

Facilitate, Integrate, Validate, Communicate



Designing Forms that Streamline and Improve Care

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GE Healthcare Collective Knowledge User Summit

Sept 22-25, 2004

CLINICAL INFORMATION SYSTEMS


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Advanced Development Concepts

- Data validation
- Providing decision support
- Working with clinical lists
- Customizing chart note translation
- Integrating multiple forms
 - Improving user interface
 - SOAP note translation
- Sharing functions between forms
- A picture is worth a thousand words...
- A few words about sharing
- Reference – Shortcuts / MEL

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Implementing Data Validation

- Enforce a valid range for numeric data entry
- Available through Advanced Options tab
- Provide a warning or prevent invalid data entry
- Applies to all efforts to enter data in the update (not just within the form)

Data Validation


Numeric Validation: None Warning Force Use of Numeric Mask Recommended

Range Validation: None Warning Force

Range Minimum: Range Maximum: Units:

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Providing User Feedback

- There are many ways to provide feedback
- Watcher expressions provide automatic feedback
- Buttons trigger evaluation of data at the users request
- Common methods of displaying feedback are through data display items or message boxes

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Data Display

- Do not require user to respond
- Can be more easily missed or ignored
- Using a different font or text color can make them more visible

ATP III Cholesterol Guidelines: Bill A. Vario

Risk Factors | Assessment | Medications

Medications

PRLOSEC CPDR 20 MG (OMEPRAZOLE) 1 po bid
LIPITOR 20 MG TABS (ATORVASTATIN CALCIUM) 1 by mouth every night

Include medications in note

Medication Monitoring

Monitoring recommendations are subject to change and may differ for each individual medication. Lipids should be monitored periodically after initiation and during therapy.

HMG CoA Reductase Inhibitors
-LFTs should be performed prior to and 6 and 12 weeks after initiation or change in dosage
-LFTs should be performed periodically (e.g. every 6 months) during treatment

Anti-hyperlipidemic Medication Support

Medication Class: HMG CoA Reductase Inhibitors

Agent / dose	Effect	Side Effects	Contraindications
Lovastatin (20-80 mg)	Decrease LDL 18-55%	Myopathy	Absolute - active or chronic liver disease
Pravastatin (20-40 mg)	Increase HDL 5-15%	Increased liver enzymes	Relative - Concomitant use of certain drugs
Simvastatin (20-80 mg)	Decrease TG 7-30%		
Fluvastatin (20-80 mg)			
Atorvastatin (10-80 mg)			
Rosuvastatin (5-40 mg)			

Generic Name: [atorvastatin] Dosage: [20 mg] Dispense: [30]

Medication Instructions: [1] by mouth every night [Add Medication] [Change Medication]

Select Form: [] [Go to form]

Prev Form (Ctrl+PgUp) Next Form (Ctrl+PgDn) [Close]

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Message Boxes

- Require user response
- ? User is more likely to pay attention
- Annoying if they appear too frequently
- Use for more "serious" warnings

ATP III Cholesterol Guidelines: Bill A. Vario

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Select Form: [] [Go to form]

Prev Form (Ctrl+PgUp) Next Form (Ctrl+PgDn) [Close]

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Modifying Clinical Lists

- Add problems, medications or orders
- Facilitate commonly performed operations
- Choose changes that are related to the form (e.g. diabetes medications or orders from a diabetes form)
- Can be triggered from buttons or functions
- Can also add assessments for problems

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Using Buttons to Edit Clinical Lists

- **RUNPROCESS** buttons can automatically add common medications, problems or orders to the clinical lists

Action Button

Options | Translation | Advanced

Label: Options: Begin Suppression Block: End Suppression Block:

Height per line:

Connection: Type:

MEL_ADD_PROBLEM("dx of", "Tobacco abuse", "ICD-305.1", str(_TODAYSDATE), "", "")

Symbol Observation Function MEL Medication MEL Problem MEL Order

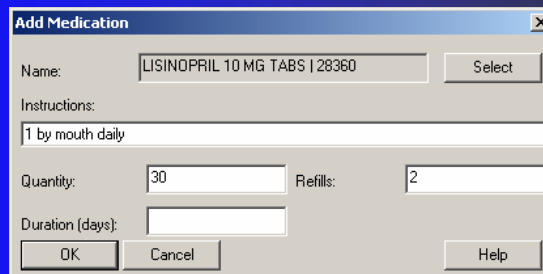
Previous Next OK Cancel Apply Help

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Add Medication

- Enter information to create a MEL expression
- Fields can be linked to other items in the form
- Medication names / DDID numbers pulled from database



Add Medication

Name: LISINOPRIL 10 MG TABS | 28360

Instructions: 1 by mouth daily

Quantity: 30 Refills: 2

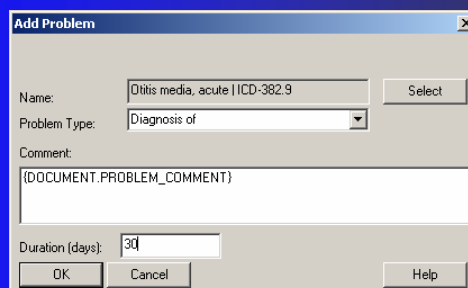
Duration (days):

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Add Problem

- Enter information to create a MEL expression
- Fields can be linked to other items in the form
- Problems / codes pulled from the database



Add Problem

Name: Otitis media, acute | ICD-382.9

Problem Type: Diagnosis of

Comment: {DOCUMENT.PROBLEM_COMMENT}

Duration (days): 30

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Add Order

- Enter information to create a MEL expression
- Fields can be linked to other items in the form
- Orders / Diagnoses pulled from the database

The screenshot shows a dialog box titled "Add Order" with the following fields and options:

- Type: Test
- Category: Laboratory
- Description: CBC with Differential
- *Modifiers: CBC with Differential, Cholesterol, Coombs Indirect
- *Diagnoses: Cortisol, CPK
- *Comment: CPK Isoenzymes, Culture, Blood
- *Units: Culture, Chlamydia
- *Priority: [dropdown]
- *Provider: [text field]
- *Order date (number of days from current date): [text field]

* denotes an optional field

Buttons: OK, Cancel, Help

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Adding Problem Assessment

- Allows a way to track changes in a problem over time
- Can include a comment
- Must correctly identify an existing problem in patient's problem list based on:
 - Problem type
 - Problem description
 - Problem code

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Customizing Form Translation

- Changing the item translation
- Narrative translation with suppression blocks
- Conditionally suppressing translation of items

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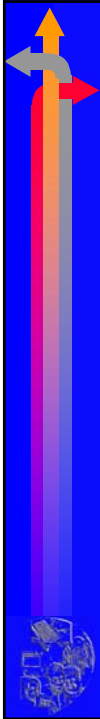
Customizing translation – cmft()

- By default all items on their own line
- Creates a list rather than a readable note
- Modify the cmft() expression to eliminate the newline character in each item
- Can also add period / spacing after items using posttext parameter

*cmft(expression, format[, pretext][, pretext format]
[, posttext][, posttext format])*

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Customizing translation – cmft() An Example

Change the default translation:

```
{CFMT(OBSANY("HEIGHT"), "", "Height (inches): ", "B", " ")}
```


To the custom translation:

```
{CFMT(OBSANY("HEIGHT"), "", "Ht: ", "B", " in ")}
```




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Suppression Blocks – Part 1

- Suppression blocks suppress the translation for all items if no data is entered in the block of items
- This can be used to place a label at the beginning of a group and a newline at the end
 - Display multiple items on a single line
 - Create paragraph formatting



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Suppression Blocks – Part 1 An Example

- Create a suppression block for the group of vital signs items
- Change the translation for the last item in the vital signs as follows:

```
(CFMT(OBSNOW("BP DIASTOLIC"), "", "/", "B", "")) + "
```


The new chart translation will be:

Vital Signs
 Ht: 70 in Wt: 145 lbs BMI: 21.31 T: 96 F R: 16 P: 88 BP: 124/76

And the next item will always be on the following line...

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Suppression Blocks – Part 2

- Some items (e.g. default previous or data displays) may trigger a suppression block to display even if changes are not made.
- This behavior can be changed in the advanced options page – Item Generated Condition

Suppression Behavior


Item Generated Condition: Standard Updated Only None

Suppression Condition: Standard Item List User Defined Condition Both

{match(GET_FORM_LIST(), "Physical Exam") == 0}

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Suppression Blocks – Part 3

- At other times you may want to suppress a group of items based on an external condition
- Use any conditional statement
- This configuration is done in the item which is the beginning of the suppression block
- The following example suppresses a group of physical exam items in an asthma form if the general physical exam form is loaded (to avoid duplication)

Suppression Behavior:


Item Generated Condition: Standard Updated Only None

Suppression Condition: Standard Item List User Defined Condition Both

```
{match(GET_FORM_LIST(), "Physical Exam") == 0}
```

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Integrating Multiple Forms

- Dynamically add generic and problem based forms to visit
- Facilitate navigation between forms
- Create an integrated translation (based on SOAP note format)

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Adding Forms to the Update

- Use a listbox to display available forms
- Could be dynamic to offer different forms based on age, gender, problem list, etc...
- A button launches the selected forms

Navigating Between Forms

- Use a dynamic dropdown to select from a list of forms
- A button then opens the selected form

Integrated Translation

- Configure forms as containers / servers in Visual Form Editor
- A container, if present, will display chart translation for all servers
- Servers will display translation if no container, but will allow container to display if available

Integrated Translation

- Multiple forms loaded
- However, all information displayed by Vital Signs form

Summary Problems Medications Alerts Flowsheet Orders Documents Update
Doc ID: 88 Properties: Office Visit at E PEDS on 09/01/2004 12:29 PM by Kelly G. Starr MD
Summary: [Change Properties]

Extended Vital Signs
HPI
Review of Systems
Physical Exam
Impression
Plan
ATP III Cholesterol G

SUBJECTIVE
History from patient Reason for Visit: routine follow-up
Chief Complaint: pain
HPI: Patient reports continued severe pain in right hip. No longer going out and limiting ADLs.
Patient had recent cholesterol testing done.

REVIEW OF SYSTEMS
Musculoskeletal: Patient complains of see HPI.

HISTORY
Past Medical History: Bilateral pneumonia in Navy age 24
Broken pelvis in severe MVA at age 36
Arthritis - bilateral hips
Disorder, tobacco use

OBJECTIVE
Vital Signs
Ht: 70 in Wt: 148 lbs BMI: 21.31 T: 98 F T Sites: Oral R: 16 P: 88 Rhythmic: Regular BP: 128/86
General appearance: Well developed in NAD

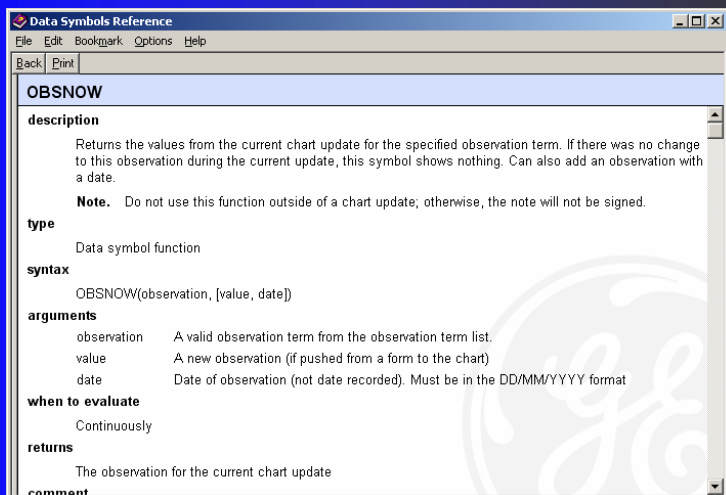
Physical Exam Comments:
Limited range of motion in hips bilaterally. Right > Left. Difficulty ambulating, getting out of chair.

ASSESSMENT
Impression Summary:
Arthritis - Deteriorated. No longer able to perform ADLs without assistance.

Cholesterol
Cholesterol Assessment (based on ATP III Guidelines):
Patient has 1 major risk factors for coronary artery disease including cigarette use. Patient has coronary artery disease risk equivalents including coronary artery disease. Framingham risk assessment not valid for patients with coronary artery disease risk equivalents. LDL target range is <100mg/dL. Therapeutic lifestyle changes indicated for LDL >=100mg/dL. Drug therapy should be considered for LDL >= 130mg/dL. Most recent LDL for patient was 64 mg/dL on 09/08/2001. Patient does not have Metabolic Syndrome, but does have risk factors including triglycerides greater than or equal to 150 and hypertension. Most recent triglyceride for patient was 175mg/dL on 09/08/2001. Most recent HDL for patient was 70 mg/dL on 09/08/2001.

PLAN
Plan Summary:
Arthritis. Will refer to orthopedics for surgical evaluation.
Cholesterol

Data Symbols Reference




The screenshot shows a window titled "Data Symbols Reference" with a menu bar (File, Edit, Bookmark, Options, Help) and a toolbar (Back, Print). The main content area is titled "OBSNOW" and contains the following information:

- description**
Returns the values from the current chart update for the specified observation term. If there was no change to this observation during the current update, this symbol shows nothing. Can also add an observation with a date.
Note. Do not use this function outside of a chart update; otherwise, the note will not be signed.
- type**
Data symbol function
- syntax**
OBSNOW(observation, [value, date])
- arguments**
 - observation: A valid observation term from the observation term list.
 - value: A new observation (if pushed from a form to the chart)
 - date: Date of observation (not date recorded). Must be in the DD/MM/YYYY format
- when to evaluate**
Continuously
- returns**
The observation for the current chart update
- comment**

A Picture is Worth a Thousand Words...

- What would you like to see?

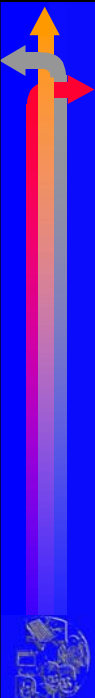


A Word On Sharing...

- Sharing resources
 - Logician User Group Interactive site
<http://www.logicianusers.com/lug>
 - Logician User Group bulletin board
<http://www.logicianusers.com/boards>
 - ? KnowledgeBank
<http://knowledge.medicallogic.com>
- Advantages to sharing forms
 - Receive feedback from others that use them
 - Allows more users / patients to benefit from your efforts
(If I'm going to spend a day on building a form why should only 3 people be using it...)

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Reference - Shortcuts

- Using the shift key when moving an item will force it to be placed to the right of the item the anchor is over
- Up and down arrows move through items on the page
- Ctrl + Up arrow moves to the group an item is contained in (row, section, visibility region)

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Shortcuts (Continued)

- Pressing F1 when the cursor is on a Standard MEL (e.g. str() will bring up an explanation of that function)
- “Opposing list boxes” prevent user from selecting same option for positive/negative
- Aligning items through the Tools pulldown
- All items on a line can also be made the same size

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Reference MEL Made Simple

- Very basic programming language
- Variables
- Operators
- Boolean expressions
- Conditional statements
- Commenting
- Functions
- MEL “watcher” expressions

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Variables

- Observation Terms – Stored in database permanently
- DOCUMENT variables – Stored in database until update is signed
- Local
 - For use in a single function / expression
 - Preferable to global in most cases
- Global
 - Can be used to store information for sharing
 - Default type for all variables
 - Not stored when user leaves an update

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Operators (Calculation)

- \wedge Exponential
- $*$ Multiply
- $/$ Divide
- $+$ Add (or concatenate for strings)
- $-$ Subtract
- $=$ Assignment operator

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Operators (Comparison)

- Evaluate to TRUE or FALSE
- == Equality
- <> Not equal
- < Less than
- <= Less than or equal
- > Greater than
- >= Greater than or equal

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Boolean Expressions

- Used to control flow:
- AND Evaluates to true only if both sides are true
- OR Evaluates to true if either side is true
- NOT Reverses result of expression
- () Specify evaluation order

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Controlling Flow (IF)

*IF (condition) THEN (execute)
ELSE (execute) ENDIF*

- TRUE/FALSE statement after IF determines what statement to execute
- If TRUE, statements after THEN will be executed
- If FALSE, statements after ELSE are executed (ELSE statement optional)
- ENDIF must be present

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Controlling Flow (WHILE)

*WHILE (condition) DO
(execute)
ENDWHILE*

- Loop to repeat an action multiple times
- Condition should eventually evaluate to FALSE or loop may never end (see below)
- BREAK will stop execution
- CONTINUE will immediately start next iteration

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Controlling Flow (FOR)

*FOR (execute), (condition), (expression) DO
(execute)
ENDFOR*

- Similar to WHILE, but has 2 additional statements to execute
- First expression executed prior to starting
- Second expression is executed at end of each loop
- BREAK and CONTINUE as with WHILE

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Controlling Flow (COND)

*COND
CASE (condition)
(execute)
CASE (condition)
(execute)
...
ENDCOND*

- Starts series of conditional “cases”
- Similar to IF, but used where there are more than two possible cases

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Comments

- /* Begin Comment
- */ End Comment
- // Comment until the end of the line
- Important to enhance “readability” of complex expressions
- Allows other developers to understand the thought process
- Can also help when going back to look at code in the future
- “Nesting” of statements can also be used to enhance readability and prevent missed syntax

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Standard MEL Functions

- There is a library of standard MEL functions
- Definitions can be found in the Data Symbols help file (included with CPO EMR 5.6)
- This can also be downloaded as a .pdf document from the web at:
<http://support.medicallogic.com/logician/55/documentation.html>

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Putting it all together

- Functions – Used to string together multiple statements for execution


```
fn FunctionName(parameter list)
{
  (execute)
}
```

- MEL expressions
 - Enclosed by braces { }
 - Triggered by changes in the variables / terms in the expression
 - ! Will trigger an expression when the form is loaded
- There is no “right” way to structure functions (if it works, it works...)

Example Function

```
/* Calculates Body Mass Index based on observation terms Weight  
and Height. Will use previous values from Height, but must have  
new value for Weight. Returns empty string ("" ) if valid height and  
weight do not exist. */
```

```
fn fnCalcBMI()
{
  IF (OBSNOW("WEIGHT") == "" OR OBSANY("HEIGHT") == "" OR  
OBSANY("HEIGHT") <= 0) THEN  
    return ""  
  ENDIF  
  
  return (OBSNOW("WEIGHT") / 2.2) / ((OBSANY("HEIGHT") / 39.4) ^2)  
}
```




Example MEL expression

```
{  
    !OBSNOW("BMI", fnCalcBMI())  
    OBSNOW("HEIGHT")  
    OBSNOW("WEIGHT")  
}
```

- ! Causes expression to be evaluated when form loads
- OBSNOW("HEIGHT") and OBSNOW("WEIGHT") trigger evaluation when height or weight values change

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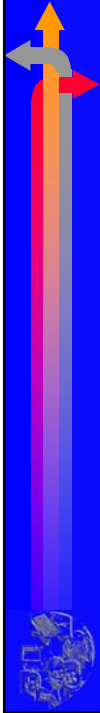


Avoiding MEL Pitfalls

- Make sure that all conditional statements are terminated (ENDIF, ENDFOR, ...)
- Make sure that all braces, parentheses and quotations are opened and closed
- Check for invalid variables before using (e.g. Make sure a number is not 0 before dividing)

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Troubleshooting MEL

- Error messages returned are often ambiguous and may not indicate the location of the error
- A MEL trace will store all statements executed in the file TRACEMEL.TXT which is stored in the root directory (C:\)
- Press Ctrl+Alt+M to start/stop tracing
- Search for ERROR to find the problem
- This will (usually) occur directly after the statement that caused the problem
- Delete the trace file periodically (or it will be huge)