

# Case Finder

optimized cancer registry case finding



# Case Finding

- Case finding is the first step in the cancer registry process.
- Identify patients diagnosed with a reportable cancer.
- Case finding requires the review of data from patient charts: pathology reports, imaging exam reports, clinic notes and ICD-10 diagnosis codes.



# Manual Case Finding

- Pathology reports are the most authoritative source of cancer diagnosis.
- Every day cancer registrars manually review printed out stacks of pathology reports, collating the pathology cases into cancer and non-cancer piles.
- Then manually input the cancer pile into cancer registry software.



# Cancer Registries

- Federal and state laws require the collection and reporting of cancer incidence, treatment and survival.
- Cancer registrars are trained, certified professionals with expertise in the area of interpreting and collecting cancer diagnosis, treatment and follow-up data.
- Surveillance, Epidemiology and End Results Program (SEER): <https://seer.cancer.gov/>
- North American Association of Central Cancer Registries (NAACCR): <https://www.naacr.org/>
- National Cancer Registrars Association (NACRA): <http://www.ncra-usa.org/>

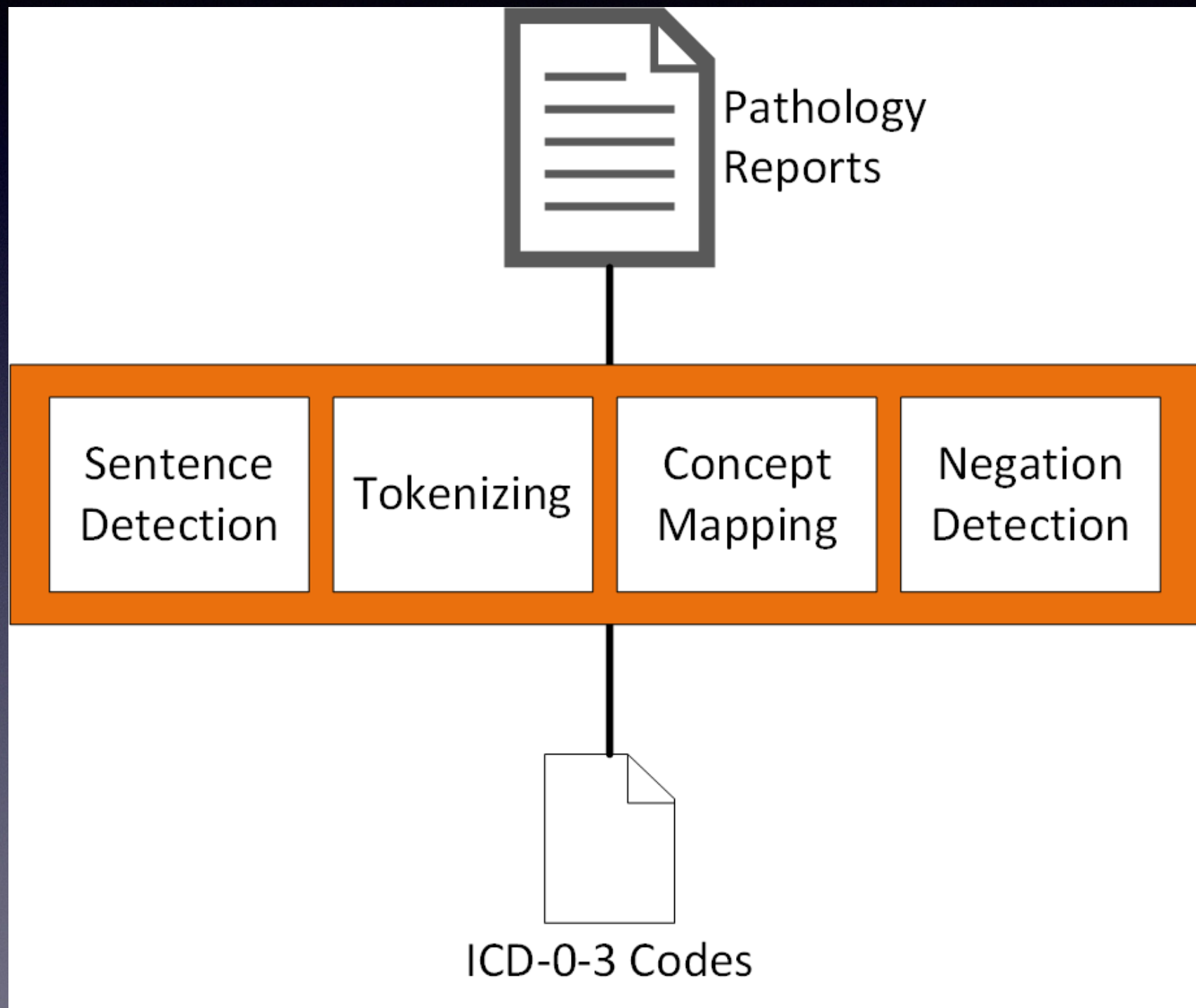


# Optimized Case Finding: Case Finder

- Case Finder optimizes the case finding process for the review of pathology reports.
- Case Finder ingests order and result HL7 messages for pathology cases via HTTP from a local EHR. The ingestion of a case includes basic demographic information.
- Case Finder uses advanced natural language processing (NLP) techniques to analyze the text of the pathology case to generate suggestions for ICD-O-3 histology and site.
- ICD-O-3 histology and site are the data points necessary to determine if a pathology case contains a reportable cancer diagnosis.



# NLP: How it Works



# Dictionaries User Interface

Case Finder

casefinder.dev/abstractor\_abstraction\_schemas/2/abstractor\_object\_values

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## Site Values

Search

SearchClear

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Value	Vocabulary code		
abdomen, nos (c76.2)	C76.2	Edit	Delete
abdominal esophagus (c15.2)	C15.2	Edit	Delete
accessory sinus, nos (c31.9)	C31.9	Edit	Delete
acoustic nerve (c72.4)	C72.4	Edit	Delete
adrenal gland, nos (c74.9)	C74.9	Edit	Delete
ampulla of vater (c24.1)	C24.1	Edit	Delete
anal canal (c21.1)	C21.1	Edit	Delete
anterior 2/3 of tongue, nos (c02.3)	C02.3	Edit	Delete
		Edit	Delete



# Dictionaries User Interface

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## Edit Value

Value

abdomen, nos (c76.2)

Vocabulary Code

C76.2

Case Sensitive?

☐

Comments

### Variant Values

<div>Variant Value</div> <div>abdomen, nos</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>
<div>Variant Value</div> <div>abdominal wall, nos</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>
<div>Variant Value</div> <div>intra-abdominal site, nos</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>
<div>Variant Value</div> <div>abdomen</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>
<div>Variant Value</div> <div>abdominal wall</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>
<div>Variant Value</div> <div>intra-abdominal site</div>	<div>Case Sensitive?</div> <div><input type="checkbox"/></div> <div>Delete</div>

Add variant

Save

Cancel



# Rules Engine

- Uses a 'rule engine' to further refine NLP suggestions by post-processing suggestion combinations. Rules dictated by reporting agencies.



# Example Rule

```
// -----  
// RULE DESCRIPTION  
// -----  
// When a histology code has a */0 or */1 extension,  
// and there are no brain-related sites,  
// -----  
// Then delete the histology  
// -----  
rule "Remove */0 and */1 Histology codes"  
when  
    $hist : Histology(codeMatches(".+/[0|1]"))  
    and exists Site()  
    and forall (Site (code not in ("C70.0", "C70.1", "C70.9",  
                                     "C71.0", "C71.1", "C71.2",  
                                     "C71.3", "C71.4", "C71.5",  
                                     "C71.6", "C71.7", "C71.8",  
                                     "C71.9", "C72.0", "C72.1",  
                                     "C72.2", "C72.3", "C72.4",  
                                     "C72.5", "C72.8", "C72.9",  
                                     "C75.1", "C75.2", "C75.3"))) )  
  
then  
    suggestions.remove($hist.suggestion);  
end
```



# Rules Engine User Interface

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## Rules

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Name	Abstractor subjects		
Rule 0: Add meninges Site when meningioma Histology.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 1: Remove *0 and */1 Histology when no brain Site.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 2: Remove Histology when skin Site.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 3: Remove 8077/2 Histology when skin or cervix Sites.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 4: Replace 8150/0 Histology or 8150/1 Histology with 8150/3.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 5: Replace 'insulinoma, nos (8151/0)' Histology with 'insulinoma, malignant (8151/3)' Histology.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 6: Replace '8152/1' Histology with 'enteroglucagonoma, malignant (8152/3)' Histology.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
Rule 7: Replace '8153/1' Histology with 'gastrinoma, malignant (8153/3)' Histology.	Histology (PathologyCase), Site (PathologyCase)	Edit	Delete
		Edit	Delete



# Rules Engine User Interface

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## Edit Rule

Name

Rule 2: Remove Histology when skin Site.

Description

When a histology is one of a particular set of histologies, and the only sites are skin-related,  
Then delete the histology

Abstraction subjects

**Histology**

PathologyCase

**Site**

PathologyCase

Rule

```
rule "Remove Histology codes when Skin Site"
when
  $hist : Histology(code in ("8000/3","8000/6","8000/9","8001/3","8002/3","8003/3","8004/3","8005/3",
    "8010/2","8010/3","8010/6","8010/9","8011/3","8012/3","8013/3","8014/3",
    "8015/3","8020/3","8021/3","8022/3","8030/3","8031/3","8032/3","8033/3",
    "8034/3","8035/3","8041/3","8042/3","8043/3","8044/3","8045/3","8046/3",
    "8050/2","8050/3","8051/3","8052/2","8052/3","8070/2","8070/3","8070/6",
    "8071/3","8072/3","8073/3","8074/3","8075/3","8076/2","8076/3",
    "8078/3","8080/2","8081/2","8082/3","8083/3","8084/3","8090/1","8090/3",
    "8091/3","8092/3","8093/3","8094/3","8095/3","8097/3","8098/3","8102/3",
    "8110/0","8110/3"))
  and exists(Site())
  and forall (Site (code in ("C44.0","C44.1","C44.2","C44.3","C44.4","C44.5","C44.6","C44.7","C44.8","C44.9")))
then
  suggestions.remove($hist.suggestion);
end
```

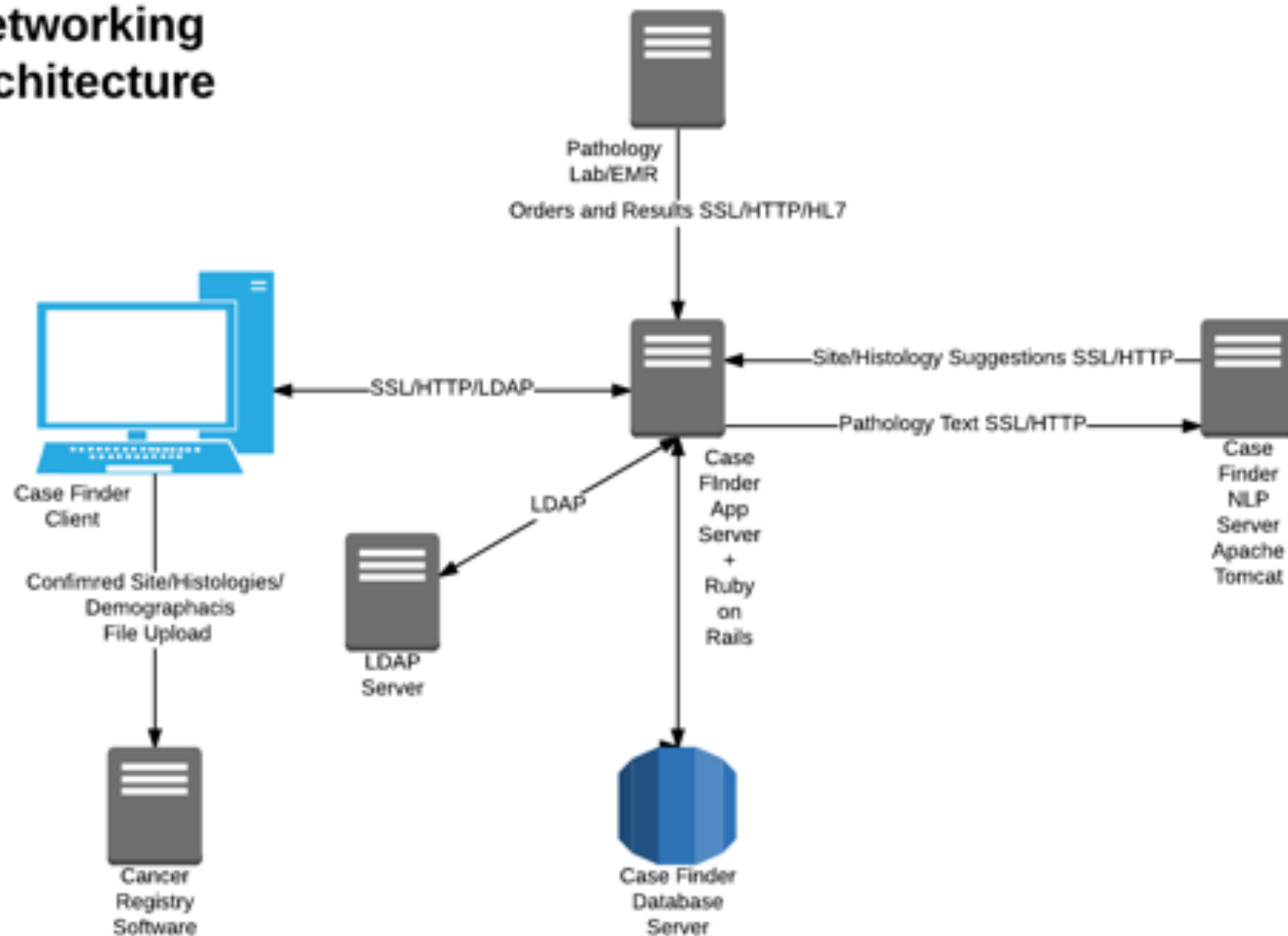
Save

Cancel



# Case Finder Architecture

## Case Finder Networking Architecture





# Presenting “Flagged” Pathology Cases

- Case Finder presents ‘flagged’ pathology cases to the user for review. A ‘flagged’ case is any pathology report that has a suggested ICD-0-3 histology. The high confidence of the Case Finder NLP relieves the user from needing to review ‘not flagged’ pathology cases.



# Presenting “Flagged” Pathology Cases

Case Finder: Pathology Cases

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## Pathology Cases

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Reviewed?  
pending

By

Flagged?  
flagged

☒ Collected

☐ Imported

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Accession Number	Collection Date	Suggested Histologies	Suggested Sites	
ABC-11-11111	08/04/2015	papillary carcinoma of thyroid (8260/3) papillary carcinoma, nos (8050/3)	lymph node, nos (c77.9) parathyroid gland (c75.0) thyroid gland (c73.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	cancer (8000/3)	bladder, nos (c67.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	renal cell carcinoma, nos (8312/3)	kidney, nos (c64.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	mature teratoma (9080/3)	connective, subcutaneous and other soft tissues, nos (c49.9) fallopian tube (c57.0) ovary (c56.9) peritoneum, nos (c48.2) skin, nos (c44.9) specified parts of peritoneum (c48.1) thyroid gland (c73.9) uterine adnexa (c57.4)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	melanoma in situ (8720/2)	lower limb, nos (c76.5) skin, nos (c44.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	cancer (8000/3)	bladder, nos (c67.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	cancer (8000/3) carcinoma, nos (8010/3) dcis, nos (8500/2) ductal carcinoma, nos (8500/3) et (9962/3)	bone marrow (c42.1) breast, nos (c50.9) connective, subcutaneous and other soft tissues, nos (c49.9)	<a href="#">Review</a>
ABC-11-11111	08/04/2015	cancer (8000/3)	unknown primary site (c80.9)	<a href="#">Review</a>
ABC-11-11111	08/05/2015	melanoma, nos (8720/3)	other ill-defined sites (c76.7) skin, nos (c44.9) upper limb, nos (c76.4)	<a href="#">Review</a>
ABC-11-11111	08/05/2015	cancer (8000/3)	bladder, nos (c67.9)	<a href="#">Review</a>

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# Reviewing a “Flagged” Pathology Case

- Case Finder presents the suggested sites and histologies for ‘flagged’ pathology cases to the user for confirmation or revision.
- Case Finder provides visual highlighting for the substantiation of its NLP suggestions.
- Case Finder allows the user to submit for export any pathology cases with a confirmed site/histology pairing.



# Reviewing a “Flagged” Pathology Case


Case Finder: Pathology Case


casefinder.dev/pathology\_cases/193/edit?index=22&previous\_pathology\_case\_id=193


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## Pathology Case


Collection Date	Accession Number	Patient	MRN	SSN	Birth Date	Sex	Attending	Surgeon
08/05/2015	ABC-11-11111	Bob Jones	111111111	111111111	03/21/1967	M	BLUM MD, MICHAEL DAVID	

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### Primary Cancer


Histology

☐ adenocarcinoma, nos (8140/3) 

☐ carcinoma, nos (8010/3) 

Edit | Clear

Site

☐ prostate gland (c61.9) 

Edit | Clear

Add Primary Cancer

Submit to METRIQ

Discard Case

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Pathology Case: Note

- **Adenocarcinoma, acinar** type.

Gleason score: 7 (3 + 4)

Number of cores involved: 1 of 2

Percentage of tumor: 11% of specimen involved by tumor

Total length of tumor: 3 mm of tumor

>50% tumor in any core: No

- See comment.

**B) Prostate gland, left mid lobe, needle core biopsy:**

- **Adenocarcinoma, acinar** type.

Gleason score: 7 (3 + 4)

Number of cores involved: 1 of 2

Percentage of tumor: 11% of specimen involved by tumor

Total length of tumor: 3 mm of tumor

>50% tumor in any core: No

- See comment.

**C) Prostate gland, left apex, needle core biopsy:**

- Benign prostatic tissue.

**D) Prostate gland, right base, needle core biopsy:**

- Benign prostatic tissue.

**E) Prostate gland, right mid lobe, needle core biopsy:**



# Reviewing a Flagged” Pathology Case


Case Finder: Pathology Case


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## Pathology Case


Collection Date	Accession Number	Patient	MRN	SSN	Birth Date	Sex	Attending	Surgeon
08/05/2015	ABC-11-11111	Bob Jones	111111111	111111111	03/21/1967	M	BLUM MD, MICHAEL DAVID	

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### Primary Cancer

Histology

☐ adenocarcinoma, nos (8140/3) 

☐ carcinoma, nos (8010/3) 

Edit | Clear

Site

SaveCancel

Add Primary Cancer

Pathology Case: Note

- **Adenocarcinoma, acinar type.**  
Gleason score: 7 (3 + 4)  
Number of cores involved: 1 of 2  
Percentage of tumor: 11% of specimen involved by tumor  
Total length of tumor: 3 mm of tumor  
>50% tumor in any core: No  
- See comment.

**B) Prostate gland, left mid lobe, needle core biopsy:**  
- **Adenocarcinoma, acinar type.**  
Gleason score: 7 (3 + 4)  
Number of cores involved: 1 of 2  
Percentage of tumor: 11% of specimen involved by tumor  
Total length of tumor: 3 mm of tumor  
>50% tumor in any core: No  
- See comment.

**C) Prostate gland, left apex, needle core biopsy:**  
- Benign prostatic tissue.

**D) Prostate gland, right base, needle core biopsy:**  
- Benign prostatic tissue.

**E) Prostate gland, right mid lobe, needle core biopsy:**

Submit to METRIQ

Discard Case

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# Discarding a “Flagged” Pathology Case

- Case Finder allows the user to discard pathology cases without a confirmed site/histology pairing.



# Discarding a “Flagged” Pathology Case


Case Finder: Pathology Case


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## Pathology Case


Collection Date	Accession Number	Patient	MRN	SSN	Birth Date	Sex	Attending	Surgeon
08/05/2015	ABC-11-11111	Bob Jones	111111111	111111111	03/21/1967	M	BLUM MD, MICHAEL DAVID	

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### Primary Cancer

**Histology**

☐ adenocarcinoma, nos (8140/3) 

☐ carcinoma, nos (8010/3) 

**Site**

☐ prostate gland (c61.9) 

Submit to METRIQ

Undiscard Case

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Pathology Case: Note

Nature of Specimen:

**A. Prostate Left Base Needle Core Biopsy-NSLS**

**B. Prostate Left Mid Lobe Needle Core Biopsy-NSLS**

**C. Prostate Left Apex Needle Core Biopsy-NSLS**

**D. Prostate Right Base Needle Core Biopsy-NSLS**

**E. Prostate Right Mid Lobe Needle Core Biopsy-NSLS**

**F. Prostate Right Apex Needle Core Biopsy-NSLS**

FINAL DIAGNOSIS:

**A) Prostate gland, left base, needle core biopsy:**

- Adenocarcinoma, acinar type.

Gleason score: 7 (3 + 4)

Number of cores involved: 1 of 2

Percentage of tumor: 11% of specimen involved by tumor

Total length of tumor: 3 mm of tumor

>50% tumor in any core: No

- See comment.

**B) Prostate gland, left mid lobe, needle core biopsy:**

- Adenocarcinoma, acinar type.



# Exporting Confirmed Site/Histology Pairings

- Case Finder allows the user to export pending confirmed site/histology pairings along with basic demographics to a standard format for import into the local cancer registry software.
- The import process relieves the user from needing to manually input data into the local cancer registry software.



# Exporting Confirmed Site/Histology Pairings

Case Finder: New Export

casefinder.dev/batch\_exports/new

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## New Export

Create ExportLoad prior export: Search for export

Accession Number	Collection Date	Histology	Site	
ABC-11-11111	08/03/2015	ductal carcinoma, nos (8500/3)	breast, nos (c50.9)	<div>Review</div>
ABC-11-11111	08/04/2015	carcinoma, nos (8010/3)	breast, nos (c50.9)	<div>Review</div>



# Exporting Confirmed Site/Histology Pairing


Case Finder: Export

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Export: 4 (09/10/2017)

[New Export](#)

☐ Simple ☒ Full

Create File

Accession Number	Collection Date	Histology	Site	
ABC-11-11111	08/03/2015	ductal carcinoma, nos (8500/3)	breast, nos (c50.9)	<div>Review</div>
ABC-11-11111	08/04/2015	carcinoma, nos (8010/3)	breast, nos (c50.9)	<div>Review</div>



# Case Finder Benefits

- Case Finder significantly reduces the time needed to review and input pathology cases for the case finding cancer registry process.
- The fundamental case finding data points of site and histology are not only valuable for reporting to the government. The timely and accurate collection of these data points could have many clinical, research and quality assurance applications. Exports could be directed to other destinations beyond cancer registry software.
- Case Finder is built on top of a generic data model and architecture that can be applied to track other data points on other document types beyond pathology reports.