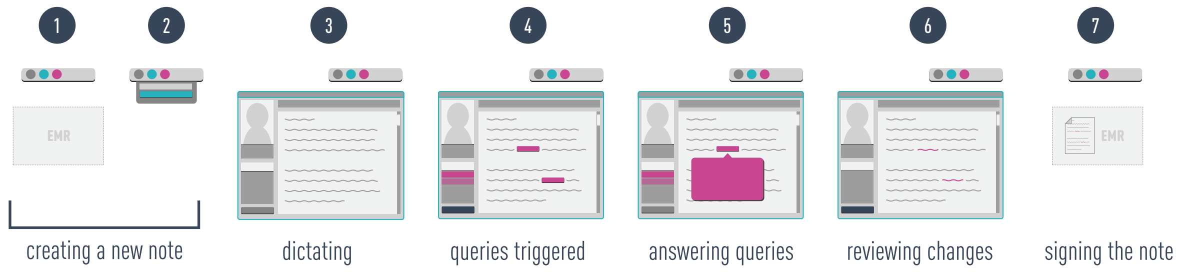
WORKFLOW SCENARIOS

We have identified three major workflows that InQuery needs to support. Each of these is treated here with a detailed scenario walkthrough, describing how the workflow would play out in our implementation of InQuery.

Scenario 1: The physician responds to queries as part of the review process immediately following dictation (p. 25)

Scenario 2: The physician allows queries to go unanswered and returns to them later (p. 33)

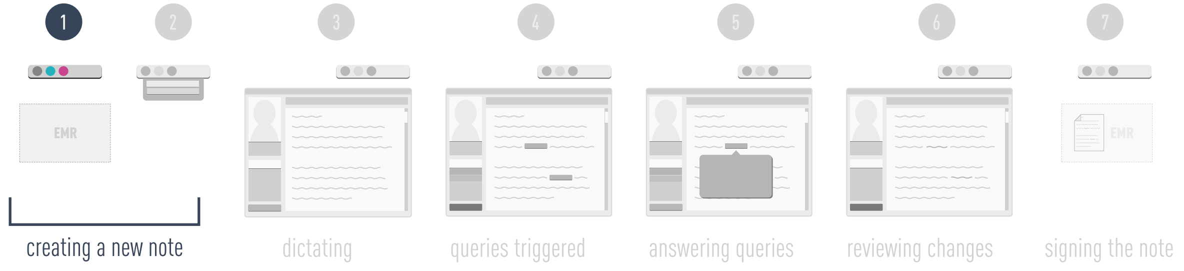
Scenario 3: A query is generated by events outside the note authoring process and accessed via a New Query Notification (p. 38)



Scenario 1: The physician responds to queries as part of the review process immediately following dictation

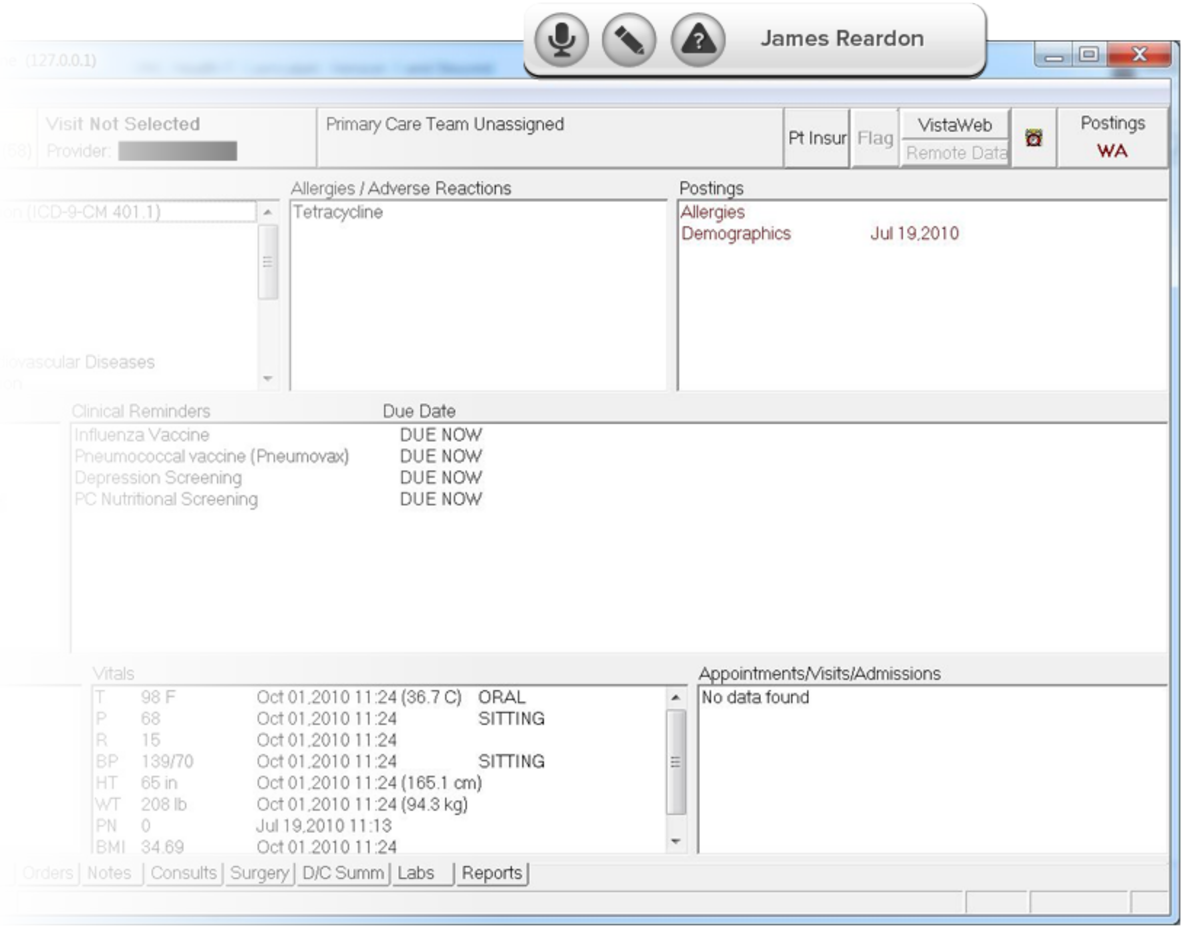
As described in the design overview (p. 18), the main benefit associated with InQuery is the ability to identify deficiencies and address queries at the time of note authoring. This scenario illustrates that workflow. Each step is explained as a physician dictates his note and follows through on InQuery's intervention. As he is dictating, InQuery registers two issues with the note. The physician is notified of the problems. After he has completed his dictation, he addresses the issues through Query Dialogs and then signs the note.

Though there are clear benefits of addressing queries at the time of note authoring, InQuery has been designed with an understanding that queries must be unobtrusive. Queries are placed clearly in the path of the physician's workflow, but they never obstruct that path. The physician chooses to address the query in each case.



Working in the EMR

Dr. Reardon has just completed a patient encounter. He has opened the patient's chart in his EMR. He also has Fluency Direct open and has signed in. The Fluency pill sits at the top of his screen where it does not obscure his view of the EMR.



(127.0.0.1)

Visit Not Selected
Provider:

Primary Care Team Unassigned

(ICD-9-CM 401.1)

vascular Diseases

Allergies / Adverse Reactions
Tetracycline

Postings
Allergies
Demographics Jul 19,2010

Clinical Reminders	Due Date
Influenza Vaccine	DUE NOW
Pneumococcal vaccine (Pneumovax)	DUE NOW
Depression Screening	DUE NOW
PC Nutritional Screening	DUE NOW

Vitals

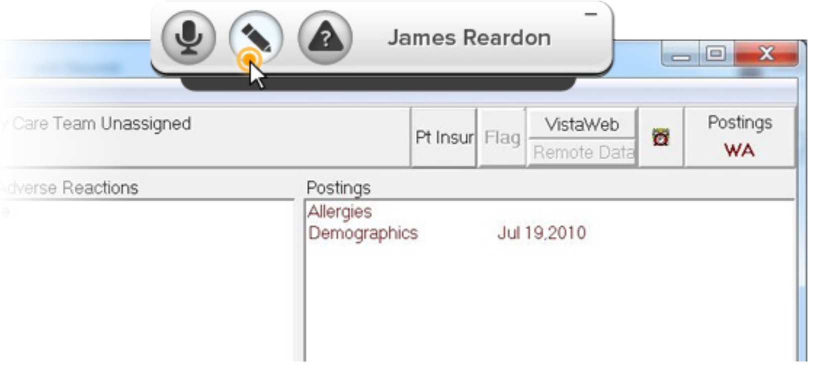
T	98 F	Oct 01,2010 11:24 (36.7 C)	ORAL
P	68	Oct 01,2010 11:24	SITTING
R	15	Oct 01,2010 11:24	
BP	139/70	Oct 01,2010 11:24	SITTING
HT	65 in	Oct 01,2010 11:24 (165.1 cm)	
WT	208 lb	Oct 01,2010 11:24 (94.3 kg)	
PN	0	Jul 19,2010 11:13	
BMI	34.69	Oct 01,2010 11:24	

Appointments/Visits/Admissions
No data found

1
2
3
4
5
6
7
EMR
creating a new note
dictating
queries triggered
answering queries
reviewing changes
signing the note

Clicking the 'New Note' button

Dr. Reardon is ready to create a new note based on his patient visit. He goes to click the 'New Note' button in the Pill. As his mouse comes over the button, he sees the button glow. Consistent with existing Fluency behavior, a minimize button shows up in the corner of the Pill, and a drawer slides out slightly below the Pill. Dr. Reardon clicks on the 'New Note' button.



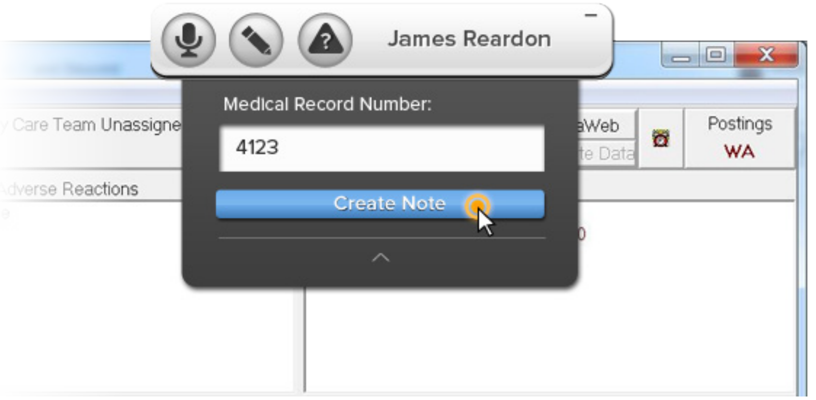
Care Team Unassigned

verse Reactions

Postings
Allergies
Demographics Jul 19,2010

Entering the MRN

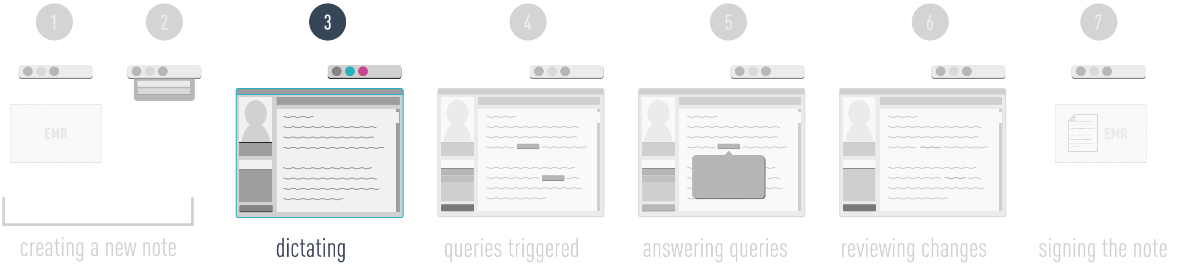
After he clicks, the drawer slides out completely, revealing a prompt to enter a medical record number. Dr. Reardon enters the patient's record number and clicks the 'Create Note' button.



Medical Record Number: 4123

Care Team Unassigne

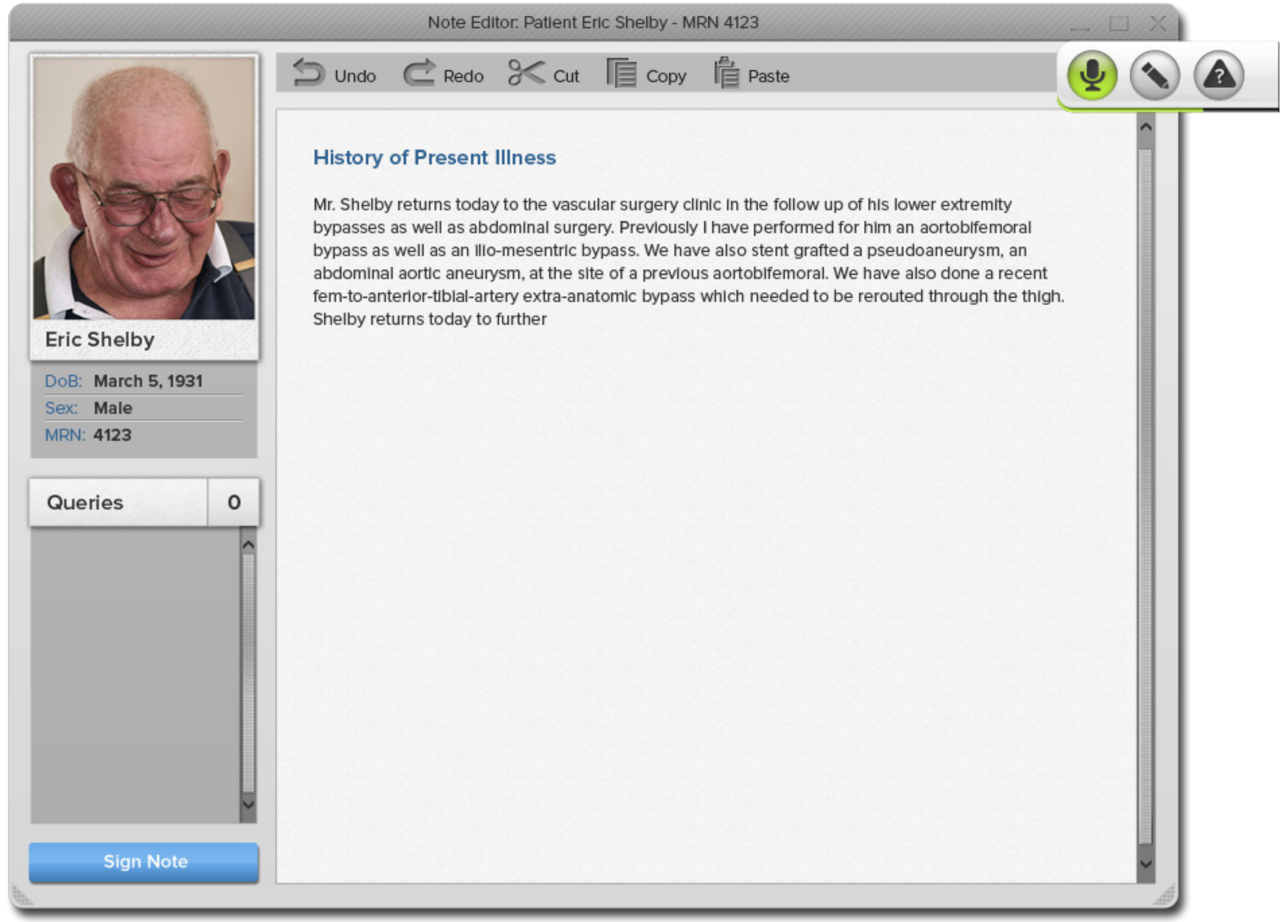
verse Reactions



Beginning dictation

The Note Editor opens, populated with the patient's basic information. Dr. Reardon docks the Fluency Pill on the side of his screen so that it will take up less space.

Dr. Reardon begins his dictation. He holds down the button on his handheld microphone and as he does, sees the microphone indicator light up in the Fluency Pill (consistent with existing Fluency behavior). As he speaks, his note is generated in the text field.



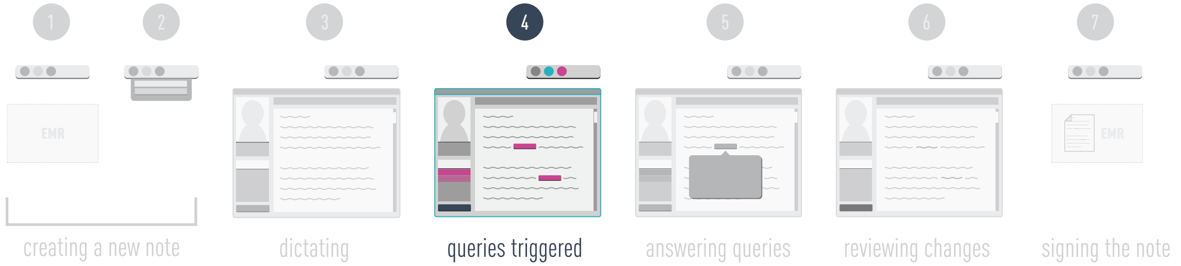
Eric Shelby

DoB: March 5, 1931
Sex: Male
MRN: 4123

Queries 0

History of Present Illness

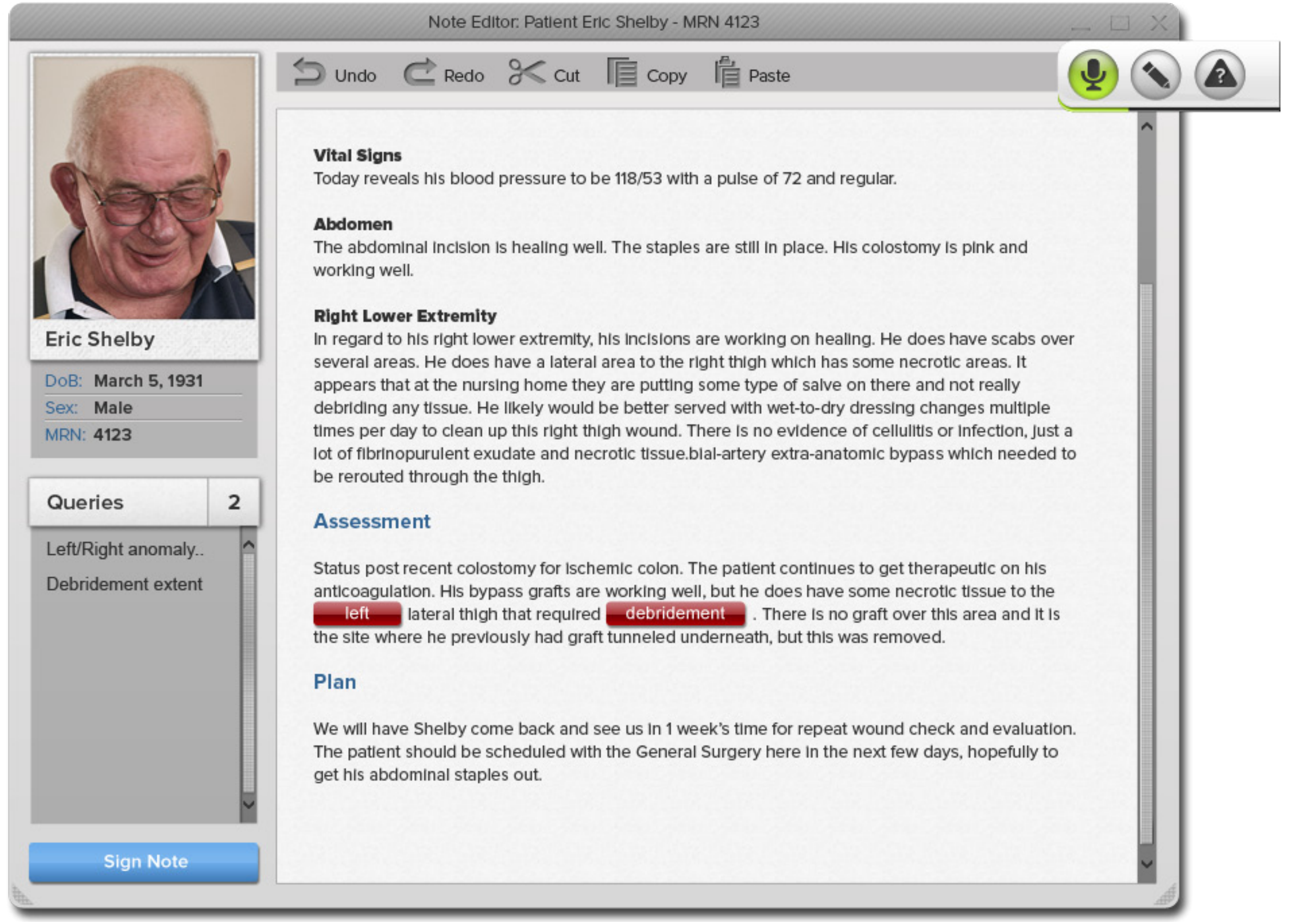
Mr. Shelby returns today to the vascular surgery clinic in the follow up of his lower extremity bypasses as well as abdominal surgery. Previously I have performed for him an aortobifemoral bypass as well as an ilio-mesentric bypass. We have also stent grafted a pseudoaneurysm, an abdominal aortic aneurysm, at the site of a previous aortobifemoral. We have also done a recent fem-to-anterior-tibial-artery extra-anatomic bypass which needed to be rerouted through the thigh. Shelby returns today to further



Queries are triggered

As Dr. Reardon is dictating his assessment, he mistakenly refers to necrotic tissue on the patient's left thigh. Previously in his note he had referred to necrotic tissue on the right thigh. InQuery registers the anomaly and generates a query. A red button forms around the word "left" and the query is added to the query list.

Dr. Reardon triggers another query when he neglects to be specific enough about the extent of the debridement he performed. This is important information for billing. A red button forms around the word "debridement" and the debridement query is added to the query list.



Eric Shelby

DoB: March 5, 1931
Sex: Male
MRN: 4123

Queries 2

Left/Right anomaly..
Debridement extent

Vital Signs
Today reveals his blood pressure to be 118/53 with a pulse of 72 and regular.

Abdomen
The abdominal incision is healing well. The staples are still in place. His colostomy is pink and working well.

Right Lower Extremity
In regard to his right lower extremity, his incisions are working on healing. He does have scabs over several areas. He does have a lateral area to the right thigh which has some necrotic areas. It appears that at the nursing home they are putting some type of salve on there and not really debriding any tissue. He likely would be better served with wet-to-dry dressing changes multiple times per day to clean up this right thigh wound. There is no evidence of cellulitis or infection, just a lot of fibrinopurulent exudate and necrotic tissue.bial-artery extra-anatomic bypass which needed to be rerouted through the thigh.

Assessment

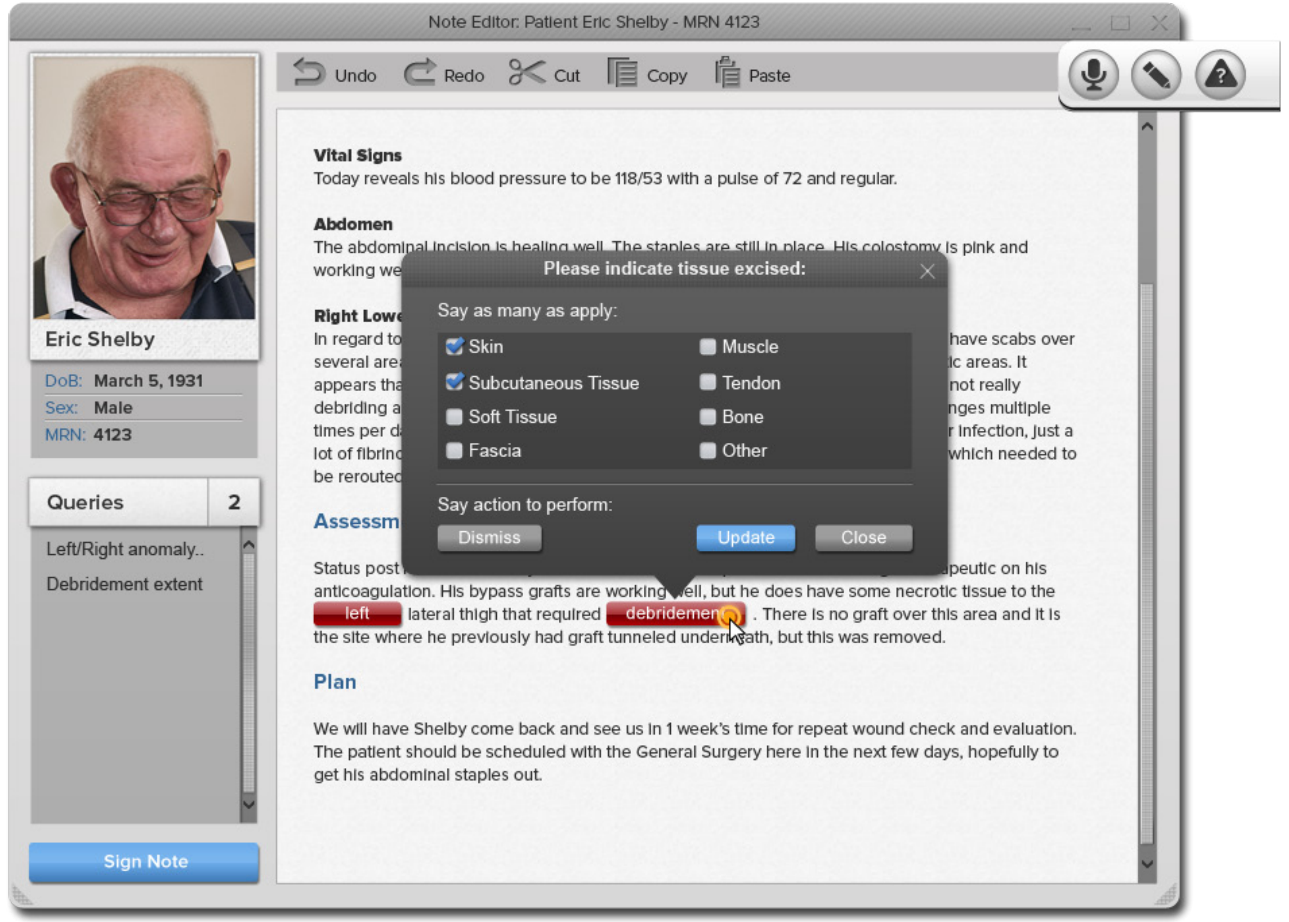
Status post recent colostomy for ischemic colon. The patient continues to get therapeutic on his anticoagulation. His bypass grafts are working well, but he does have some necrotic tissue to the left lateral thigh that required debridement . There is no graft over this area and it is the site where he previously had graft tunneled underneath, but this was removed.

Plan

We will have Shelby come back and see us in 1 week's time for repeat wound check and evaluation. The patient should be scheduled with the General Surgery here in the next few days, hopefully to get his abdominal staples out.

Clicking the Query Button

After completing his dictation, Dr. Reardon clicks on the red debridement Query Button. He sees a dialog pop-up prompting him for additional information about the excised tissue. Using his microphone he speaks his selection, 'skin, subcutaneous tissue.' He sees checkmarks appear in the appropriate checkboxes. Satisfied, he says 'update' to push the changes into his note. The Query Dialog disappears and the red Query Button with the word 'debridement' on it is replaced with the phrase 'excisional debridement of the skin and subcutaneous tissue.'



Note Editor: Patient Eric Shelby - MRN 4123

Eric Shelby
DoB: March 5, 1931
Sex: Male
MRN: 4123

Queries 2
Left/Right anomaly..
Debridement extent

Vital Signs
Today reveals his blood pressure to be 118/53 with a pulse of 72 and regular.

Abdomen
The abdominal incision is healing well. The staples are still in place. His colostomy is pink and working we

Right Lowe
In regard to … have scabs over several are… ic areas. It appears tha… not really debriding a… nges multiple times per d… r infection, just a lot of fibrin… which needed to be rerouted

Assessm

Status post … apeutic on his anticoagulation. His bypass grafts are working well, but he does have some necrotic tissue to the left lateral thigh that required debridement . There is no graft over this area and it is the site where he previously had graft tunneled underneath, but this was removed.

Plan

We will have Shelby come back and see us in 1 week's time for repeat wound check and evaluation. The patient should be scheduled with the General Surgery here in the next few days, hopefully to get his abdominal staples out.

Please indicate tissue excised:

Say as many as apply:

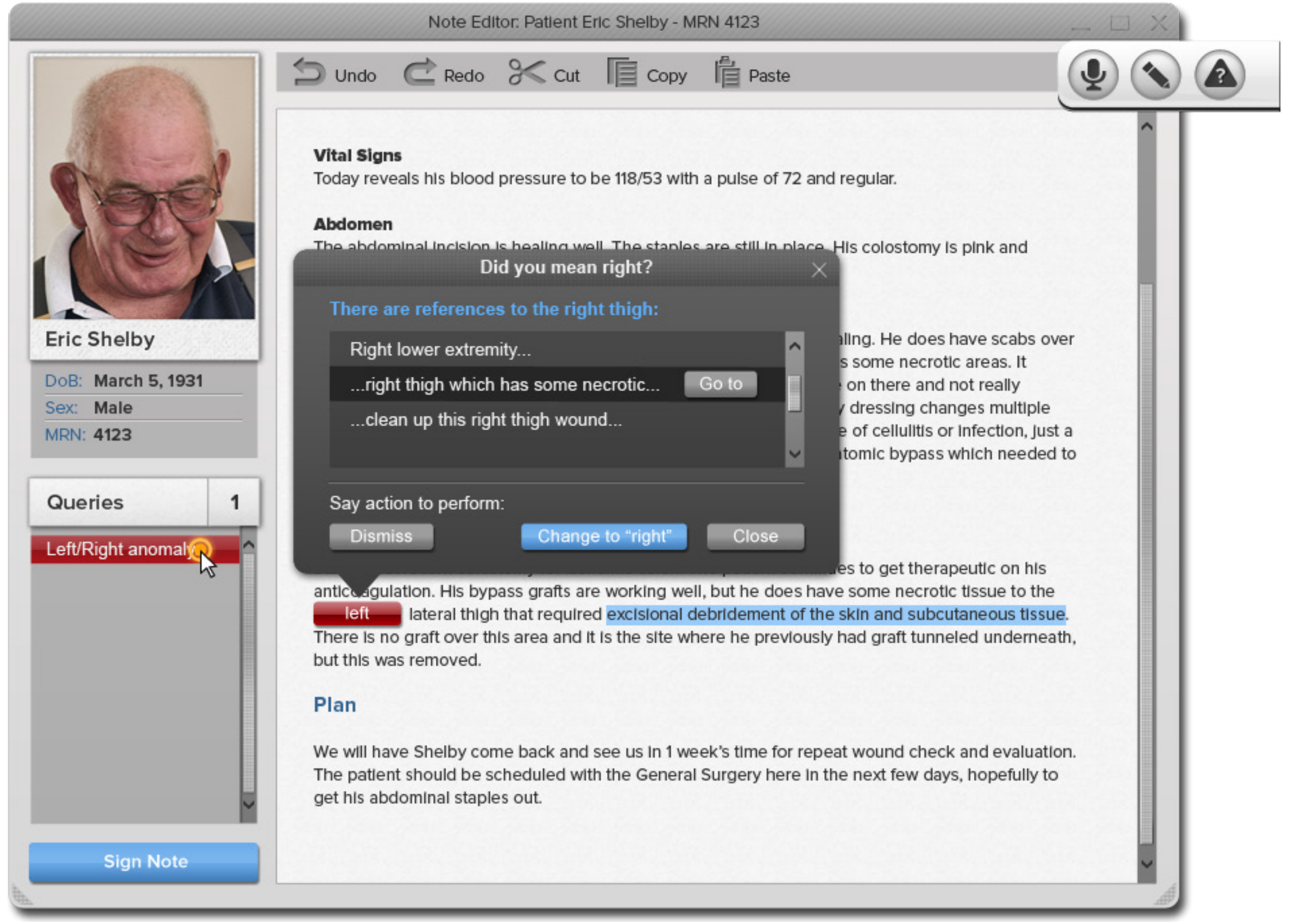
☑ Skin ☐ Muscle
☑ Subcutaneous Tissue ☐ Tendon
☐ Soft Tissue ☐ Bone
☐ Fascia ☐ Other

Say action to perform:

Clicking a query in the Query List

To address the left/right anomaly, Dr. Reardon goes to click on the query description in the Query List on the left. As his mouse hovers over the list item, it is highlighted red to show the connection with the in-line Query Button. When he clicks, the Query Dialog automatically pops up over the associated button.

The dialog provides evidence of the anomaly. He sees his mistake and says 'change to right' to make the correction in his note.



Note Editor: Patient Eric Shelby - MRN 4123

Eric Shelby
DoB: March 5, 1931
Sex: Male
MRN: 4123

Queries 1
Left/Right anomaly

Vital Signs
Today reveals his blood pressure to be 118/53 with a pulse of 72 and regular.

Abdomen
The abdominal incision is healing well. The staples are still in place. His colostomy is pink and

…aling. He does have scabs over …s some necrotic areas. It … on there and not really …y dressing changes multiple …e of cellulitis or infection, just a …tomic bypass which needed to

…es to get therapeutic on his anticoagulation. His bypass grafts are working well, but he does have some necrotic tissue to the left lateral thigh that required excisional debridement of the skin and subcutaneous tissue. There is no graft over this area and it is the site where he previously had graft tunneled underneath, but this was removed.

Plan

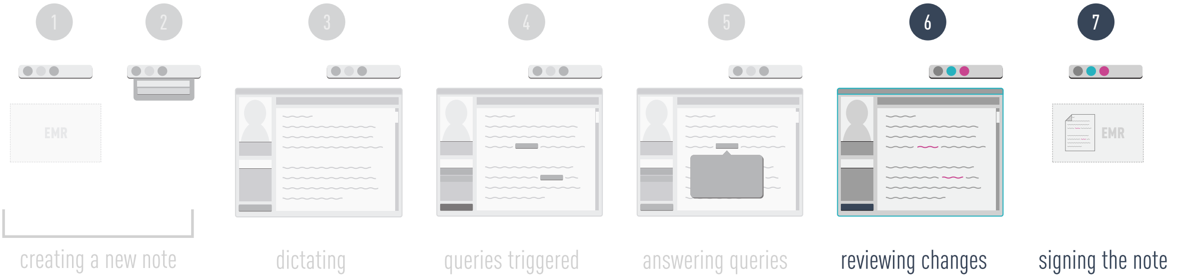
We will have Shelby come back and see us in 1 week's time for repeat wound check and evaluation. The patient should be scheduled with the General Surgery here in the next few days, hopefully to get his abdominal staples out.

Did you mean right?

There are references to the right thigh:

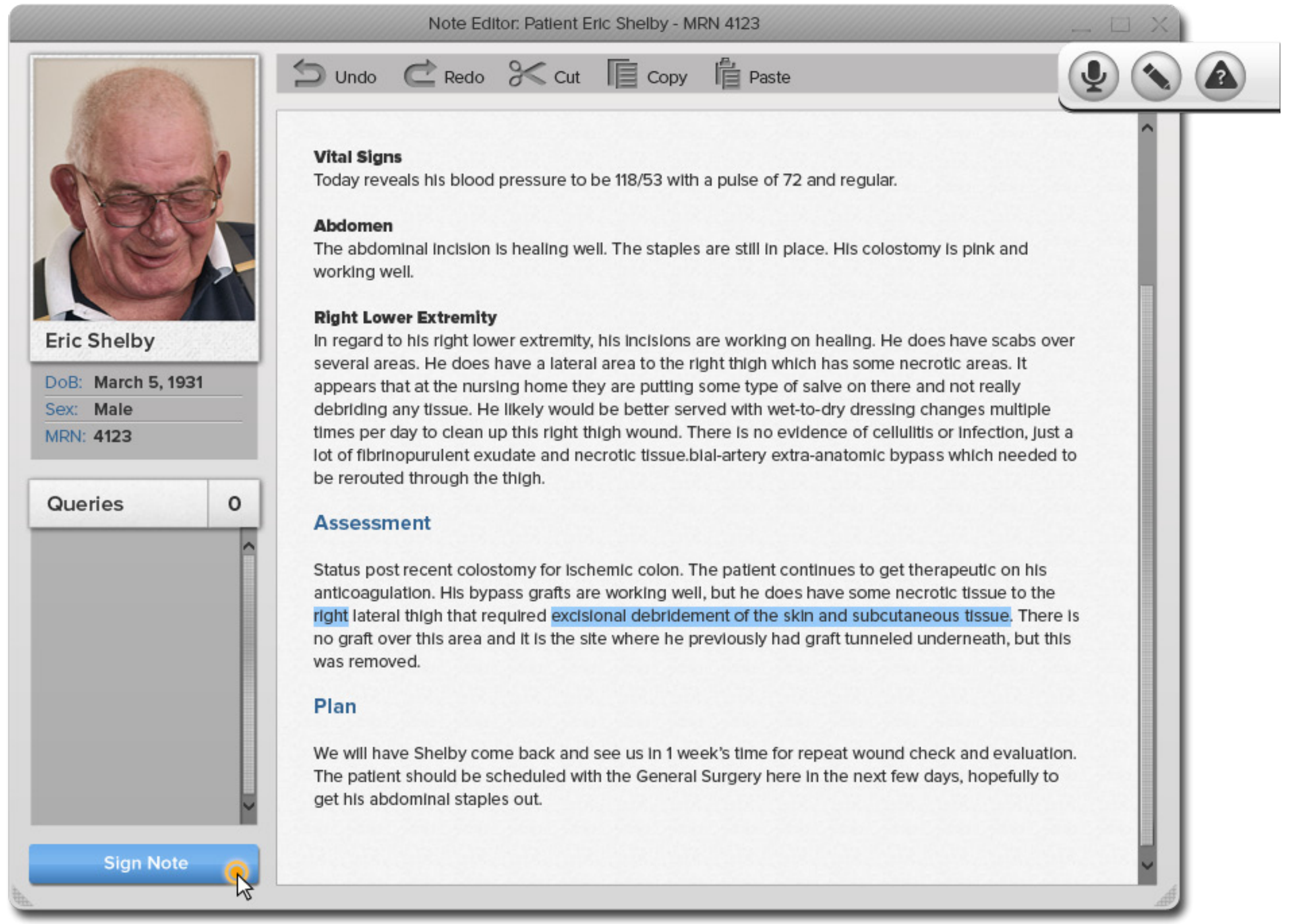
Right lower extremity...
...right thigh which has some necrotic...
...clean up this right thigh wound...

Say action to perform:



Reviewing changes and signing the note

Dr. Reardon can now see both of the corrections made to his note highlighted in blue. The highlighting helps him easily identify and review the auto-inserted text. After quickly looking over the note for any other errors, Dr. Reardon is ready to sign the note. He clicks the 'Sign Note' button, which pushes the note back into his EMR. The note editor window automatically closes.



Vital Signs
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Assessment

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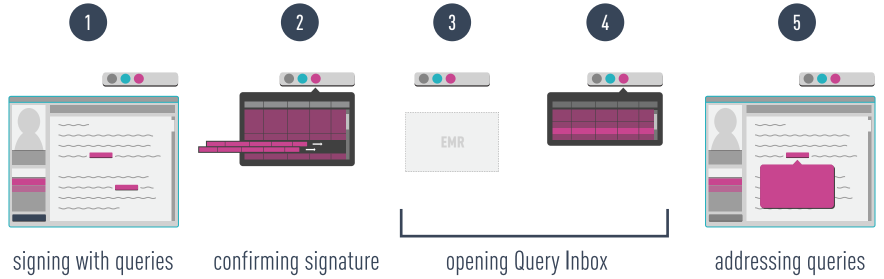
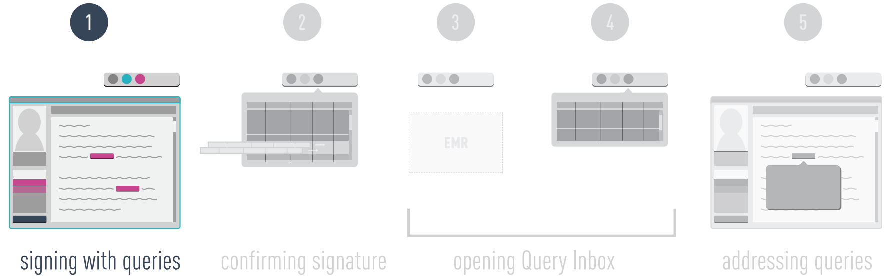
Plan

We will have Shelby come back and see us in 1 week's time for repeat wound check and evaluation. The patient should be scheduled with the General Surgery here in the next few days, hopefully to get his abdominal staples out.



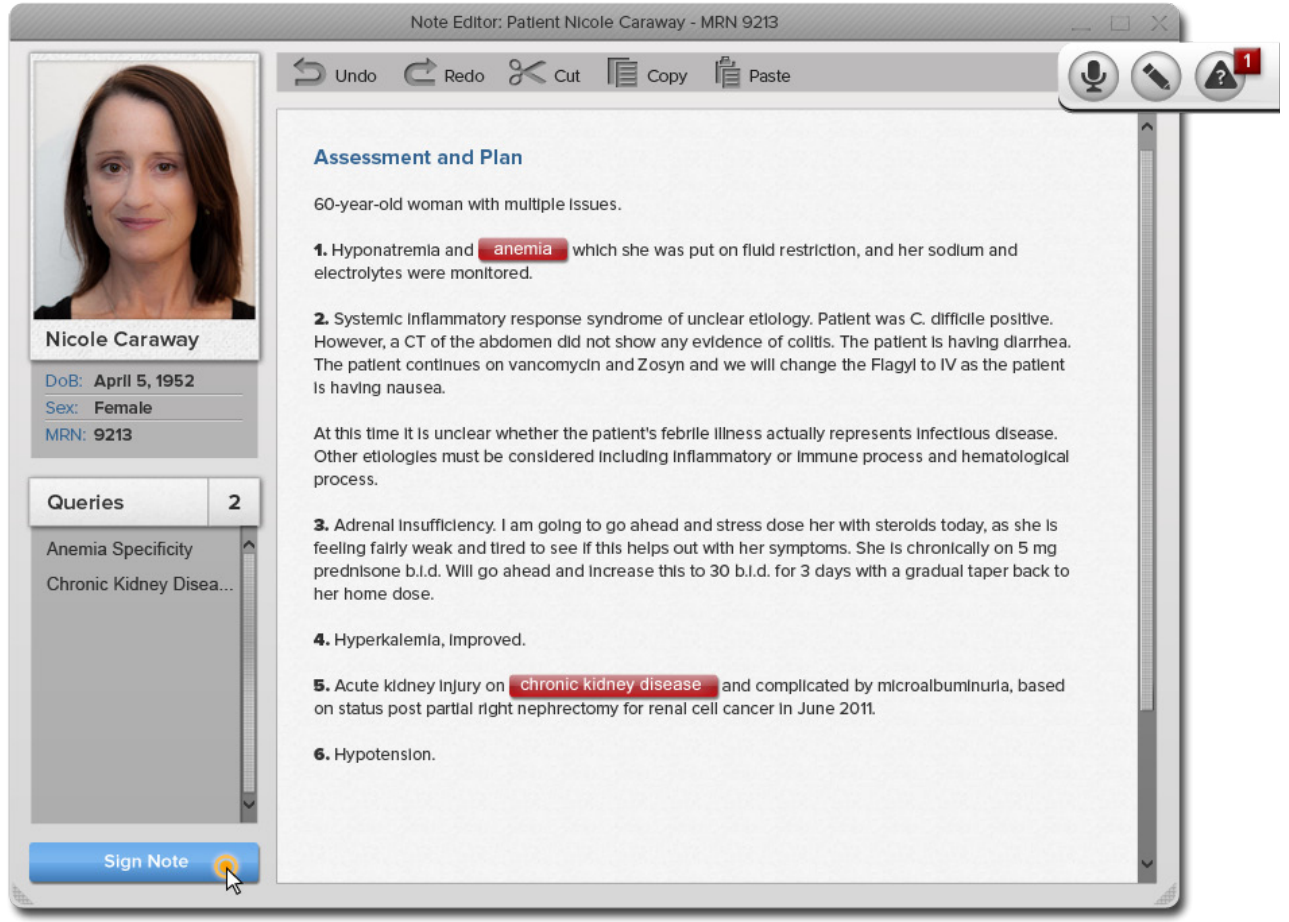
Scenario 2: The physician allows queries to go unanswered and returns to them later

As we saw in our usability testing, it is not always preferable, or even possible, to address deficiencies at the time a note is being authored. In some cases, a physician simply does not have time to address all the queries in their documentation. It was to address these cases that we implemented the Query Inbox, which aggregates outstanding queries across patients (see Usability Findings p. 84). This two-part scenario depicts the workflow for a physician who chooses to initially ignore the queries in her note. Later the physician will address the queries by accessing them through the Query Inbox.



Signing the Note with Unanswered Queries

Dr. Sharon Wilson has just completed dictating a progress note for her patient in the Fluency Note Editor. She sees that there are two queries on the note but she has to rush to see her next patient and doesn't have time to address the queries at the moment. Dr. Wilson clicks the 'Sign Note' button.



Nicole Caraway

DoB: April 5, 1952
Sex: Female
MRN: 9213

Queries 2

Anemia Specificity
Chronic Kidney Disea...

Assessment and Plan

60-year-old woman with multiple issues.

1. Hyponatremia and anemia which she was put on fluid restriction, and her sodium and electrolytes were monitored.

2. Systemic inflammatory response syndrome of unclear etiology. Patient was C. difficile positive. However, a CT of the abdomen did not show any evidence of colitis. The patient is having diarrhea. The patient continues on vancomycin and Zosyn and we will change the Flagyl to IV as the patient is having nausea.

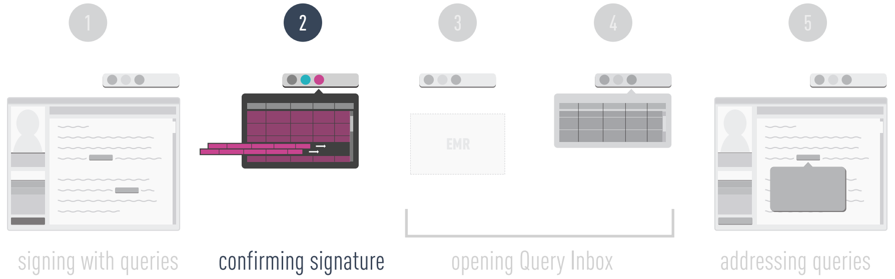
At this time it is unclear whether the patient's febrile illness actually represents infectious disease. Other etiologies must be considered including inflammatory or immune process and hematological process.

3. Adrenal insufficiency. I am going to go ahead and stress dose her with steroids today, as she is feeling fairly weak and tired to see if this helps out with her symptoms. She is chronically on 5 mg prednisone b.i.d. Will go ahead and increase this to 30 b.i.d. for 3 days with a gradual taper back to her home dose.

4. Hyperkalemia, improved.

5. Acute kidney injury on chronic kidney disease and complicated by microalbuminuria, based on status post partial right nephrectomy for renal cell cancer in June 2011.

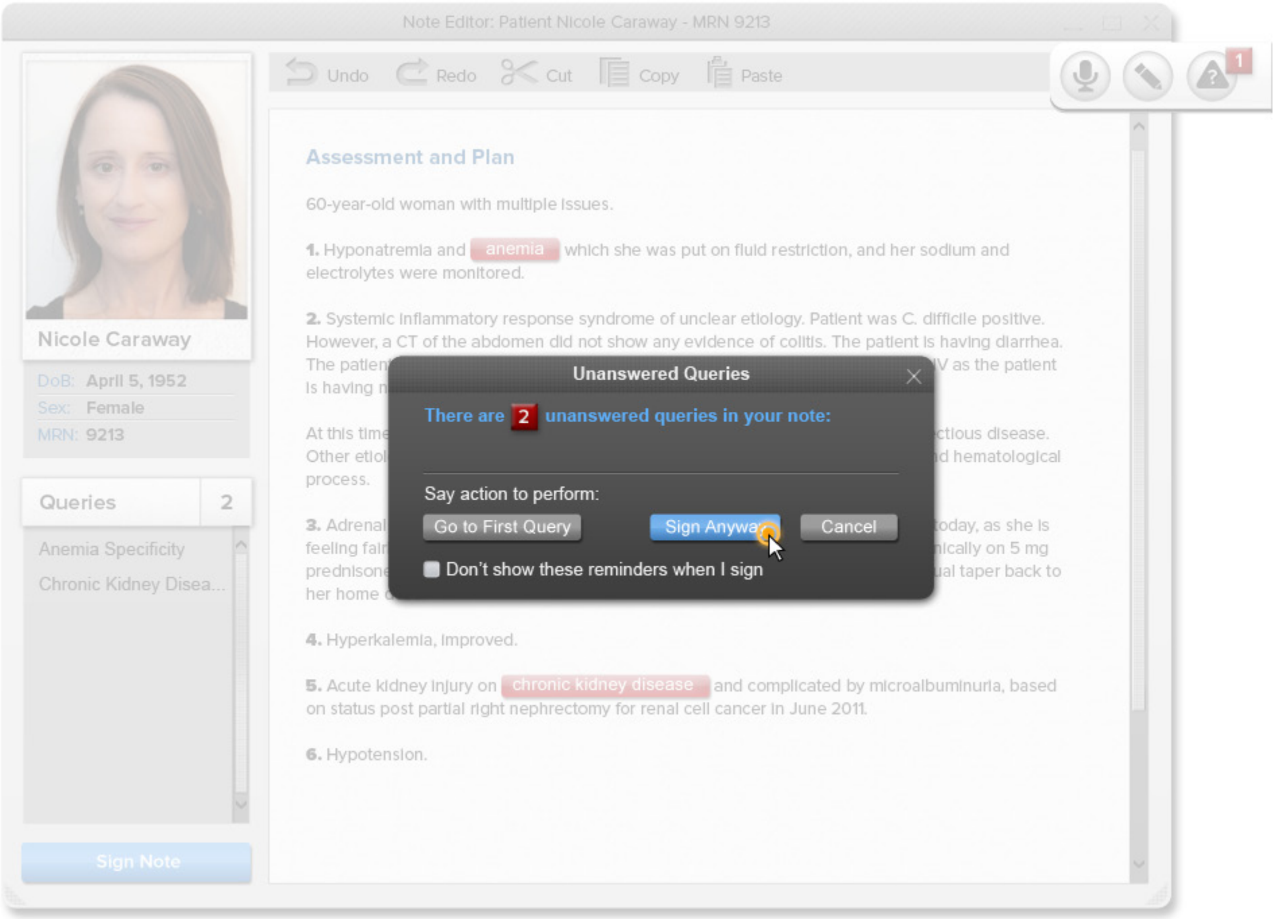
6. Hypotension.



Confirming Signature

Because there are unanswered queries in the note, a dialog pops up. The background is overlaid with a transparency. She is told that there are two unanswered queries in her note. This dialog ensures that Dr. Wilson did not overlook the queries by mistake. She is already aware of the queries and wants to sign, so she clicks the 'Sign Anyway' button.

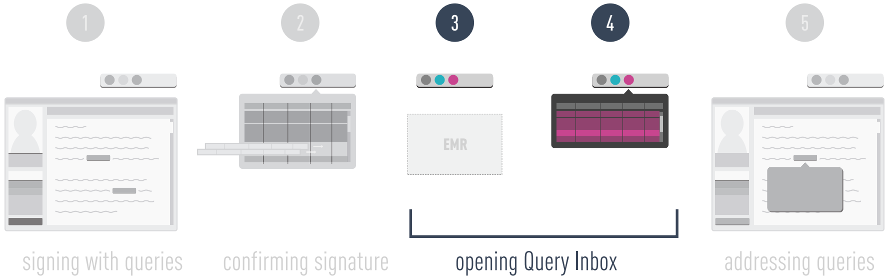
The query count displayed in the dialog animates over to where the query count is displayed in the Pill. The count in the Pill is updated accordingly. This indicates to Dr. Wilson that the queries have been added to the query inbox. The dialog and the Note Editor both close.



There are 2 unanswered queries in your note:

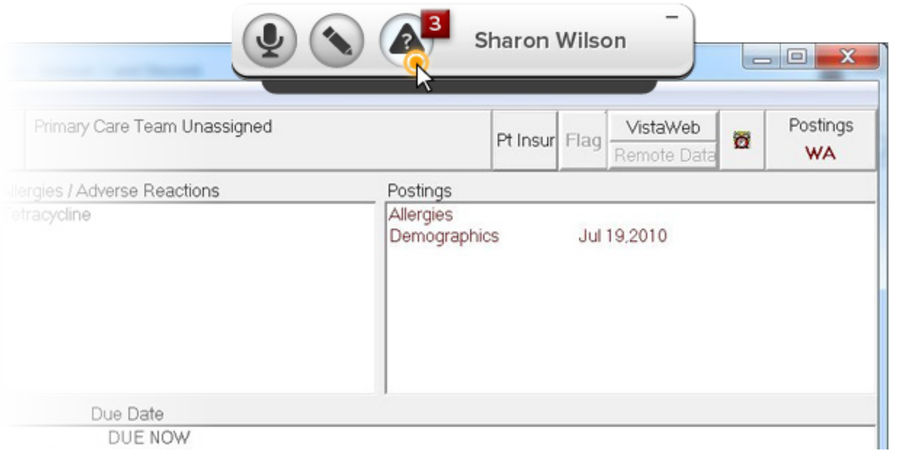
Say action to perform:

□ Don't show these reminders when I sign



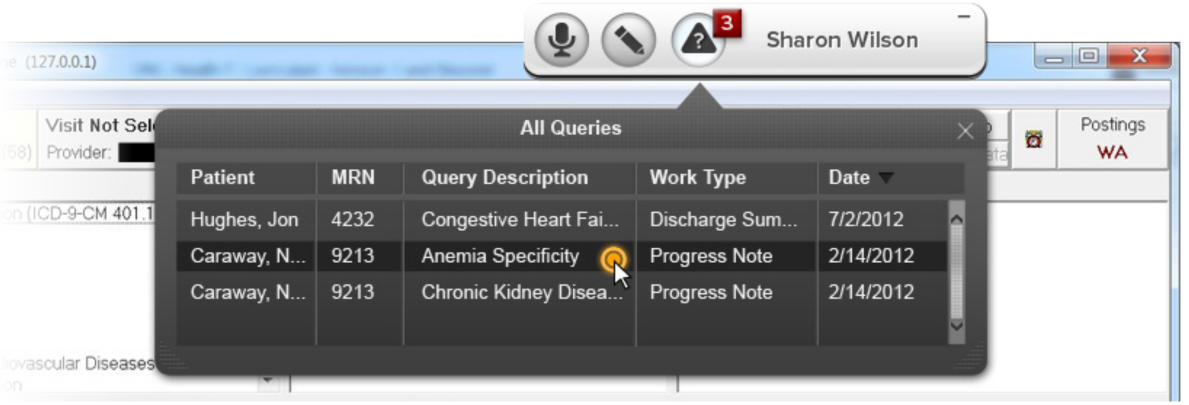
Accessing the Query Inbox

At the end of the day, when Dr. Wilson has finished with her patients, she would like to tie up the loose ends from the day's documentation. By looking at the count displayed in the Pill, she can see at a glance that she has three unanswered queries. As her mouse comes over the Pill, the drawer peeks out below. The 'Query Inbox' button glows as the mouse comes over it. Dr. Wilson clicks the 'Query Inbox' button.



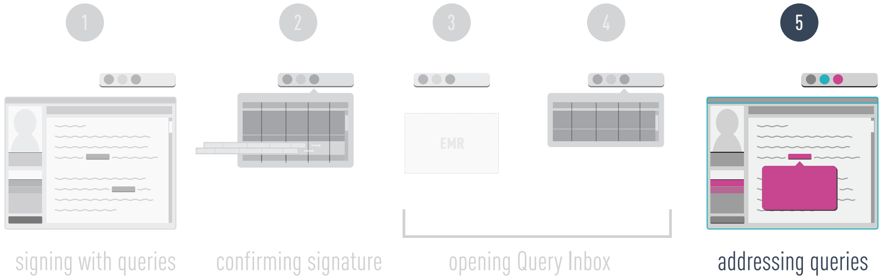
Opening a Query from the Inbox

When she clicks, the drawer recedes back into the Pill. The 'Query Inbox' button stays lit, and the Query Inbox animates in (fading in and scaling up from a point inside the Query Inbox Button). The Inbox displays summary information about each unanswered query. As Dr. Wilson's mouse passes over each query, it is highlighted in the list. She clicks on the 'Anemia Specificity' query for patient Nicole Caraway.



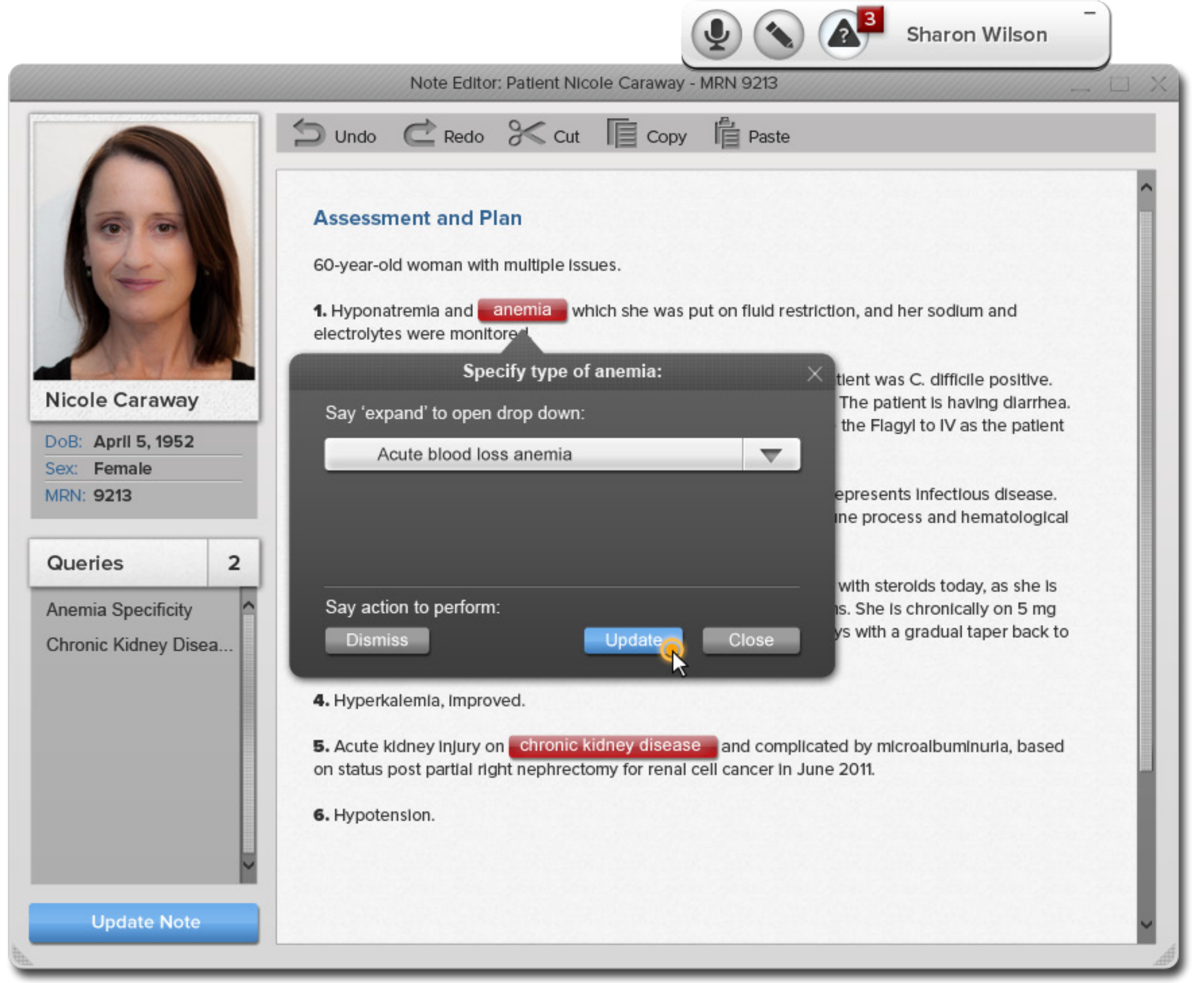
All Queries

Patient	MRN	Query Description	Work Type	Date
Hughes, Jon	4232	Congestive Heart Fai...	Discharge Sum...	7/2/2012
Caraway, N...	9213	Anemia Specificity	Progress Note	2/14/2012
Caraway, N...	9213	Chronic Kidney Disea...	Progress Note	2/14/2012



Responding to the Query

The Query Inbox animates out and the Note Editor opens with Nicole Caraway's note loaded. The note is scrolled to reveal the open Query Dialog for the query that Dr. Wilson selected from the Inbox. By seeing the query in the context of her note she is able to remind herself quickly about the details of the case. She makes her selections for both queries in the note and hits the 'Update Note' button. Her signed note in the EMR is appended with the additional information generated by the query responses.



Note Editor: Patient Nicole Caraway - MRN 9213

Nicole Caraway
DoB: April 5, 1952
Sex: Female
MRN: 9213

Assessment and Plan

60-year-old woman with multiple issues.

1. Hyponatremia and anemia which she was put on fluid restriction, and her sodium and electrolytes were monitored.

Specify type of anemia:
Say 'expand' to open drop down: Acute blood loss anemia
Say action to perform:

tient was C. difficile positive. The patient is having diarrhea. the Flagyl to IV as the patient

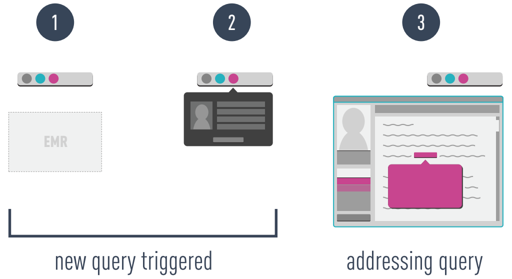
epresents infectious disease. ne process and hematological

with steroids today, as she is s. She is chronically on 5 mg ys with a gradual taper back to

4. Hyperkalemia, improved.

5. Acute kidney injury on chronic kidney disease and complicated by microalbuminuria, based on status post partial right nephrectomy for renal cell cancer in June 2011.

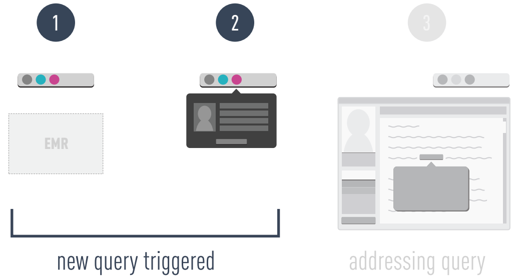
6. Hypotension.



Scenario 3: Queries are generated by events outside the note authoring process and accessed via a New Query Notification

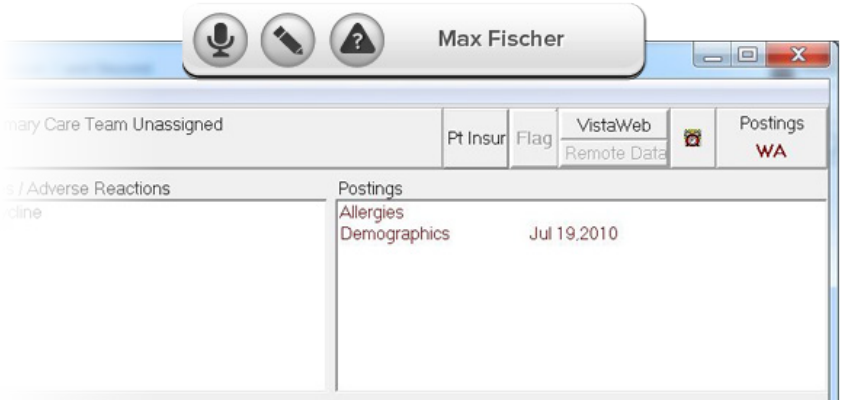
This final scenario shows the workflow for responding to a new query that is not generated at the time of note authoring. There are occasions when a query would not be triggered until certain information became available outside of a note. For example, lab results coming in could suggest a missed comorbidity of sepsis. We also foresee that there will be deficiencies that are too complex for InQuery to capture. In these cases, documentation specialists could generate queries manually and channel them into the Query Inbox. This would create an ideal situation where all queries could be handled in one centralized location, in a uniform fashion.

This scenario illustrates how InQuery notifies a physician of a new query on a preexisting note, and provides him access to that query.



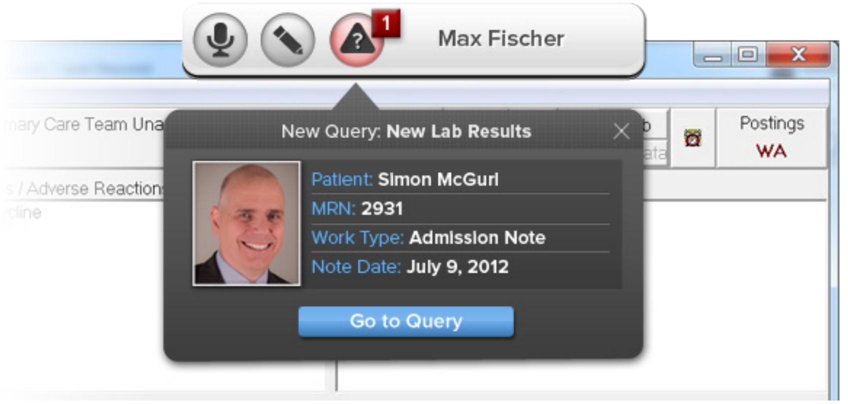
Working in the EMR

Dr. Max Fischer is signed into Fluency Direct and is reviewing his patient list for the day in his EMR. The previous day he had dictated an admission note for a patient named Simon McGurl. He suspected that Simon had congestive heart failure but he noted that he was waiting for lab results to confirm the diagnosis.

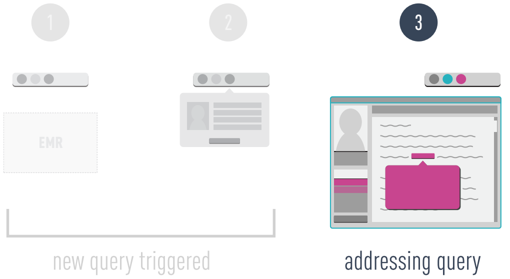


New Query Notification animates in

Simon's lab results become available. InQuery recognizes that the new information may assist Dr. Fischer in forming a diagnoses and triggers a query. Since Dr. Fischer is not in the middle of authoring a note, InQuery guesses that it is a good time to interrupt. The 'Query Inbox' button pulses red twice and the count notification appears along with a notification below the Fluency Pill. The notification dialog displays summary information about the query and shows a picture of the patient. Dr. Fischer can see that the subject of the query is 'New Lab Results.' He has been waiting for the lab results, so he stops what he is doing and clicks the 'Go to Query' button.

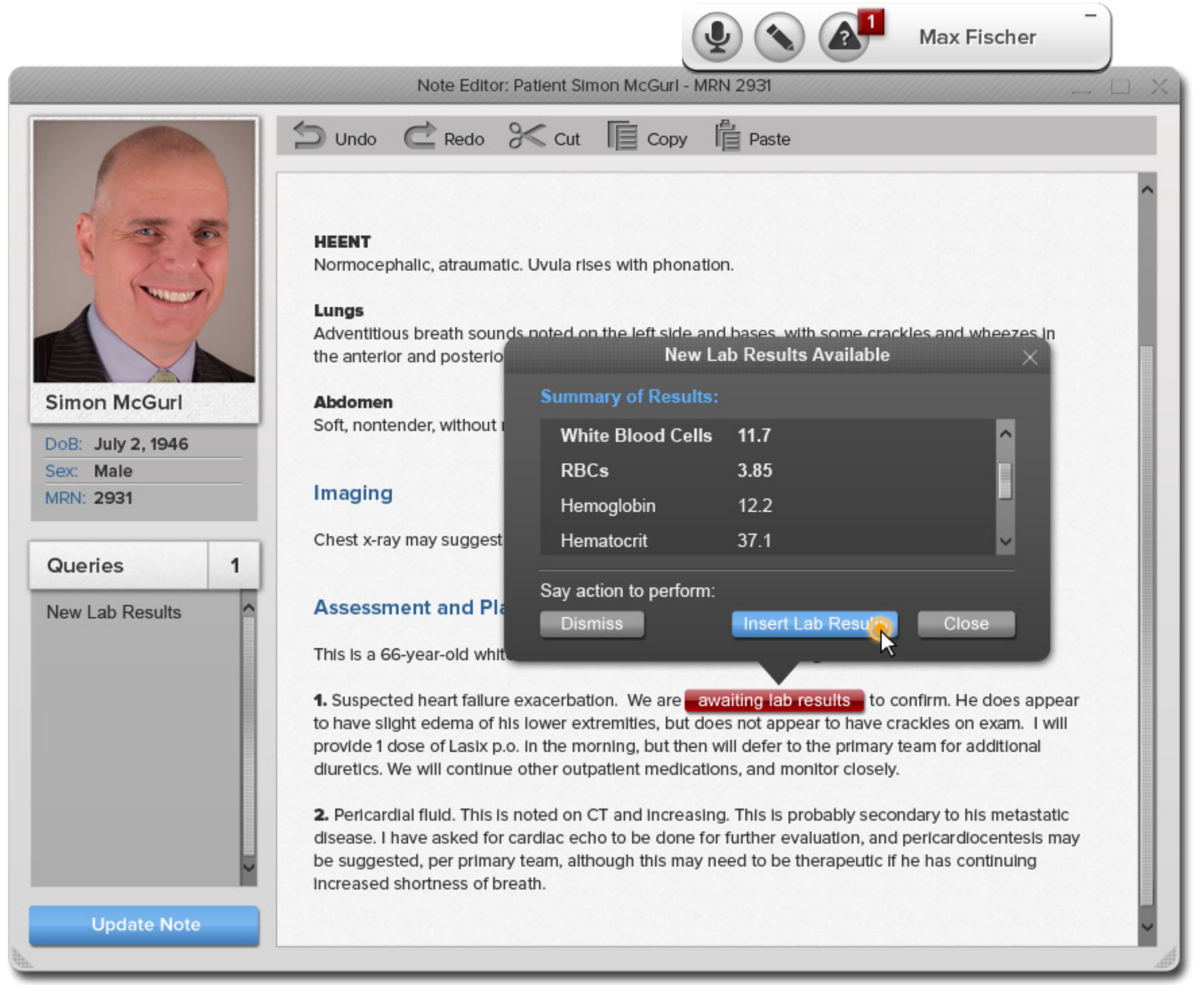

New Query: New Lab Results

Patient: Simon McGurl
MRN: 2931
Work Type: Admission Note
Note Date: July 9, 2012



Updating the Note

The Note Editor opens with Simon McGurl's admission note loaded. The note is scrolled to display the Query Dialog which exhibits a summary of the newly received lab results. Dr. Fischer reviews the lab results within the dialog and clicks the 'Insert Lab Results' button. The results are inserted in a table format in a new 'Laboratory Results' section. This action resolves the query, but Dr. Fischer still needs to update his diagnosis. He goes back to the Assessment and Plan section and dictates a new paragraph clarifying his diagnosis based on the lab results. When he is done he clicks the 'Update Note' button, which pushes the addendum to his EMR.



Simon McGurl

DoB: July 2, 1946
Sex: Male
MRN: 2931

Queries 1

New Lab Results

HEENT
Normocephalic, atraumatic. Uvula rises with phonation.

Lungs
Adventitious breath sounds noted on the left side and bases, with some crackles and wheezes in the anterior and posterio

Abdomen
Soft, nontender, without

Imaging

Chest x-ray may suggest

Assessment and Pla

This is a 66-year-old whit

1. Suspected heart failure exacerbation. We are awaiting lab results to confirm. He does appear to have slight edema of his lower extremities, but does not appear to have crackles on exam. I will provide 1 dose of Lasix p.o. in the morning, but then will defer to the primary team for additional diuretics. We will continue other outpatient medications, and monitor closely.

2. Pericardial fluid. This is noted on CT and increasing. This is probably secondary to his metastatic disease. I have asked for cardiac echo to be done for further evaluation, and pericardiocentesis may be suggested, per primary team, although this may need to be therapeutic if he has continuing increased shortness of breath.

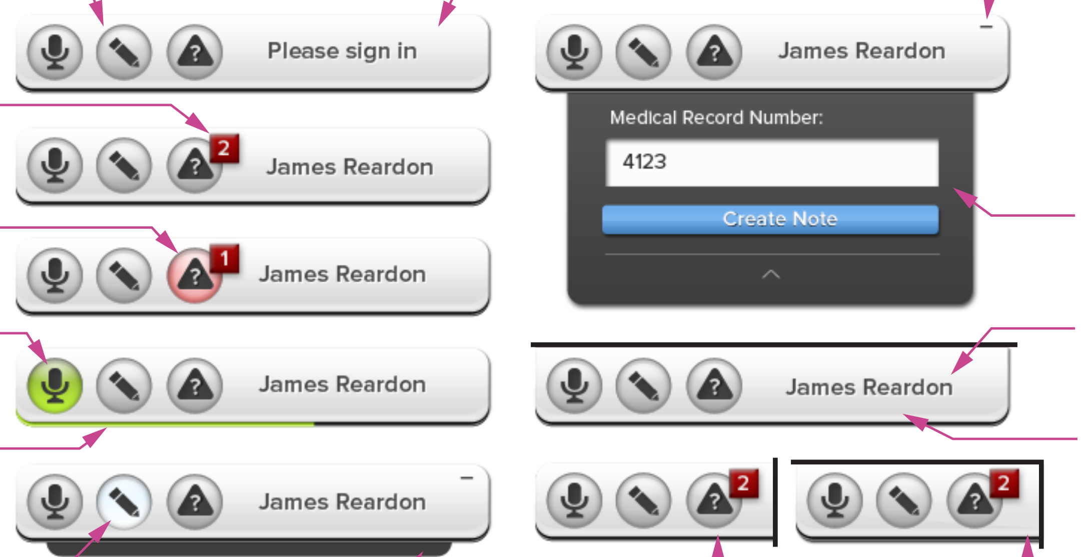
New Lab Results Available

Summary of Results:

White Blood Cells	11.7
RBCs	3.85
Hemoglobin	12.2
Hematocrit	37.1

Say action to perform:

KEY SCREENS AND STATES



Pill in default state before physician has signed in

Query Inbox button showing count for all unanswered queries across patients. Count only shows up if unanswered queries exist

Button pulses red twice when new queries are added

Microphone button consistent with existing Fluency behavior

Sound level indicator. Fluctuates during dictation

New Note button in mouse over state. Mouse over state looks similar for the other buttons

Drawer animates out slightly when mouse is over the Pill. It recedes on click of Query Inbox button.

Pill in docked state at side of screen. Expands to full width on mouse over.

Pill docked in the corner of the screen

Chrome, icon style and buttons to match existing Fluency design

Minimize button shows when mouse is over the Pill. It disappears on click of the Query Inbox button.

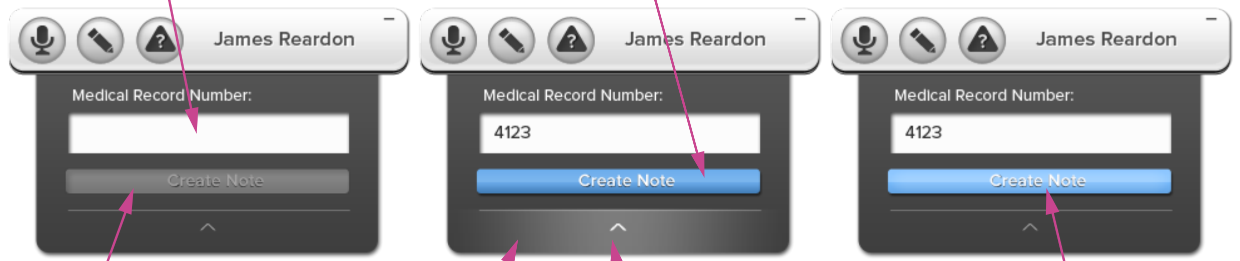
Sliding drawer for menu access, MRN entry, and sign in. Modeled on existing Fluency behaviors

Name of physician signed in to Fluency

Pill in docked state at the top of screen. Pill can be docked anywhere on the margins of the screen including any of the four corners of the screen and will remain in the foreground even if it loses focus

The Pill

The Pill is based on the existing Fluency Direct Pill. It is the ever-present navigation hub and communication vehicle which remains open while the physician works with their EMR. It provides the access point to the Note Editor and the Query Inbox. The Pill also displays a query count, associated with the Query Inbox. The query count provides a quick reference for physicians as to whether they have unanswered queries.



Text field for entering the medical record number

Button in active state

Default button state is inactive. Button becomes active when a valid MRN number is entered

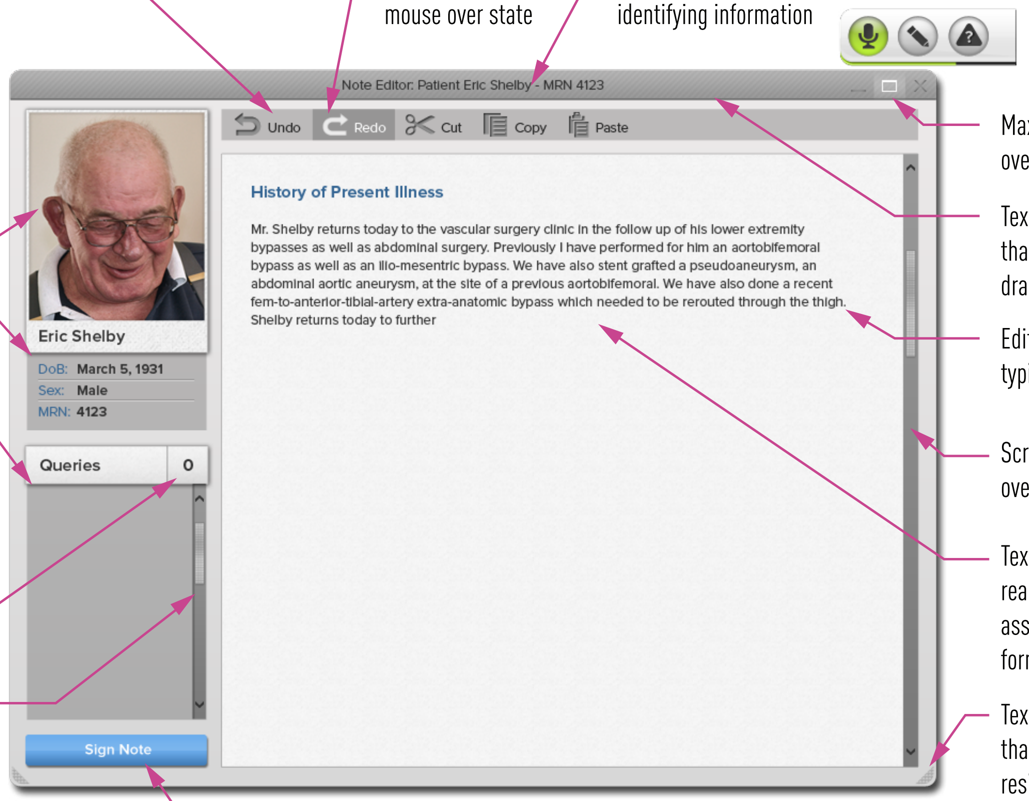
Drawer animates up on click of drawer collapse button or of ‘Create Note’ button

Drawer collapse button in mouse over state. Arrow is bold and area is highlighted with white gradient.

Button in mouse over state. Button gradient is lighter shade of blue.

Entering the MRN

This is an intermediate state of the Pill accessed by clicking the New Note button. By entering a medical record number the physician synchronizes their note with the EMR. Ideally the Fluency's Note Editor would be more closely integrated with the EMR, making this step unnecessary.



Note Editor: Patient Eric Shelby - MRN 4123

Eric Shelby

DoB: March 5, 1931
Sex: Male
MRN: 4123

Queries 0

History of Present Illness

Mr. Shelby returns today to the vascular surgery clinic in the follow up of his lower extremity bypasses as well as abdominal surgery. Previously I have performed for him an aortobifemoral bypass as well as an ilio-mesentric bypass. We have also stent grafted a pseudoaneurysm, an abdominal aortic aneurysm, at the site of a previous aortobifemoral. We have also done a recent fem-to-anterior-tibial-artery extra-anatomic bypass which needed to be rerouted through the thigh. Shelby returns today to further

Toolbar for text editing and text entry tools. Tools should be extended based on a competitive analysis of note authoring environments. Possible additions include templates, auto-insert, and text formatting

Redo button in mouse over state

Window label with identifying information

Patient photograph

Identifying information for the patient

Query List area. Located near the sign button for high visibility. Any queries within the note are listed here.

Query count for queries within the note

Scrollbar appears only when the list overflows the container

Maximize button in mouse over state

Textured titlebar to indicate that area is grabbable for dragging window

Editable text area supports typing or dictation

Scrollbar appears only when text overflows the container

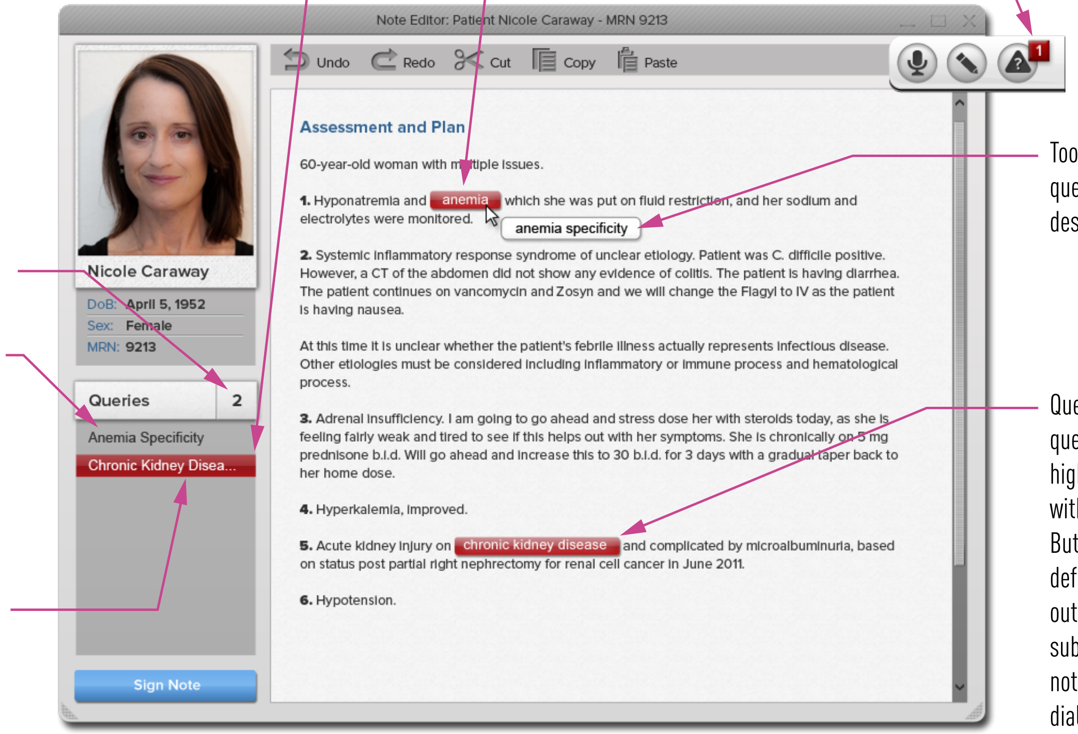
Text formatting is important for readability. Section headers are associated with particular formatting

Textured corners to indicate that area is grabbable for resizing window

Sign Note button pushes the note back to the physician's EMR. If an open note is already signed, button label reads 'Update Note'

Note Editor

The Note Editor is an authoring environment for dictating and typing notes. As mentioned in the design overview (p. 18), this feature was not the focus of our design. The note editor serves as a proof of concept for how InQuery could be integrated into a note authoring tool. The features of the Editor that are important to InQuery will be discussed in the subsequent pages. If the Note Editor were to be implemented in full, its features would require further consideration. As referenced in the callout of the toolbar above, the Note Editor would benefit from a competitive analysis of existing note authoring environments.



Note Editor: Patient Nicole Caraway - MRN 9213

Nicole Caraway

DoB: April 5, 1952
Sex: Female
MRN: 9213

Queries 2

Anemia Specificity
Chronic Kidney Disea...

Assessment and Plan

60-year-old woman with multiple issues.

1. Hyponatremia and anemia which she was put on fluid restriction, and her sodium and electrolytes were monitored.

anemia specificity

2. Systemic inflammatory response syndrome of unclear etiology. Patient was C. difficile positive. However, a CT of the abdomen did not show any evidence of colitis. The patient is having diarrhea. The patient continues on vancomycin and Zosyn and we will change the Flagyl to IV as the patient is having nausea.

At this time it is unclear whether the patient's febrile illness actually represents infectious disease. Other etiologies must be considered including inflammatory or immune process and hematological process.

3. Adrenal insufficiency. I am going to go ahead and stress dose her with steroids today, as she is feeling fairly weak and tired to see if this helps out with her symptoms. She is chronically on 5 mg prednisone b.i.d. Will go ahead and increase this to 30 b.i.d. for 3 days with a gradual taper back to her home dose.

4. Hyperkalemia, improved.

5. Acute kidney injury on chronic kidney disease and complicated by microalbuminuria, based on status post partial right nephrectomy for renal cell cancer in June 2011.

6. Hypotension.

Query Button color to match color for query count badge in the Pill and mouse-over highlight color in Query List

Query count for queries within the note

Query List displaying succinct descriptions of all unanswered queries in the note for easy access. When a query is answered or dismissed it is removed from the Query List

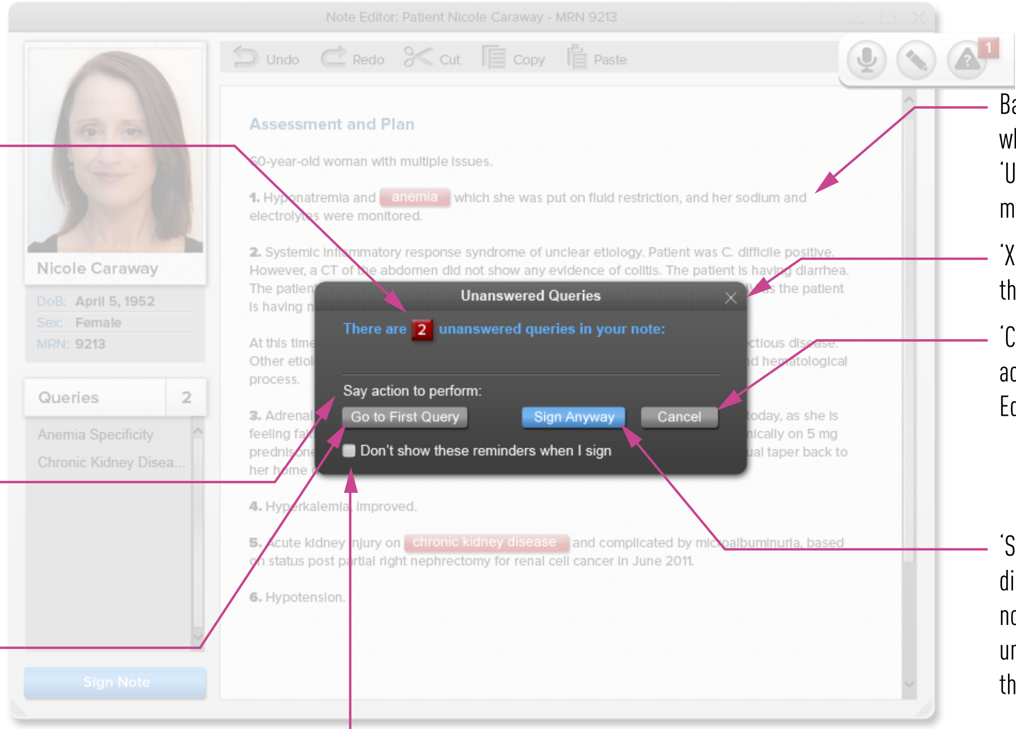
Query list item in mouse-over state. Clicking brings up a Query Dialog in the context of the note

Tooltip when mouse passes over query button displays succinct description of the query

Query communicated through a query button. The button highlights the term associated with a suspected deficiency. Buttons fade in as soon as a deficiency is detected and fade out again if the deficiency is subsequently addressed in the note. Clicking brings up a query dialog

Query Buttons

The in-context Query Buttons are at the heart of InQuery's design. They provide a highly visible, unobtrusive vehicle for communicating note deficiencies. The queries are communicated within the context of the note before a physician has moved on to another task. The Query Buttons provide access to the Query Dialogs with a click. As we saw in usability testing, the Query Buttons are noticeable but do not distract physicians during dictation. Once placed, the query buttons behave as a single character in the text which can be selected and deleted like any character. This allows physicians to learn to recognize deficiencies and correct them manually, if they prefer, without going through the Query Dialog. All unanswered queries within a note are aggregated in the Query List on the left for easy access. The Query List becomes particularly useful when dealing with long notes.



Note Editor: Patient Nicole Caraway - MRN 9213

Nicole Caraway

DoB: April 5, 1952
Sex: Female
MRN: 9213

Assessment and Plan

60-year-old woman with multiple issues.

1. Hyponatremia and anemia which she was put on fluid restriction, and her sodium and electrolytes were monitored.

2. Systemic inflammatory response syndrome of unclear etiology. Patient was C. difficile positive. However, a CT of the abdomen did not show any evidence of colitis. The patient is having diarrhea. The patien … s the patient is having n …

At this time … ctious disease. Other etiol … d hematological process.

3. Adrenal … today, as she is feeling fa … ically on 5 mg prednisone … ual taper back to her home …

4. Hyperkalemia improved.

5. Acute kidney injury on chronic kidney disease and complicated by microalbuminuria, based on status post partial right nephrectomy for renal cell cancer in June 2011.

6. Hypotension.

Unanswered Queries

There are 2 unanswered queries in your note:

Say action to perform:

□ Don't show these reminders when I sign

Count for unanswered queries within the note shown in the same visual style as the count on the Query Inbox. If the physician clicks 'Sign Anyway,' the count icon animates over to the count in the Query Inbox to make it visually clear where the queries can be accessed

Instructions for voice control of the dialog. Voice control should be provided wherever feasible

'Go to First Query' button closes the dialog and scrolls to the first query in the note, bringing up the appropriate Query Dialog

Background is overlaid with a white transparency because the 'Unanswered Queries' dialog is modal and must be addressed

'X' button functions the same as the Cancel button

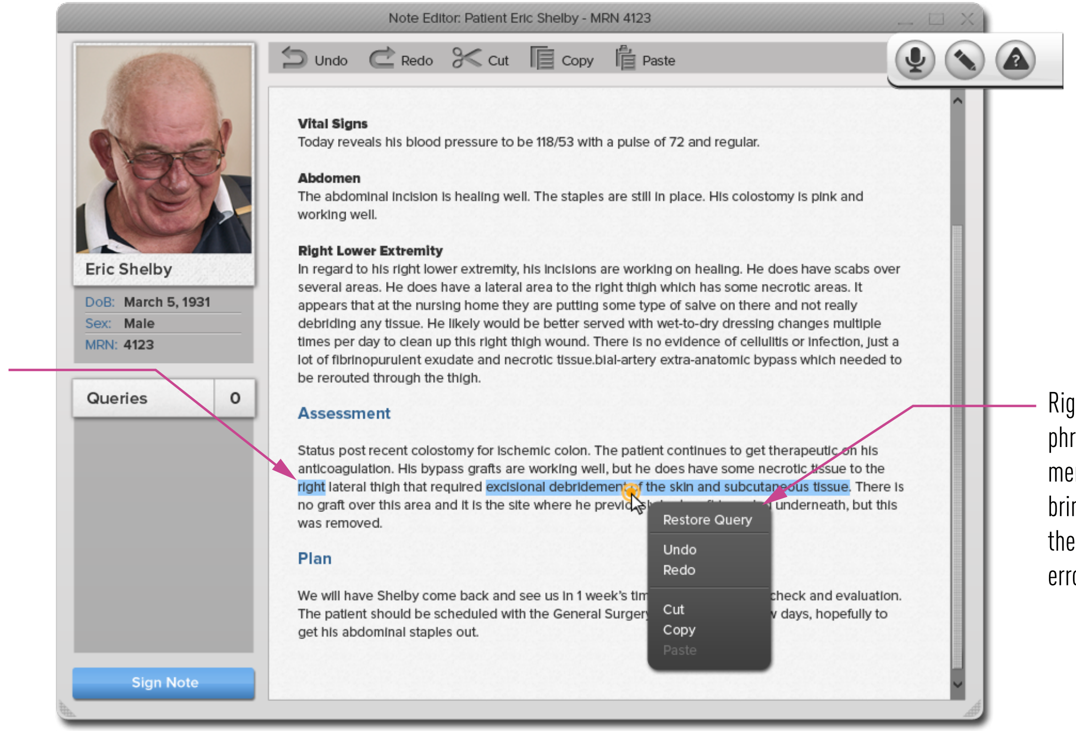
'Cancel' button cancels the sign action, returning to the Note Editor

'Sign Anyway' button closes the dialog and the Note Editor. The note is pushed to the EMR and unanswered queries are added to the Query Inbox

An option to opt out of 'Unanswered Query' reminders. This allows the dialog to teach new users about the queries without becoming a nuisance to expert users

Unanswered Query Reminder

If a physician clicks the 'Sign Note' button in the Note Editor while the note still contains unanswered queries, a dialog points out the unanswered queries and asks the physician to confirm that they want to 'Sign Anyway.' This was a feature that came directly out of usability testing (see Usability Findings p. 83) to address the problem of inexperienced users not knowing what to do with the Query Buttons. The dialog provides an option to turn the reminder off so that it will not become a nuisance to experienced users who wish to defer their query response.



Note Editor: Patient Eric Shelby - MRN 4123

Eric Shelby

DoB: March 5, 1931
Sex: Male
MRN: 4123

Vital Signs
Today reveals his blood pressure to be 118/53 with a pulse of 72 and regular.

Abdomen
The abdominal incision is healing well. The staples are still in place. His colostomy is pink and working well.

Right Lower Extremity
In regard to his right lower extremity, his incisions are working on healing. He does have scabs over several areas. He does have a lateral area to the right thigh which has some necrotic areas. It appears that at the nursing home they are putting some type of salve on there and not really debriding any tissue. He likely would be better served with wet-to-dry dressing changes multiple times per day to clean up this right thigh wound. There is no evidence of cellulitis or infection, just a lot of fibrinopurulent exudate and necrotic tissue.bial-artery extra-anatomic bypass which needed to be rerouted through the thigh.

Assessment

Status post recent colostomy for ischemic colon. The patient continues to get therapeutic on his anticoagulation. His bypass grafts are working well, but he does have some necrotic tissue to the right lateral thigh that required excisional debridement of the skin and subcutaneous tissue. There is no graft over this area and it is the site where he previo… underneath, but this was removed.

Plan

We will have Shelby come back and see us in 1 week's tim… check and evaluation. The patient should be scheduled with the General Surgery… days, hopefully to get his abdominal staples out.

Actions taken through Query Dialogs result in automatic changes to the text of the note. These changes are highlighted so that the physician can easily see the outcome of their response. If the physician has dismissed the query the Query Button is replaced with the original text highlighted in blue

Right-clicking on the highlighted phrase brings up a contextual menu which allows physician to bring the Query Dialog back up in the event that they made an erroneous selection

Query Response

When a query is responded to through a Query Dialog, the term on the query button is replaced with blue highlighted text. This allows physicians to see at a glance the outcome of their selection in the Query Dialog. Right-clicking on the text allows the user to return to the Query Dialog. This ability to restore the dialog is important, as it allows the physician to recover from an erroneous selection. It is also important that this option be provided even if the physician has chosen to dismiss a query. The highlighting will persist until the note is signed or the text is manually edited.

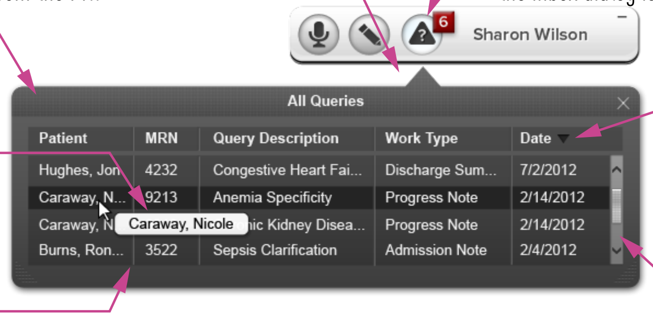
Arrow in title bar disappears if Query Inbox is dragged away from the Pill

Query Inbox button stays highlighted while the inbox dialog is open

Textured title bar to indicate that area is grabbable for dragging window

Tooltip shows full text on mouse-over if item overflows its column

Adjustable column width. Click and drag on divider to adjust



Sharon Wilson

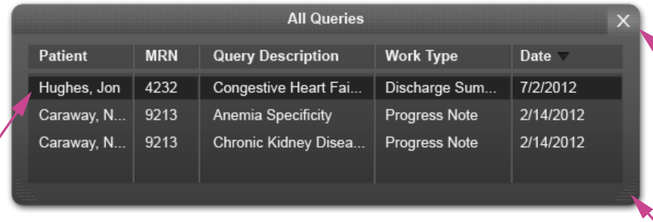
All Queries

Patient	MRN	Query Description	Work Type	Date
Hughes, Jon	4232	Congestive Heart Fai...	Discharge Sum...	7/2/2012
Caraway, N...	9213	Anemia Specificity	Progress Note	2/14/2012
Caraway, N		ic Kidney Disea...	Progress Note	2/14/2012
Burns, Ron...	3522	Sepsis Clarification	Admission Note	2/4/2012

Caraway, Nicole

Headers for sortable query attributes. Sort arrow shows on mouse-over and remains on click, indicating currently active sort attribute. Clicking again toggles sort direction

Scrollbar appears only when text overflows the container



All Queries

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Caraway, N...	9213	Anemia Specificity	Progress Note	2/14/2012
Caraway, N...	9213	Chronic Kidney Disea...	Progress Note	2/14/2012

Mouse-over style for query. Clicking the query in the list opens it in the Note Editor

'X' button in mouse-over state

Textured corners to indicate that area is grabbable for resizing window

Query Inbox

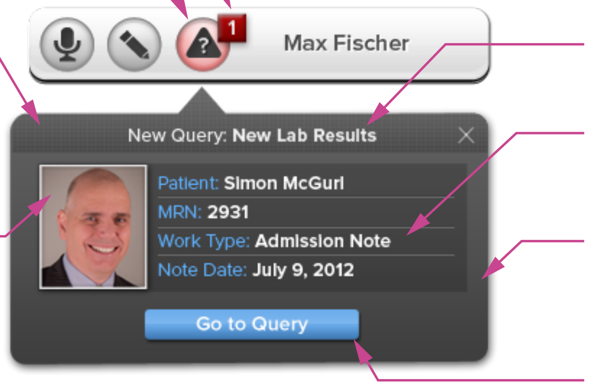
The Query Inbox aggregates all unanswered queries across patients. It can be accessed at any time from the Pill. As we learned during our usability testing, it is important to support physicians who cannot address queries at the time of note authoring. The Query Inbox allows physicians to collect queries in a single accessible location and deal with them as their schedule allows. The Inbox dialog provides enough information about each query so that the physician can be reminded about the nature and the context of the query. If they want to open the query they simply click on the item in the Inbox.

Query Inbox button pulses red twice when new query is added

Query count increases to account for new query. Query is also added to the Query Inbox list

Textured title bar to indicate that area is grabbable for dragging window. If the notification is dragged, it will not animate out as it normally would

Patient photo to assist physician in associating the notification with the correct individual. This is important since the physician may not currently be engaged with that patient's record



Max Fischer

New Query: New Lab Results

Patient: Simon McGurl
MRN: 2931
Work Type: Admission Note
Note Date: July 9, 2012

Go to Query

Dialog title indicates nature of query

Summary information about the context of the query

New Query Notification remains open for 20 seconds before animating out

'Go to Query' button closes the dialog and opens the query in the Note Editor

New Query Notification

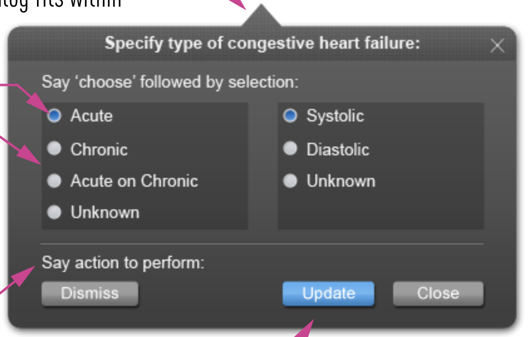
These notifications animate in to alert physicians about new queries that are not triggered during note authoring. If a physician is in the midst of dictating another note, these notifications will queue up and be displayed when the physician signs the current note. Further research may be required to identify other interruptible moments where the physician will be most receptive to these out of context notifications. The notification displays summary information about the query and shows a picture of the patient to remind the physician to whom the query is in reference. As discussed in the overview of Scenario 3 (p. 38), new queries could be triggered outside of note authoring as the result of new information becoming available in the EMR, such as lab results or specialist consultations. We envision that new queries could also be generated manually by staff within a hospital. When a New Query Notification is displayed, the query is simultaneously added to the Query Inbox. The query can be accessed either through the 'Go to Query' button in the notification or later through the Query Inbox.

Arrow in title bar points to its Query Button and is positioned on the dialog so that dialog fits within the Note Editor's text field

Radio button in selected state

Radio group signified by containing rectangle, only one item can be selected in each group

Instructions for voice command of the dialog



Specify type of congestive heart failure:

Say 'choose' followed by selection:

● Acute
○ Chronic
○ Acute on Chronic
○ Unknown

● Systolic
○ Diastolic
○ Unknown

Say action to perform:

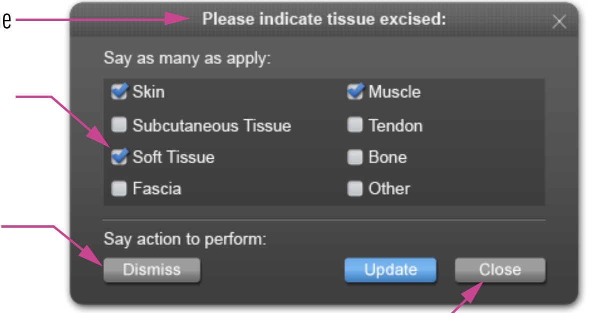
Update button replaces the Query Button in the note with text based on the user's selection. Update button is disabled until a selection has been made

Arrow in title bar disappears if dialog is dragged away from the Query button or text beneath the query is scrolled

Text in titlebar describes the query

Checkbox in checked state

Dismiss button closes the dialog and removes the query, replacing the Query Button with the original text



Please indicate tissue excised:

Say as many as apply:

☑ Skin
☐ Subcutaneous Tissue
☑ Soft Tissue
☐ Fascia

☑ Muscle
☐ Tendon
☐ Bone
☐ Other

Say action to perform:

Close button closes the dialog without making any changes

Radio Button Dialog:

This dialog type is ideal for a query that can be framed as a selection of one option from among a small group of alternatives. This example includes two separate radio groups for specifying information about a congestive heart failure. In each radio group one selection would exclude the others.

Checkbox Dialog:

This dialog type should be used for queries with multiple options that are not mutually exclusive. This example asks for additional information about the extent of a debridement procedure. Possible responses could include one or all of the options provided.

Query Dialogs

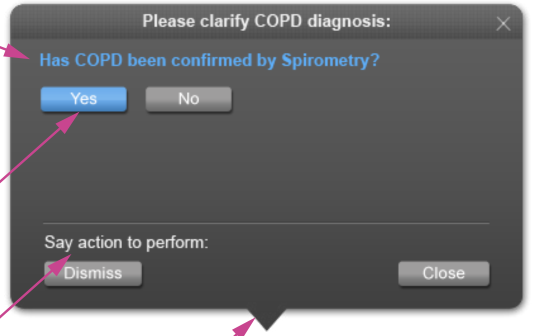
A Query Dialog pops up at the site of a Query Button to both communicate the content of a query and provide physicians with an available set of actions to address the query or dismiss it. A physician's note is automatically edited based on their selection within the dialog. Provided here is a set of six possible dialog designs that could be applied to a wide range of queries. This list is not exhaustive, and there is no formula for the design of Query Dialogs. As queries are added to InQuery, additional research will be required to properly craft the options and the language provided in the dialog. As we saw in our usability testing (p. 86), the subject of a query and the options provided within the Query Dialog were the biggest factors in how favorably physicians responded to InQuery.

Query question restated (in blue text to distinguish it from voice command instructions)

'Yes' button stands in for update button, 'No' button functions the same as the Dismiss button

Voice command instructions in white text

Dialog arrow will sometimes stem from bottom depending on the position of the Query Button



Please clarify COPD diagnosis:

Has COPD been confirmed by Spirometry?

Say action to perform:

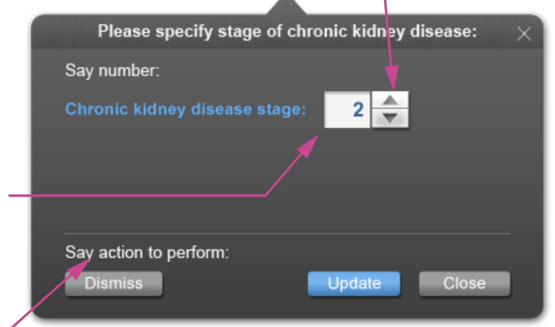
Yes/No Dialog:

Some queries may be as simple as a yes/no question. As there is no selection in these cases, the 'update' button can be omitted. The dismiss button should still be included for consistency. This example asks to confirm that a procedure has been performed to qualify a diagnosis for billing purposes.

Up arrow in mouse-over state

Number selector with text entry field and up/down buttons to adjust number

Voice command instructions in white text



Please specify stage of chronic kidney disease:

Say number:

Chronic kidney disease stage: 2

Say action to perform:

Number Input Dialog:

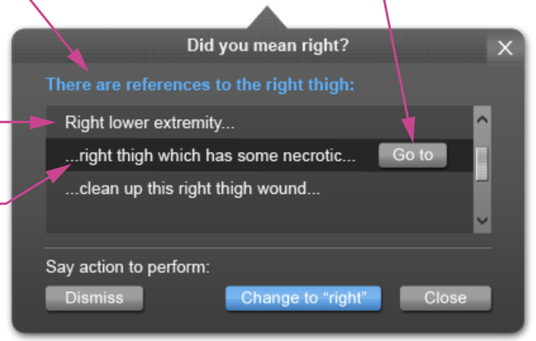
Some queries will require a numbered response. In those cases a text field to input the number manually, along with buttons to increment and decrement the number should be included. The numbers should be restricted in their range to avoid improper entry. This example asks to specify the stage of an illness.

'Go to' button shows up on mouse-over to signify that a click will scroll to the reference or open it in another window

Explanation of what the references are showing (in blue text to distinguish it from voice command instructions)

Summarized references in a list format

Reference item in a mouse over state



Did you mean right?

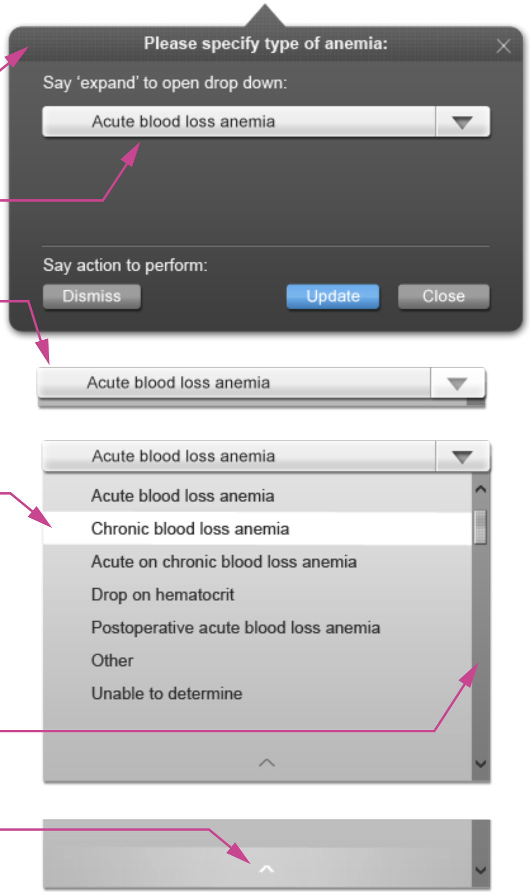
There are references to the right thigh:

Right lower extremity...
...right thigh which has some necrotic...
...clean up this right thigh wound...

Say action to perform:

Cross-reference Dialog:

This query type is ideal when a query requires review of information from another part of the note or from another document. The dialog provides a summary of that dispersed information along with hyperlinks to the reference. This example asks to clarify a potential left/right anomaly.



Please specify type of anemia:

Say 'expand' to open drop down:

Acute blood loss anemia

Say action to perform:

Acute blood loss anemia

Acute blood loss anemia

- Acute blood loss anemia
- Chronic blood loss anemia
- Acute on chronic blood loss anemia
- Drop on hematocrit
- Postoperative acute blood loss anemia
- Other
- Unable to determine

Textured title bar to indicate that area is grabbable for dragging window

Drop-down menu. Click anywhere to expand

Drop-down menu in mouse-over state. Arrow is highlighted and drawer slides out slightly, similar to behavior of the Pill

Expanded drop-down showing list item in mouse-over state. On click the selection blinks and replaces the item at the top of the drop-down. The drawer then slides back in

Scrollbar only appears if list overflows the container size

Drawer collapse button in mouse over state

◀ Drop-down Dialog:

This dialog type is the best option for queries that require the selection of one option from among many. The Drop-down Dialog should only be used if the number of options is too great to fit into a Radio Button Dialog, as the Radio Button dialog provides more convenience. This example asks for a clarification on the type of anemia.