

GEM Cutter

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Overview

The process of extracting knowledge from practice guidelines and incorporating it into computer programs has been arduous. In an effort to streamline this process, we are developing systems to help translate guideline knowledge into components that computers can “understand” and manipulate.

GEM is a model that was developed to organize guideline knowledge into a standardized structure. Using this model, information contained in a wide variety of guidelines can be organized into a hierarchical collection of **Elements**, which we refer to as the **Guideline Elements Model**.

GEM Cutter is a tool that is intended to facilitate the transformation of guideline information into GEM format. GEM files are XML documents that can be displayed and manipulated for a wide variety of purposes including guideline quality assessment, dissemination, and implementation.

Operating Environment

The GEM Cutter application operates on PCs equipped with Windows 98, Me, NT 4.0, 2000, and XP. The .Net Framework needs to be installed to run the GEM Cutter Installer.

Installation

To launch the GEM Cutter Installation Wizard, double click on the ‘Installer’ file located in the directory where GEM Cutter was downloaded. Follow the installation instructions. The application will be included in the list of ‘Programs’ on your Windows ‘Start’ menu and a shortcut to GEM Cutter will be added to your desktop.

GEM Cutter Screens

Main Window

GEM Cutter's Main Screen consists of three vertical segments and a horizontal toolbar.

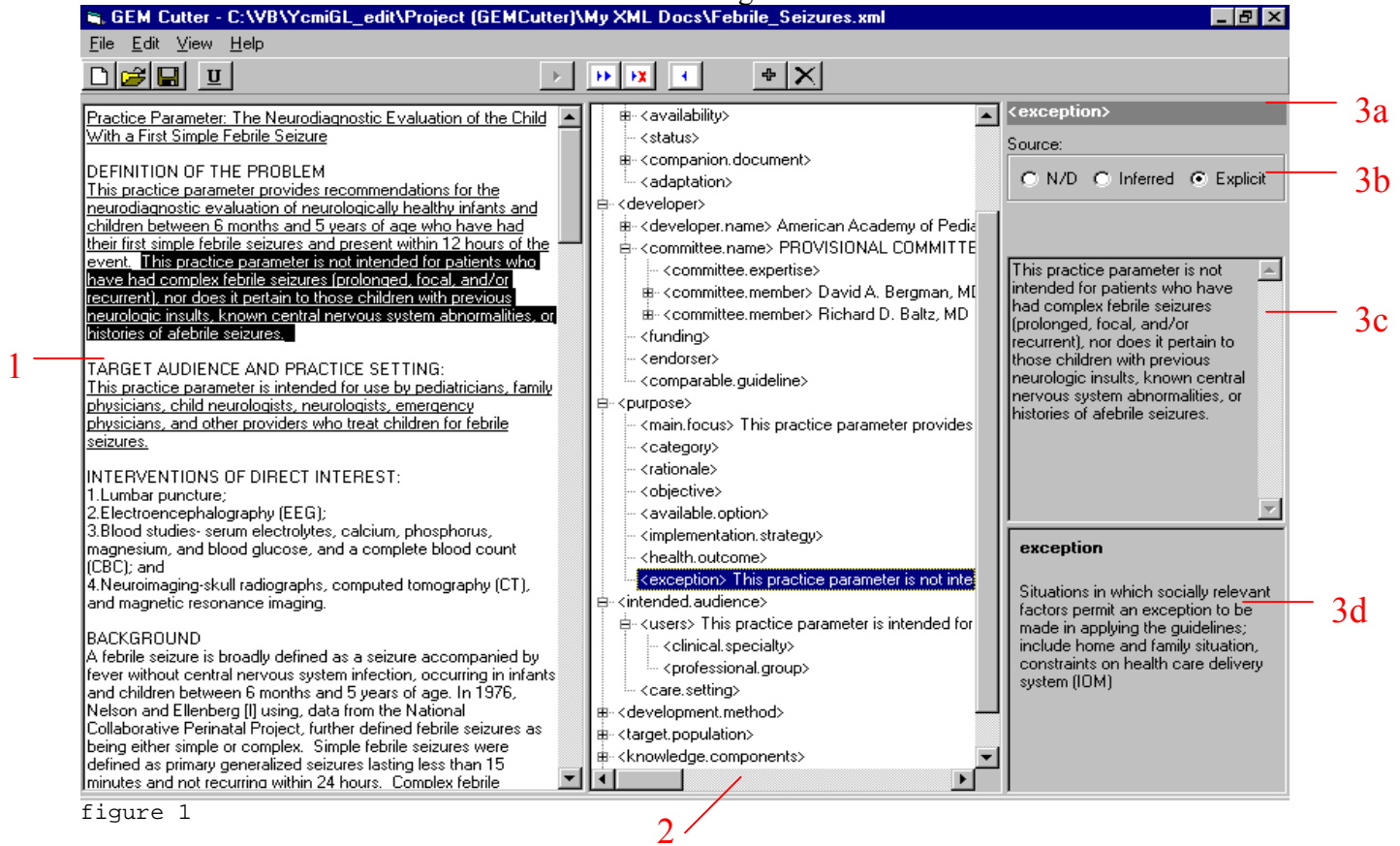


figure 1

On this screen, you see the original text of the guideline in the left control, a tree view of the developing GEM file in the control at the middle, and additional, important information about the GEM file in the controls in the right column.

(1) Guideline Text Segment

Contains the original guideline text document from which the GEM file is being developed. Text is copied from this window into elements in the GEM Tree segment (Window 2). Text that has been copied is underlined.

(2) GEM Tree Segment

Displays the contents of the GEM Document in tree structure format. Each item on the tree represents a GEM Element. An element can contain text and can be edited by selecting the element in this window before choosing an editing option.

(3) Element Segment

3a. Element Name Bar

Contains the name of the Element that is currently selected in Window 2.

3b. Element Source Bar

Displays the source of the Element that is currently selected in Window 2.

The Source value is derived from the manner in which the data was supplied to the GEM document. (*ND*-Not Defined, *Inferred*-User supplied the text, *Explicit*-Copied directly from the Guideline Text Document). The Source value can be changed by clicking a different option.

3c. Element Text Box

Contains the complete text of the Element that is currently selected in Window 2. Text can be input directly or edited in this window.

3d. Element Definitions Box

Contains the Definition of the Element that is currently selected in Window 2.

GEM Structure Screen

The GEM Structure can be displayed in organizational chart format to clarify relationships among the elements. To display the hierarchy, select 'View/GEM Structure' from the menu bar on the Main Window. Clicking on the tabs at the top of the GEM Structure window will allow you to view the individual sections of the GEM Structure.

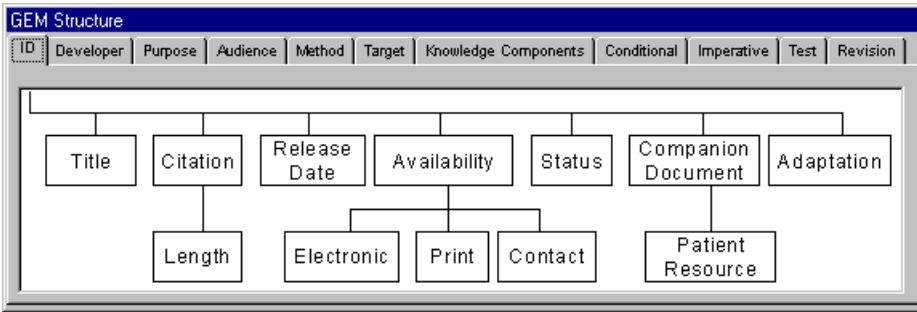


figure 2

XML Screen

On this screen, you can view the XML code that is being built by the GEM Cutter application. This screen provides menu items that allow you print the code or refresh the screen after changes have been.

```
<?xml version="1.0" encoding="utf-8"?>
<!--example_4_Text.rtf-->
<!--GEMversion="1.4"-->
<guideline.document>
  <guideline.header.id="n2">
    <identity.source="explicit" id="n3">The Diagnosis, Treatment, and Evaluation of the Initial Urinary Tract Infection
in Febrile Infants and Young Children
    <guideline.title.source="explicit" id="n5">Practice Parameter: The Diagnosis, Treatment, and Evaluation
of the Initial Urinary Tract Infection in Febrile Infants and Young Children</guideline.title>
    <citation.source="nd" id="n7">
      <guideline.length.source="nd" id="n8"></guideline.length>
    </citation>
    <release.date.source="nd" id="n9"></release.date>
    <availability.source="nd" id="n10">
      <electronic.source="nd" id="n11"></electronic>
      <print.source="nd" id="n12"></print>
      <contact.source="nd" id="n13"></contact>
    </availability>
    <status.source="nd" id="n14"></status>
    <companion.document.source="inferred" id="n15">Technical Report available at
http://www.pediatrics.org/cgi/content/full/103/4/e54.
    <patient.resource.source="nd" id="n17"></patient.resource>
    </companion.document><adaptation.source="nd" id="n18"></adaptation></identity>
  </guideline.header.id>
  <developer.source="nd" id="n19">
    <developer.name.source="nd" id="n20">AMERICAN ACADEMY OF PEDIATRICS<developer.type.source="ngc"
id="n22"></developer.type></developer.name>
    <committee.name.source="explicit" id="n23">
      Subcommittee on Urinary Tract Infection
    <committee.expertise.source="explicit" id="n25">pediatricians with expertise in the fields of epidemiology
and informatics, infectious diseases, nephrology, pediatric practice, radiology, and urology to draft the parameter.
    </committee.expertise><committee.member.source="explicit" id="n27">
      Russell W. Steele, MD
    <member.expertise.source="explicit" id="n29"></member.expertise></committee.member>
  </developer.source>
</guideline.document>
```

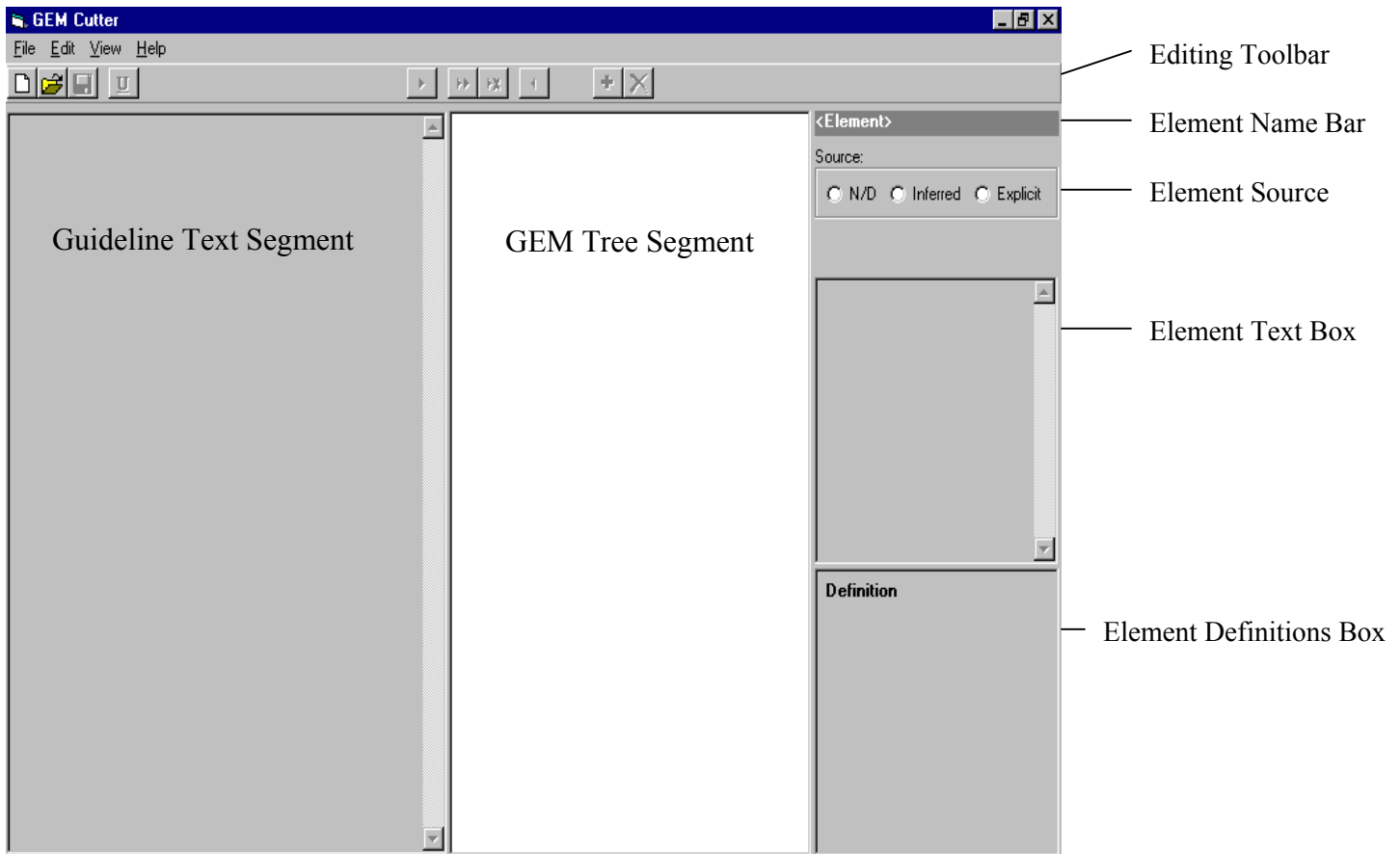
figure 3

GEM Cutter Tutorial

This tutorial will lead you through the major activities involved in marking up a guideline using GEM Cutter. A text guideline on management of urinary tract infection (UTI) will be used. This tutorial should take you less than 15 minutes.

I. Open the GEM Cutter Application

To Open the GEM Cutter application, select GEM Cutter from your Programs group on your Start Menu



The three vertical segments in GEM Cutter's Main Screen are displayed.

II. Open the GEM file for the UTI practice guideline

Toolbar: 

Menu: 'File/Open'

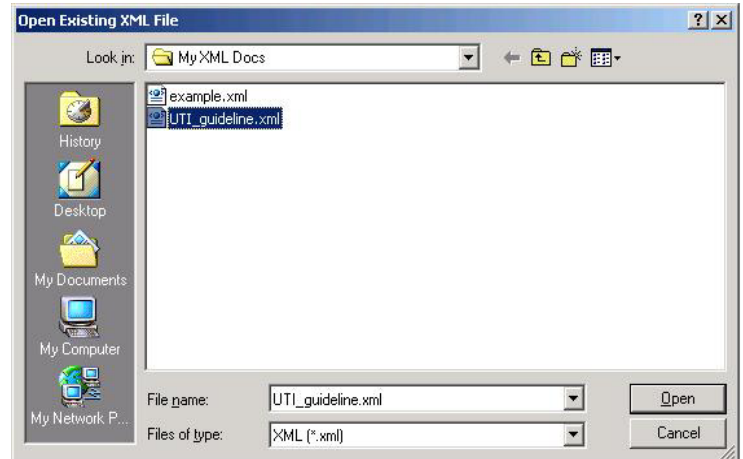
Using the toolbar or menu, open Windows browser window and select the GEM file containing the UTI practice guideline:

UTI_guideline.xml

This file should be located in the GEM Cutter folder at the root of your hard drive.


This usually looks like:

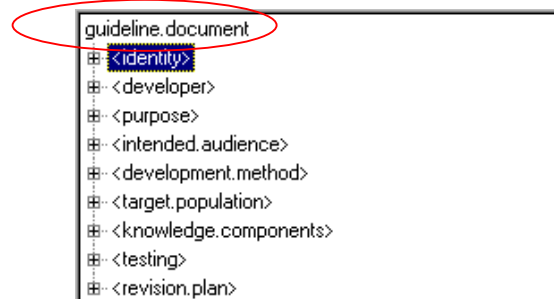
c:\Program Files\GEM\GEM Cutter x.x.x\My Xml Documents\UTI_Guideline.xml




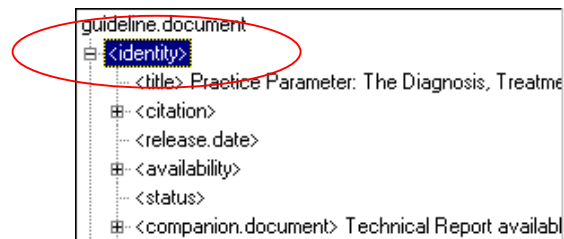
The text file fills the leftmost segment of the Main screen (the Guideline Text segment) and the previously encoded GEM file (the GEM Tree Segment) occupies the middle of the screen.

III. Expand/Contract Elements in the GEM Tree Segment

To view subcomponents of the `<identity>` element, expand it by double clicking on the word `<identity>` or click the  (plus sign) at its left.

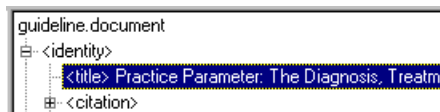


To contract an element (make subelements disappear), double click on `<identity>` or click the  (minus sign) at its left.



IV. View text in the GEM Tree Segment

Expand the <identity> element again and select the <title> element from the expanded view in the GEM Tree segment.

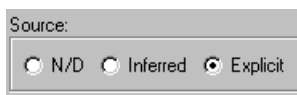


Notice that:

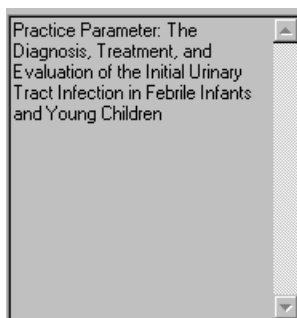
1. The **Name** of the element, <title>, is displayed in the Element Name Bar



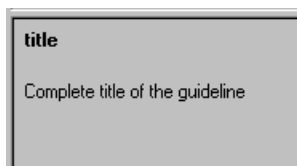
2. The **Source** of the element is displayed in the Element Source Bar. “Explicit” refers to text copied directly from the guideline. “Inferred” text is entered by the user based on his/her understanding of the guideline. The “ND” indicates that the source is not defined.



3. The **Text** of the element is displayed in the Element Text Box. The first few words can be seen in the GEM Tree segment, but the full text is visible in this box.



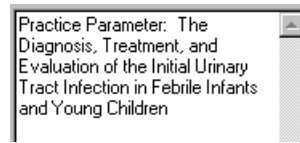
4. The **Definition** of the GEM element is displayed in the Element Definitions Box. The definition can help to decide the element in which guideline information should be stored.



V. Manually edit text in the GEM Tree Segment

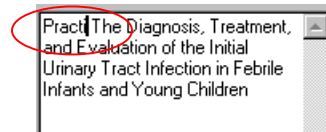
The Element Text Box acts like a simple word processor. You can add or edit text for an element in this box

With the <title> element still selected, click inside the Element Text Box (to the right of the GEM Tree Segment)

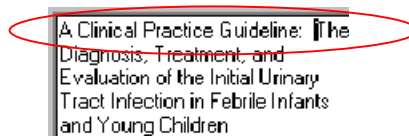


The background of the box will become white to indicate that text is available for editing. Use the mouse or your arrow buttons to position your cursor in front of the word 'The' on the first line and use the Delete key on your keyboard to delete the phrase:

'Practice Parameter: '
(remember to delete the colon and extra spaces)

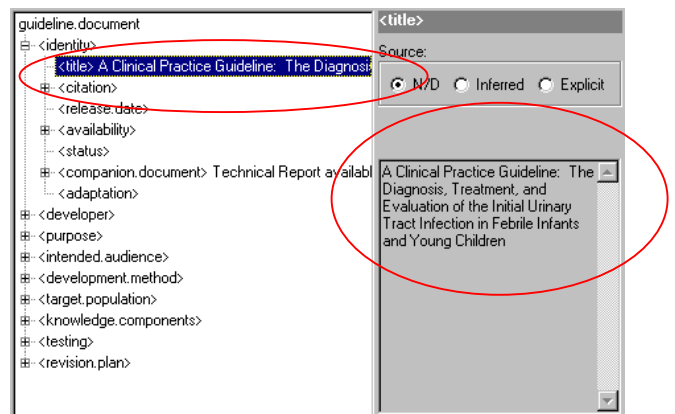


Next, input the phrase:
'Clinical Practice Guideline: '
before the word 'The' on the first line.



When you have finished, simply click on the item in the GEM Tree Segment. As soon as you click on a new control, the background of the box will become gray and editing will be complete. Notice that both the GEM Tree Segment and the Element Text Box display the new text of the <title> element.

Note: if you want to delete the entire text of an element, it is better to use the 'Delete Text' option that will be described later in the tutorial.



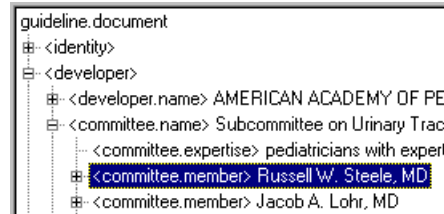
VI. Replicate an Element in the GEM Tree Segment

The GEM Tree segment contains one of each of the elements in the GEM hierarchy. Often more than one instance of an element is needed to store guideline content. For example, guideline development committees usually have more than one member.

1) Collapse the <identity> element and expand the <developer> element.

2) Expand the first <committee.name> element and select the first <committee.member> element.

3) Double click to expand the selected committee member and notice that it has one sub element <member.expertise>.

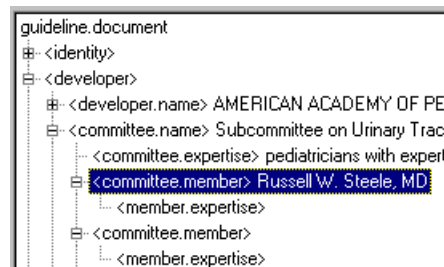


Using either the toolbar or menu, select the 'Replicate Element' option

Toolbar: 

Menu: 'Edit/Replicate Element + SubElements'

Notice that a blank <committee.member> element has been added to the tree directly after the element that was replicated. The new <committee.member> also has a sub element named <member.expertise>.



VII. Insert text explicitly from the Guideline

The most commonly used GEM Cutter methods are used to copy and paste explicit text from the guideline into specific GEM elements.

In the Guideline Text Segment, scroll down to the bottom of the document where it says '*Subcommittee on Urinary Tract Infection*' and highlight the text: '*Kenneth B. Roberts*'

Committee on Quality Improvement, 1999 David A. Bergman, MD, Chairperson Richard D. Baltz, MD James R. Cooley, MD Liaison Representatives Michael J. Goldberg, MD, Sections Liason Gerald B. Hickson, MD Charles J. Homer, MD, MPH, Section on Epidemiology Liaison Paul V. Miles, MD Joan E. Shook, MD William M. Zurthellen, MD Liaison Representative Betty A. Lowe, MD, NACHRI Liaison

Subcommittee on Urinary Tract Infection Kenneth B. Roberts, MD, Chairperson Stephen M. Downs, MD, MS Stanley Hellerstein, MD Michael J. Holmes, MD, PhD Robert L. Lebowitz, MD Jacob A. Lohr, MD Russell W. Steele, MD

In the GEM Tree Segment, make sure the new <committee.member> element is selected

```
guideline.document
├─ <identity>
└─ <developer>
   └─ <developer.name> AMERICAN ACADEMY OF PEI
      └─ <committee.name> Subcommittee on Urinary Tract
         ├── <committee.expertise> pediatricians with experi
         ├── <committee.member> Russell W. Steele, MD
         │   └─ <member.expertise>
         ├── <committee.member>
         │   └─ <member.expertise>
         └─ <committee.member> Jacob A. Lohr, MD
```

Using either the toolbar or menu, select the 'Insert Text' option

Toolbar: 

Menu: 'Edit/Insert Text'

The selected text will appear in the GEM Tree Segment

```
guideline.document
├─ <identity>
└─ <developer>
   └─ <developer.name> AMERICAN ACADEMY OF PEI
      └─ <committee.name> Subcommittee on Urinary Tract
         ├── <committee.expertise> pediatricians with experi
         ├── <committee.member> Russell W. Steele, MD
         │   └─ <member.expertise>
         ├── <committee.member> Kenneth B. Roberts
         │   └─ <member.expertise>
         └─ <committee.member> Jacob A. Lohr, MD
```

Notice that '*Kenneth B. Roberts*' has been underlined in the Guideline Text Segment. This indicates that the text has been used in the GEM Tree Segment.

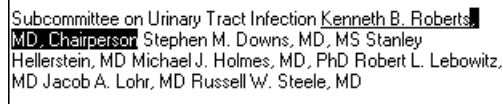
Subcommittee on Urinary Tract Infection Kenneth B. Roberts, MD, Chairperson Stephen M. Downs, MD, MS Stanley Hellerstein, MD Michael J. Holmes, MD, PhD Robert L. Lebowitz, MD Jacob A. Lohr, MD Russell W. Steele, MD

VIII. Append text explicitly from the Guideline

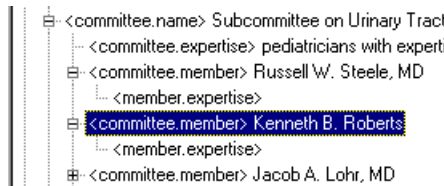
In the last process, we inserted the text *'Kenneth B. Roberts'* into a `<committee.member>` element. However, we forgot to include Kenneth's title (MD, Chairperson) in the text, so we have to append it to the existing text.

In the Guideline Text Segment highlight the text:

'MD, Chairperson'



In the GEM Tree Segment, make sure that the `<committee.member>` element containing *'Kenneth B. Roberts'* is selected

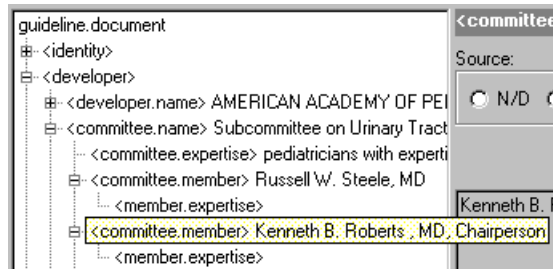


Using either the toolbar or menu, select the 'Append Text' option

Toolbar: 

Menu: 'Edit/Append Text'

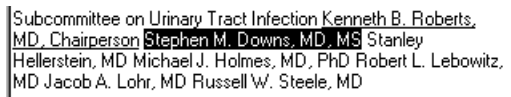
The selected text will be appended to the existing text in the GEM Tree Segment.



IX. Replace text with text taken explicitly from the Guideline

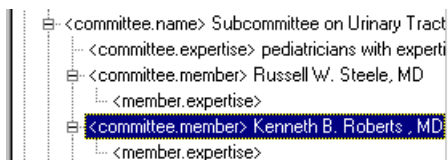
For the selected <committee.member> element, replace the text containing *'Kenneth B. Roberts'* with *'Stephen M. Downs, MD, MS'*

In the Guideline Text Segment, highlight the text: *'Stephen M. Downs, MD, MS'*



Subcommittee on Urinary Tract Infection Kenneth B. Roberts, MD, Chairperson Stephen M. Downs, MD, MS Stanley Hellerstein, MD Michael J. Holmes, MD, PhD Robert L. Lebowitz, MD Jacob A. Lohr, MD Russell W. Steele, MD

In the GEM Tree Segment, make sure that the <committee.member> element containing *'Kenneth B. Roberts, MD, Chairperson'* is selected.



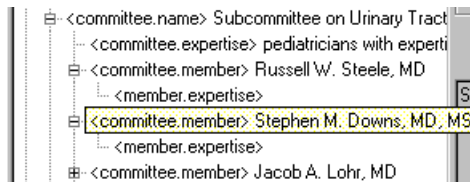
<committee.name> Subcommittee on Urinary Tract
... <committee.expertise> pediatricians with experi
... <committee.member> Russell W. Steele, MD
... <member.expertise>
... <committee.member> Kenneth B. Roberts, MD, Chairperson
... <member.expertise>

Using either the toolbar or menu, select the 'Replace Text' option

Toolbar: 

Menu: 'Edit/Replace Text'

Notice that *'Kenneth B. Roberts'* has been replaced with the text *'Stephen M. Downs, MD, MS'*

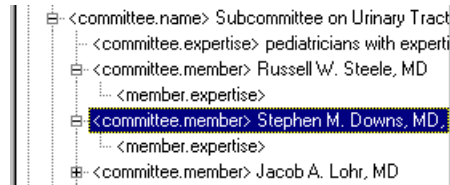


<committee.name> Subcommittee on Urinary Tract
... <committee.expertise> pediatricians with experi
... <committee.member> Russell W. Steele, MD
... <member.expertise>
... <committee.member> Stephen M. Downs, MD, MS
... <member.expertise>
... <committee.member> Jacob A. Lohr, MD

X. Delete an Element from the GEM Tree Segment

Since we changed the text of the <committee.member> element, there are now two <committee.member> elements containing the same text (the first and last <committee.member> elements in this <committee.name> are 'Stephen M. Downs, MD, MS'). One of these elements has to be deleted.

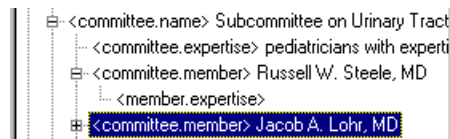
In the GEM Tree Segment, make sure the new <committee.member> element containing 'Stephen M. Downs' is selected



Using either the toolbar or menu, select the 'Delete Element' option

Toolbar: 

Menu: 'Edit/Delete Element + SubElements'

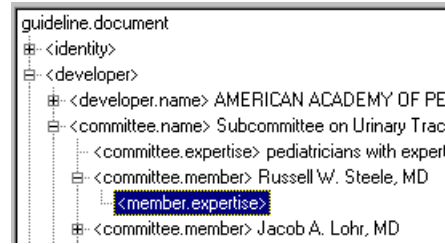


Notice that the selected <committee.member> element has been removed. GEM Cutter does not allow you to delete the last instance of an element.

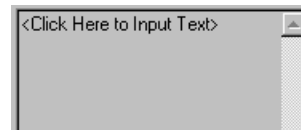
XI. Manually Add Text to the GEM Tree Segment

Input text into the GEM Tree Segment by typing text into the **Elements Text Box**. This is necessary when content of an element is inferred.

In the GEM Tree Segment, select the `<committee.expertise>` element under the *'Russell W. Steele, MD'* `<committee.member>` element.



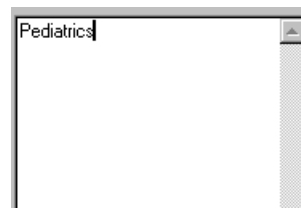
Position your cursor in the Element Text Box



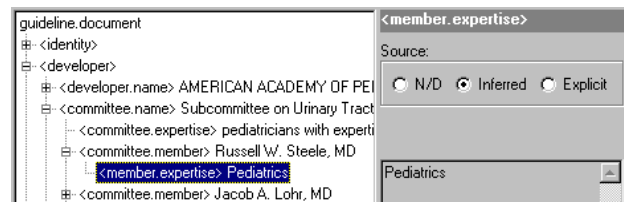
Notice that the box becomes blank and the background becomes white



Type the word 'Pediatrics' into the Element Text Box



When you have finished, simply click on the item in the GEM Tree Segment. As soon as you click on a new control, the background of the box will become gray and editing will be complete.

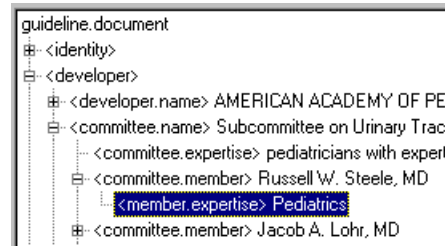


Notice that both the GEM Tree Segment and the Element Text Box display the new text of the `<member.expertise>` element.


XII. Delete Text from an Element in the GEM Tree Segment

Delete the entire text of a element without deleting the element itself.

In the GEM Tree Segment, make sure `<committee.expertise>` element containing the text 'Pediatrics' is selected.

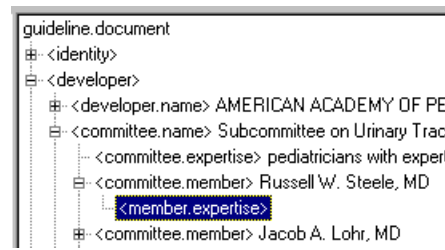


Using either the toolbar or menu, select the 'Delete Text' option

Toolbar: 

Menu: 'Edit/Delete Text'

Notice that the `<committee.expertise>` element is still there but there it doesn't contain any text.



XIII. Saving the File

To save the current file:

Using either the toolbar or menu, select the 'Save' option

Toolbar: 

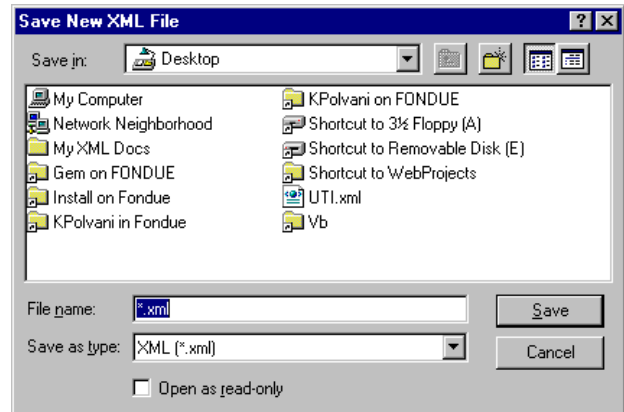
Menu: 'File/Save'

To save the file under a new name:

Using the menu, select the 'Save As' option

Menu: 'File/Save As'

The Windows browser window will be displayed prompting you to choose a new name and location for your GEM file



XIV. Close the File

To close the current file:

Using the menu, select the 'Close' option

Menu: 'File/Close'

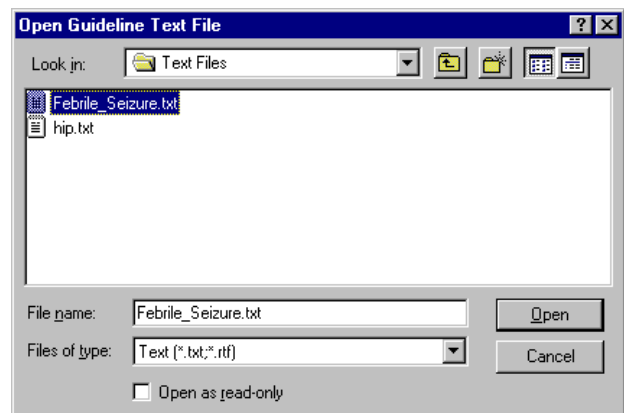
XV. Create a New File

To create a New GEM File from scratch, use the toolbar or menu and select the 'New' option.

Toolbar: 

Menu: 'File/New'

The Windows browser window will appear prompting you to choose the text file containing the practice guideline that you want to transform into a GEM file.



XVI. Exit GEM Cutter

To exit GEM Cutter:

Using the menu, select the 'Exit' option

Menu: 'File/Exit'

Menu: 'File/Exit'

GEM Cutter Menus

General

- Create a New GEM Document

Toolbar: 

Menu: **'File/New'**

Using either the menu or toolbar, choose 'New' and select the text medical guideline document from the windows browser window. This will automatically create a new GEM document.

- Modify an existing GEM Document

Toolbar: 

Menu: **'File/Open'**

From the menu or toolbar, choose 'Open' and select the GEM document you wish to open from the windows browser window. The original text guideline document should be associated with the GEM document and will displayed automatically when the GEM document is opened.

- Save a new or existing GEM document

Toolbar: 

Menu: **'File/Save' or 'File/Save As'**

To save a new GEM document, choose either **'File/Save'** or **'File/Save As'** from the menu. The application will ask you to indicate what you want the file to be named and where you want it to be located. To save an existing file under a new name, choose **'File/Save As'** and you will be prompted to provide a new name and location for the file. To simply save changes to a document, choose **'File/Save'** from the menu.

- File Recovery

Menu: **'File/Recover File'**

In the event of an unexpected termination of the GEM Cutter application, a lost document can be recovered by choosing 'Recover File' from the menu.

- View XML Code

Menu: **'View/XML'**

To view the XML code that GEM Cutter has constructed, choose 'XML' and the XML code will be displayed.

- View GEM Structure

Menu: **'View/GEM Structure'**

To open a window that will display the GEM hierarchy in organizational chart format, choose the 'GEM Structure' option from the menu.

- Undo Underline in Guideline Text Window

Toolbar: 

Menu: **'Edit/Remove Underline'**

To remove the underlining in the window containing the original Guideline text document, highlight the text where you want to remove the underline and choose 'Remove Underline' from the menu or toolbar.

GEM Editing


- Insert Text from the Guideline

Toolbar: 

Menu: **'Edit/Insert Text'**

To insert text explicitly from the Guideline, highlight the text to be inserted, click on the element where the text is to be inserted then choose 'Insert Text' option from the menu or toolbar. This is the most commonly used button during guideline markup.


- Append text to existing text

Toolbar: 

Menu: **'Edit/Append Text'**

To append additional text to existing text in an element, highlight the text to be appended, select the element the text will be appended to and choose 'Append Text' Option from the menu or toolbar.

- Replace existing text with text from the Guideline

Toolbar: 

Menu: **'Edit/Replace Text'**

To replace text in an element with text taken explicitly from the Guideline, highlight the text to be inserted and click on the element where the text is being replaced. Choose 'Replace Text' option from the menu or toolbar.


- Delete existing text

Toolbar: 

Menu: **'Edit/Delete Text'**

To delete text that has already been added to the GEM file, select the element containing the text and choose 'Delete Text' option from either the menu or toolbar.

- Replicate an Element and its subelements

Toolbar: 

Menu: **'Edit/Replicate Element + SubElements'**

To replicate an element in its entirety (including all of its sub/child elements), select the element to be replicated and choose the 'Replicate Element' option from the menu or toolbar.

- Delete an Element and its Subelements

Toolbar: 

Menu: **'Edit/Delete Element + SubElements'**

To completely delete an element (including all of its sub/child elements), select the element to be deleted and choose the 'Delete Element' option from the menu or toolbar.

- Input/Edit Text

Text can be input directly or edited using the Element Text Window (figure 1, window 5) by simply clicking inside the window. The background of the window will become white to let you know that you are in the process of editing the selected element. To finish editing the element, simply move on to your next task. As soon as you click on a new control, the background of the window will become gray again and editing will be complete.