 tablet, oral, daily, 90 tablets
- citalopram (Celexa) 20 mg oral tablet; 20 mg, 1 tablet, oral, daily, 90 tablets
- gabapentin (Neurontin) 600 mg oral tablet; 1 tablet, oral, 2 times a day, 180 tablets
- insulin glargine (Lantus) 55 units injection; 55 units, injection, at bedtime, 60 ml
- losartan 100 mg oral tablet; 100 mg, 1 tablet, oral, daily, 90 tablets
- metformin 1000 mg oral tablet; 1000 mg, 1 tablet, oral, 2 times a day, 180 tablets
- naproxen 500 mg oral tablet; 500 mg, 1 tablet, oral, 2 times a day, 180 tablets
- nitroglycerin 0.4mg oral tablet; .04 mg, 1 tablet, under tongue, every 5 mins as needed, 25 tablets
- prednisone 20 mg oral tablet; 40 mg, 2 tablets, oral, daily for 5 days as needed, 10 tablets
- QVAR 40 inhalation, 1 puff, inhaled oral, 2 times a day, 3 canisters
- simvastatin 40 mg oral tablet; 40 mg, 1 tablet, oral, daily, 90 tablets
- terbinafine (Lamisil) 250 mg oral tablet, 250 mg, 1 tablet, oral, daily for 12 weeks, 30 tablets
- zolpidem (Ambien) 5 mg oral tablet, 5 mg, 1 tablet, oral, daily, 30 tablets

Documented Medications

Documented

- aspirin 81 mg oral tablet; 1 tablet, oral, daily
- omeprazole 40 mg oral tablet; 1 tablet, oral, daily

After

Current medications

albuterol HFA (ProAir HFA) 2 puffs every 4 hrs as need
aspirin 81 mg 1 tablet daily
carvedilol (Coreg) 25 mg 1 tablet daily
chlorthalidone 25 mg 1 tablet daily
citalopram (Celexa) 20 mg 1 tablet daily
gabapentin (Neurontin) 600 mg 1 tablet 2 times a day
insulin glargine (Lantus) 55 units at bedtime
losartan 100 mg 1 tablet daily
metformin 1000 mg 1 tablet 2 times a day
naproxen 500 mg 1 tablet 2 times a day
nitroglycerin 0.4 mg 1 tablet as needed
omeprazole 20 mg 1 tablet daily
prednisone 20 mg 2 tablets for 5 days as needed
QVAR 40 1 puff 2 times a day
simvastatin 40 mg 1 tablet daily
terbinafine (Lamisil) 250mg 1 tablet daily for 12 weeks
zolpidem (Ambien) 5 mg 1 tablet daily

Handling brand and generic names

This can get tricky. We'll admit right now: there may not be one correct answer to the problem of whether to show the Brand Name, the generic name, or both names by default in the list. It depends on the context, and the people in the conversation. Somewhere in the EHR, there should be easy access to both the generic and the Brand Name.

Here are a few considerations.

Ideally, both names would be available on demand at just the right time. If it's a printed list, then you might have to choose one method of display. Alternatively, display both generic and brand name – for example "furosemide (Lasix) 20 mg". For consistency, sort alphabetically by the generic name.

The brand name isfrequently preferred in conversation because the generic name may be difficult to remember or pronounce, even for for physicians. Say these three times fast:

- adalimumab --- Humira
- ondansetron --- Zofran
- furosemide --- Lasix

Some medications have so many different confusing brand names available, many of which are NOT interchangeable, that the problem is compounded. Diltiazem is an example. It may be available as:

- Cardizem
- Cardizem LA
- Cardizem CD
- Cartia XT
- Dilacor XR
- and it goes on and on...

We can make that easier to read by **emphasizing** the name of the drug and de-emphasizing everything else. The physicians eyes need to notice the name and strength without needing to read a whole line of text. The instructions (take 1 tablet daily) are secondary pieces of information. One method of denoting that instructions are of secondary importance is to use gray text that is perceptibly different while still readable.

Use just enough difference to make it immediately apparent. If the difference in type is too great, it can be visually jarring. If the difference is too subtle, then it won't be perceived by the visual processing system of the human brain. The features that the visual system detects readily are called "preattentive attributes".

Too jarring	Too subtle
lisinopril 20 mg 1 tablet daily	lisinopril 20 mg 1 tablet daily

Alphabetize the list. The human brain expects a list of text items to be alphabetical in order to find a particular name quickly in a long list. "Are they taking warfarin?" Just jump to the "w" section.

Reduce Visual Noise. If a visual element doesn't add data, or improve the perception or processing of information, then try leaving it out. See Gallery 1.1.

Now let's move on to the interactive list.

Handling brand and generic names

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Use just enc…t. If the difference i… difference is too subtle… system of the huma…ts readily are called "p…

Too jarring

lisinopril… let daily

Pre-attentive Attributes

The little things people notice visually and understand quickly, so quickly that we have only noticed it at an unconscious level.

Several of the factors discussed above all combine with some other functions of our brains that are in play that make us notice some visual features more quickly than others. Examples include color, size, shape, orientation, and motion. We call these things that stand out to us preattentive attributes.

Quick Tips

Alphabetize the list. The human brain expects a list of text items to be alphabetical in order to find a particular name quickly in a long list. "Are they taking warfarin?" Just jump to the "w" section.

Reduce Visual Noise. If a visual element doesn't add data, or improve the perception or processing of information, then try leaving it out. See Gallery 1.1.

Now let's move on to the interactive list.

Returning to the clinical scenario: BP too high

Upon entering the room, the doctor learns that the patient has been exercising regularly and eating a healthy diet. He is on a 17 medications, tolerating them well, and taking them consistently. His BP is about 10 points too high today, and it has been high at home as well. The doctor wants to adjust the BP medications to achieve better control.

The physician turns to the interactive medication list and sorts the medications by diagnosis. He can readily see that the patient is already on three medications for a blood pressure. With some effort, the physician determines that all three medications are at their maximum dose, so a new medication will need to be added. He thinks the next drug of choice in this situation would be lisinopril, but he wonders "Why isn't the patient on lisinopril already?"

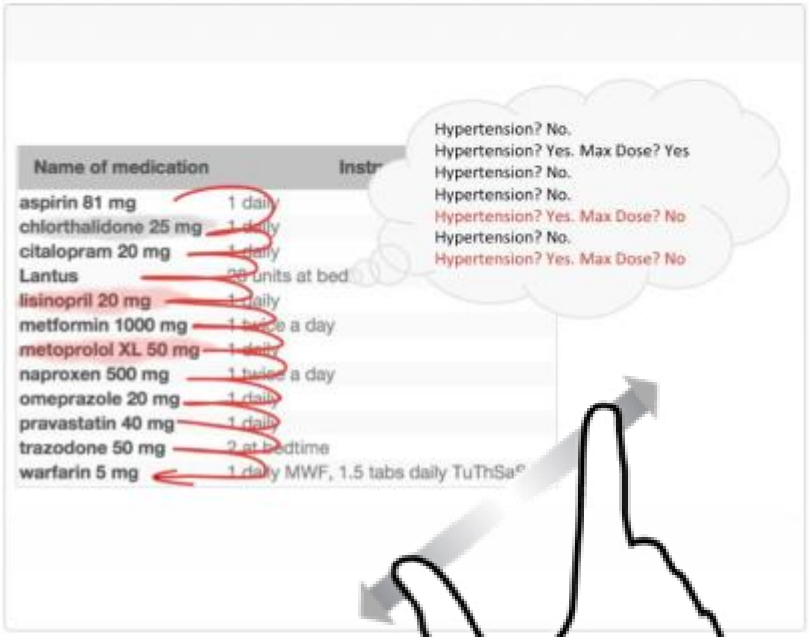
Here's the mental task for the physician (See Interactive 1.3):

- review the medication list
- identify medications for treating high BP (antihypertensives)
- determine if each medication has already reached its maximum dose.
  - if all the BP meds are at their maximum dose, then a new medication needs to be selected and added to the treatment plan
  - if one or more of the medications is not at the maximum dose, then that medication dose could be increased (and it won't cost a new co-pay, increase potential drug interactions, or increase the number of pills the patient has to take)

Sometimes, that is a lot of mental work. You can make the job much easier.

You can reduce the risk of error (missing one in the list) and lighten the mental effort (cognitive load) quite a bit by smart design features.

INTERACTIVE 1.3 **Physician's mental work (cognitive load) adjusting BP meds.**



In order of complexity, here are some solutions:

- **Allow sorting** the medication list by **associated diagnosis**. This groups them together and makes for far less reading, searching, and and relying on humans' limited working memory (which can only hold 3 to 4 items). There are potential barriers to this approach. This won't work unless the physician or provider has selected the diagnosis (or diagnoses) for each medication. Here's how it would work: When the physician prescribes a new medication, the system presents the current list of diagnoses or chronic problems so the physician can merely pick one or more from the list or add a new one. That is a task

Name of medication	Instr
aspirin 81 mg	1 daily
chlorthalidone 25 mg	1 daily
citalopram 20 mg	1 daily
Lantus	28 units at bed
lisinopril 20 mg	1 daily
metformin 1000 mg	1 twice a day
metoprolol XL 50 mg	1 daily
naproxen 500 mg	1 twice a day
omeprazole 20 mg	1 daily
pravastatin 40 mg	1 daily
trazodone 50 mg	2 at bedtime
warfarin 5 mg	1 daily MWF, 1.5 tabs daily TuThSaSu

Hypertension? No.
Hypertension? Yes. Max Dose? Yes
Hypertension? No.
Hypertension? No.
Hypertension? Yes. Max Dose? No
Hypertension? No.
Hypertension? Yes. Max Dose? No

INTERACTIVE 1.7 **Interactive Medication List**

Play with me. Try sorting, filtering, searching. Show it to a doctor friend and have them tell you what they like about it and what's missing.

What prescriptions will need to be renewed before Christmas?
Which items does Belden need to manage renewals for?
Which drugs are for Hypertension?

Review the code, play with it, improve it
https://github.com/goinvo/EHR

Code to play with

Show history

Generic	Brand	Dose	Sig (Frequency)	Quantity	Refills	Renewal Due	Prescribed	Provide	Condition
chlorthalidone		25 mg	1 daily	90	2	4 Jul 2014	1 Sept 2007	Be MD	High BP
citalopram		20 mg	1 daily	90	4	4 Jul 2013	4 Mar 2010	yin MD	Depression
insulin glargine	Lantus	28 u	28 units at bedtime	90	12	19 Oct 2013	19 Oct 201	Brietzke MD	Diabetes
lisinopril		20 mg	once daily	90	3	14 Feb 2014	10 Au 201	Belden MD	ypertension
metformin		1000 mg	1 twice daily	180	4	19 Oct 2013	19 2012	Brietzke MD	Dia tes
omeprazole		20 mg	1 daily						GERD
pravastatin		40 mg	1 daily	90	3	4 Jul 2014	4 Jul 2012	Brietzke MD	High C lesterol
warfarin		5 mg	1 daily MWF 1.5 tablets daily SuTuThSa	180	12	14 Feb 2014	14 Feb 2013	Belden MD	Preve stroke

Show history

Generic	Brand	Dose	Sig (Frequency)	Quantity	Refills	Renewal Due	Prescribed	Provider	Conditio
chlorthalidone		25 mg	1 daily	90	2	4.Jul.2014	1.Sept.2007	[illegible]	High BP
lisinopril		20 mg	once daily	90	3	14.Feb.2014	10.Aug.2012	Belden MD	Hyperter
metoprolol XL	Toprol XL XL	50 mg	1 daily	90	0		14.Jul.2012	Belden MD	Hyperter
warfarin		5 mg	1 daily MWF 1.5 tablets daily SuTuThSa	180	12	14.Feb.2014	14.Feb.2013	Belden MD	Prevent stroke
insulin glargine	Lantus	28 u	28 units at bedtime	90	12	19.Oct.2013	19.Oct.2012	Brietzke MD	Diabetes
metformin		1000 mg	1 twice daily	180	4	19.Oct.2013	19.Oct.2012	Brietzke MD	Diabetes
pravastatin		40 mg	1 daily	90	0		4.Jul.2012	Brietzke MD	High Choleste
aspirin		81 mg	1 daily					OTC	Diabetes
naproxen	Aleve	500 mg	1 tablet 2 times a day					OTC	Rheuma arthritis
omeprazole		20 mg	1 daily					OTC	GERD
citalopram		20 mg	1 daily	90	4	4.Jul.2013	4.Mar.2010	Shoyinka MD	Depressi
trazodone		50 mg	2 at bedtime	180	0		21.Jul.2012	Shoyinka MD	Insomnia

diab

Show history

Generic	Brand	Dose	Sig (Frequency)	Quantity	Refills	Renewal Due	Prescribed	Provider	Condition
aspirin		81 mg	1 daily					OTC	Diabetes
insulin glargine	Lantus	28 u	28 units at bedtime	90	12	19.Oct.2013	19.Oct.2012	Brietzke MD	Diabetes
metformin		1000 mg	1 twice daily	180	4	19.Oct.2013	19.Oct.2012	Brietzke MD	Diabetes

The Timeline View

Physicians are yearning for a timeline. They are working with people who have many complex, chronic conditions (diseases), and are managing many interventions such as medications, laboratory tests, occasional procedures, and many visits with multiple health care providers at home, offices, and hospitals. How is it possible to manage all this complex data? It takes a tremendous amount of mental effort (cognitive load). In order to understand the time course for even a single medication, it requires a lot of digging through progress notes and through medication list tables reviewing years worth of prescription renewals. Even worse, that effort may need to be duplicated to understand a second or third medication.

Here's an example of a medication timeline.
A timeline offers a complete overview. At the top level, it conveys a few basic details – When does a medication start or stop? When does the dose change, and is it going up or down? Is that the maximum dose?

GALLERY 1.2 **Interactive Timeline**

Dragging scrubber farther back in time when some medications were not yet prescribed. The labels disappear from the scrubber.

HIMSS 2014

- I’ll walk the display floor visiting you, showing off the current iBook version
- Should we plan times to meet there?

End of March 2014

- Final PDF version for SHARP-C (ONC).
- Then add more interactive parts to iBook version
  - Live interactive timeline
  - More

Final Product – iBook

- June 2014
- Promote through EHRA, ONC, California HealthCare Foundation, Twitter, blogs, and presentations
- Then a review of the product

Thanks to

- Sponsors
  - SHARP-C (from ONC)
  - California HealthCare Foundation
- In-kind support
  - EHRA Clinician Experience Workgroup
  - EHRA Board of Directors
  - EHR vendor attendees at our design workshops
    - NextGen, athenahealth, Cerner, MedSocket, and others this April

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