Automated Tumor Consolidation

THE FLORIDA ALGORITHM

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Outline

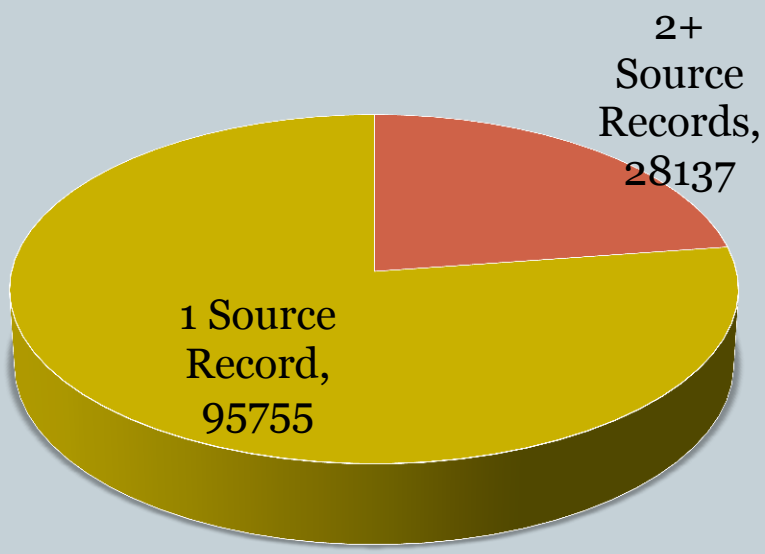
- Conclusion ☺
- Data items
- Examples of Logic – for reference
- Status Indicators
- Results of CTR review of cases with reviewable status indicators
- Brief Methodology
- Conclusion ☺!

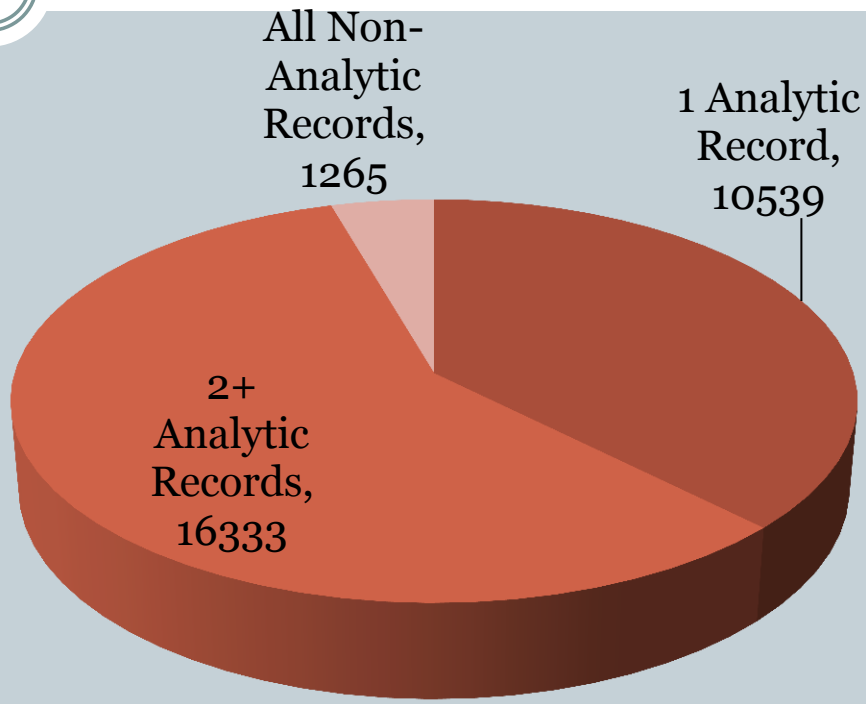
Conclusions

- Automated consolidation accurately determines the best information
  - Will NEVER be 100% automated
- Setting status indicators identifies scenarios of interest for data accuracy (routine registry analysis and for special studies)
  - Can be resolved in real-time or at specific intervals
- System is capable of "learning"
  - Evaluating results of QC review identifies ways to improve logic
- Do edits on source records, then TRUST your DATA
- Like manual consolidation, text is required for CTR review to be useful.
- **A MAJOR issue still needs to be resolved……**

The Numbers: 2009 Incident Cases

Incident Cases = 123,892





Tumors with 2+ Source Records = 28137

22.7% of incident cases need consolidation

Data items that are consolidated

Medical
Dxdate
Histology – Hematopoietic Histology – Non-Hematopoietic Histology – Benign Brain
Behavior Grade
Primary Site – Hematopoietic Primary Site – Non-Hematopoietic Primary Site – Kaposi Primary Site – Benign Brain
Laterality – Bilateral Eligible Sites Laterality – General Sites
Stage – 1977 and 2000
Method of Diagnosis Reporting Source

Treatment
Date of Initial Treatment
Surgery / Surgery Date Scope Regional Lymph Nodes Surgery Other, Regional, Distant Sites
Chemotherapy / Chemotherapy Date
Hormone Therapy / Hormone RX Date
BRM Therapy / BRM Therapy Date
Trans/Endo RX / Trans/Endo RX Date
Other Therapy / Other Therapy Date
Date Systemic
Surgery/Rad Sequence Surgery/Systemic Sequence

Sample Logic: Reporting Source

- Select Reporting Source based on hierarchy [1, 2, 8, 4, 3, 5, 6, 7]

Logic – Primary Site – Non-hematopoietc

- Select consolidated site by looping through MP2007_SITE_VALID
- Find row in table that matches the site pairs from the first two source records and select the site value in the consolidated site column.
  - IF Pair does not exist in MP2007_SITE_VALID, select site from record with earliest diagnosis date, then Class of Case hierarchy [1,0,2], then earliest date of first contact, then receipt date.
  - IF Value in Consolidated Site field = [C] (Choose), select Site from record using Class of Case hierarchy [1, 2, 0]], then earliest date of first contact, then receipt date.
- Use the result for the next search of the Site Pairs Table
- Continue looping using the result from D. until all source records have been processed; the final result is the consolidated site.

Sample Logic: Primary Site - Hematopoietic

- If consolidated histo is leukemia (histo code range: 9800-9950, 9960-9964, 9980-9992)
  - Select Site from the record that provided the consolidated histo.
  - If more than one record, use Site from record with the earliest Diagnosis Date.
- Select Extra-Lymphatic site
  - Any Site **OTHER THAN** lymphatic organs, nodes, blood sites and unknown (C809)
    - (THESE ARE THE LYMPHATIC SITES C024, C09* , C142, C172, C420, C421, C422, C423, C424, C379, C48*, C76*, C77*)
  - If more than one record, use extra-lymphatic Site from record with the earliest Diagnosis Date.

ELSE

- Select Lymphatic Organs (C024, C09*, C142, C172, C422, C379)
  - If more than one record, choose Use extra-nodal from record with the earliest Diagnosis Date.

ELSE

- IF C778 exists, select that
- IF C770-C775 - select it, if multiple *different* sites select C778
- IF C77* and a C779, use C77*
- IF C779 - select C779
- IF C77* and a (C48* or C76*), use C77*
- IF C48* - select C48* with the earliest diagnosis date
- IF C76* select C76* with the earliest diagnosis date
- ELSE use site from the record that provided consolidated histology (Note: these include C420, C423, C424, C809).

Status Indicators (flags)

- Consolidation rules provide reasonable, reproducible results for selecting the “best” information for most scenarios
- Choosing the best information for certain scenarios cannot be automated accurately.
- Implemented a status indicator system that describes how well the program thinks it did in selecting the best information.
  - No problem
  - Unknown data values
  - Only non-analytic records available
  - Specific scenarios that are useful to know or require QC review
    - N= 53 scenario status indicators

CURRENT Reviewable Status Indicators (n=19)

Field Name	#	Flag Name
DX_DATE	4	Non-analytic diagnosis date more than one year before analytic diagnosis date
PRIMARY_SITE	4	Two primaries VS two specific sites are reported. (Sarcoma, Gyn/Peritoneal, Colorectal, etc)
PRIMARY_SITE	5	A different site was submitted on a non-analytic record
PRIMARY_SITE	6	More than one extra-lymphatic site
PRIMARY_SITE	7	Site pairs not in Site Pairs Table
PRIMARY_SITE	8	Multiple sites exist for this tumor
LATERALITY	2	Different Laterality between records
LATERALITY	3	Bilateral code submitted
LATERALITY	4	Review for correct laterality (The consolidated site can have either a laterality 1-9 or a laterality of 0)
LATERALITY	5	A different laterality was submitted on a non-analytic record

CURRENT Reviewable Status Indicators (n=19)

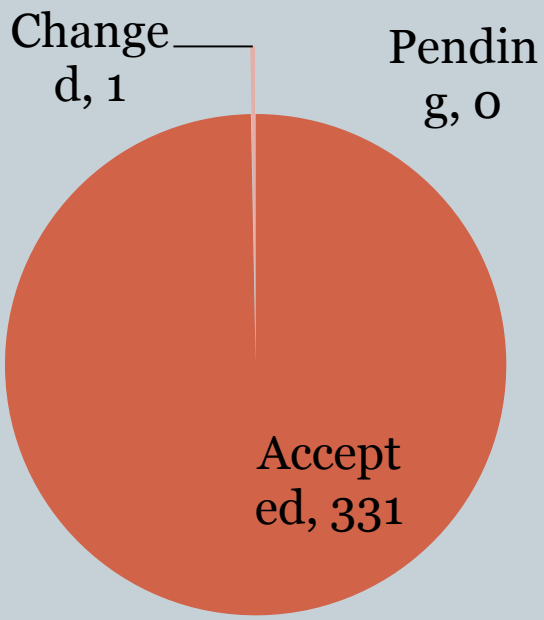
Field Name	#	Flag Name
MORPHOLOGY	2	A derived histology code is available for this tumor. (non-hematopoietic only)5
MORPHOLOGY	3	Histology pairs include pairs that might affect number of primaries due to TIMING. (Roadmap rows and columns problem)
MORPHOLOGY	4	Histo pairs not in Histo Pairs Table
MORPHOLOGY	5	A different Histology was submitted on a non-analytic record
DX_STAGE (1977 and 2000)	5	More than one CS Schema Number included for this tumor (analytic [0,1,2,6,9])
DX_STAGE (1977 and 2000)	7	Both InSitu [0] and Invasive [1,2,3,4,5,7] are available on analytic records [(0,1,2,6,9])
SURGICAL_TREATMENT	3	There is more than one FORDS Surgery Site Schema
SURG_RAD_SEQ	2	Discrepancy in Timing of Radiation Treatment relative to Surgery
SYS_SURG_SEQ	2	Discrepancy in Timing of Systemic Treatment relative to Surgery

Diagnosis Date

Code	Description
0	Diagnosis Date Okay
1	Unknown Diagnosis Date-only unknown date exists
2	Incomplete Diagnosis Date-Unknown Month (and day)
3	**Analytic Diagnosis dates occur in more than one year more than 90 days apart (the 90 days apart criteria eliminates flagging cases where Diagnosis Date are end of year/beginning of following year.)**
4	**A non-analytic diagnosis date is more than one year earlier than the consolidated Diagnosis Date**
21	Only Non-Analytic records were available to determine consolidated value

Diagnosis Date: QC Review Results

Code	Description
3	**Analytic Diagnosis dates occur in more than one year more than 90 days apart (the 90 days apart criteria eliminates flagging cases where Diagnosis Date are end of year/beginning of following year.)**



Problem scenario

Correct Diagnosis date from registry where surgery was performed

Later diagnosis date from the registry where the radiation therapy

Action/Plan:

1. Turned the flag off. (Status indicator is still set, but no longer reviewed).
2. Educate CTR's on recording dxdate

Diagnosis Date: QC Review Results

Code	Description
4	A non-analytic diagnosis date is more than one year earlier than the consolidated Diagnosis Date

Status 4: No cases in the FCDS database (1981 – 2010)

Action/Plan:
Turned flag off.
Re-claim this flag number for another scenario.

Histology

Code	Description
2	A derived histology code is available for this tumor. (non-hematopoietic only)
3	Histology pairs include pairs that might affect number of primaries due to TIMING. (Roadmap rows and columns problem)
4	**Histology Pair does not exist**
5	**A different Histology or behavior was submitted on a non-analytic record. Review for possible Multiple Primaries and to determine correct Histology value.** • **Most like a submission/processing Timing Problem with analytic and non-analytic records. Two primaries are linked into one tumor.**
6	**Different both benign and uncertain behavior have been submitted for a brain tumor.**
21	Only Non-Analytic records were available to determine consolidated value

Histology: QC Review Results

Code	Description
4	Histology Pair does not exist
6	Different both benign and uncertain behavior have been submitted for a brain tumor.

Status 4: 8 records. All Accepted

Action/Plan:
Added histo code pair combinations to the Histo Pairs Table.
Continue to review flagged cases.

Status 6: No cases in the FCDS database (1981 – 2010)

Action/Plan:

1. Recheck logic and software for accuracy
2. Review Benign Brain cases to see if other scenarios should be flagged

Laterality

Code	Description
2	**Different Laterality between ANALYTIC records**
3	**A bilateral code was submitted for this primary**
4	**Review for correct laterality (The consolidated site can have either a laterality 1-9 or a laterality of 0).**
5	**A different known laterality was submitted on a non-analytic record. Review for possible Multiple Primary is and to determine correct laterality value.**
6	Left and Right Laterality were submitted for a site that allows a bilateral code (Wilms, Retinoblastoma, epithelial ovarian w/in 60 days, inflammatory breast cancer, multiple nodules in both lungs)

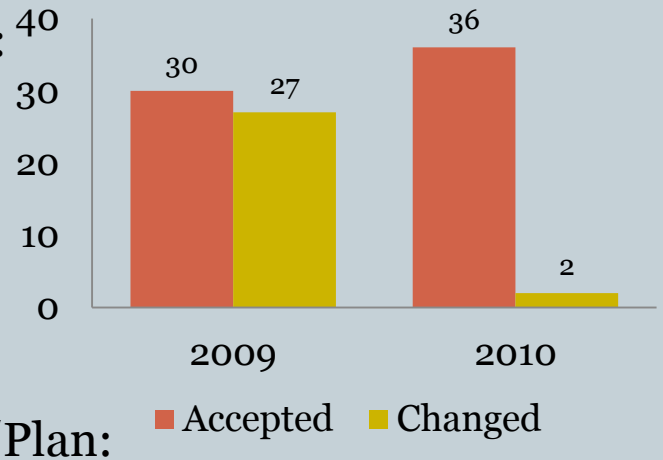
Laterality

Code	Description
2	Different Laterality between ANALYTIC records
3	A bilateral code was submitted for this primary

Status 2 :
15 records. 11 accepted

Action/Plan:
Continue reviewing. (Part of Urinary Multiple Primary decision making)

Status 3 :



Action/Plan:

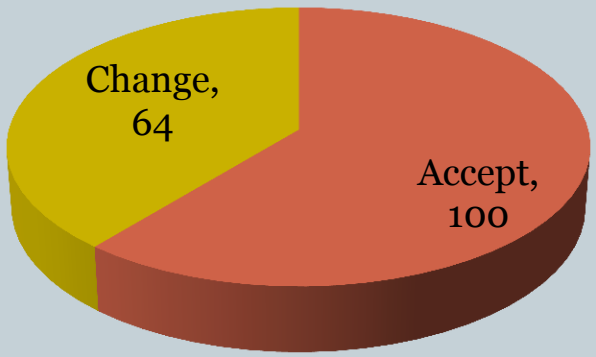
1. Evaluate difference in reviewer decision.
2. Further refine status indicator logic.

Primary Site

Code	Description
3	More than 1 specific sub-site Reported
4	**Review whether there are two primaries (Sarcoma, Gyn/Peritoneal, Colorectal, etc)**
6	**More than one Lymphatic/nodal site (hematopoietic malignancies only)**
7	**Site Pair does not exist in Site pairs table**
8	**Multiple sites exist for this tumor Review to determine best site in order to apply correct Surgical Treatment and CS Schema. (Urinary, esophagus/cardia of stomach)**
9	**More than one Extra-Lymphatic site or both extra-lymphatic and lymphatic sites are available (hematopoietic malignancies only)**

Primary Site

Code	Description
8	**Multiple sites exist for this tumor Review to determine best site in order to apply correct Surgical Treatment and CS Schema. (Urinary, esophagus/cardia of stomach)**

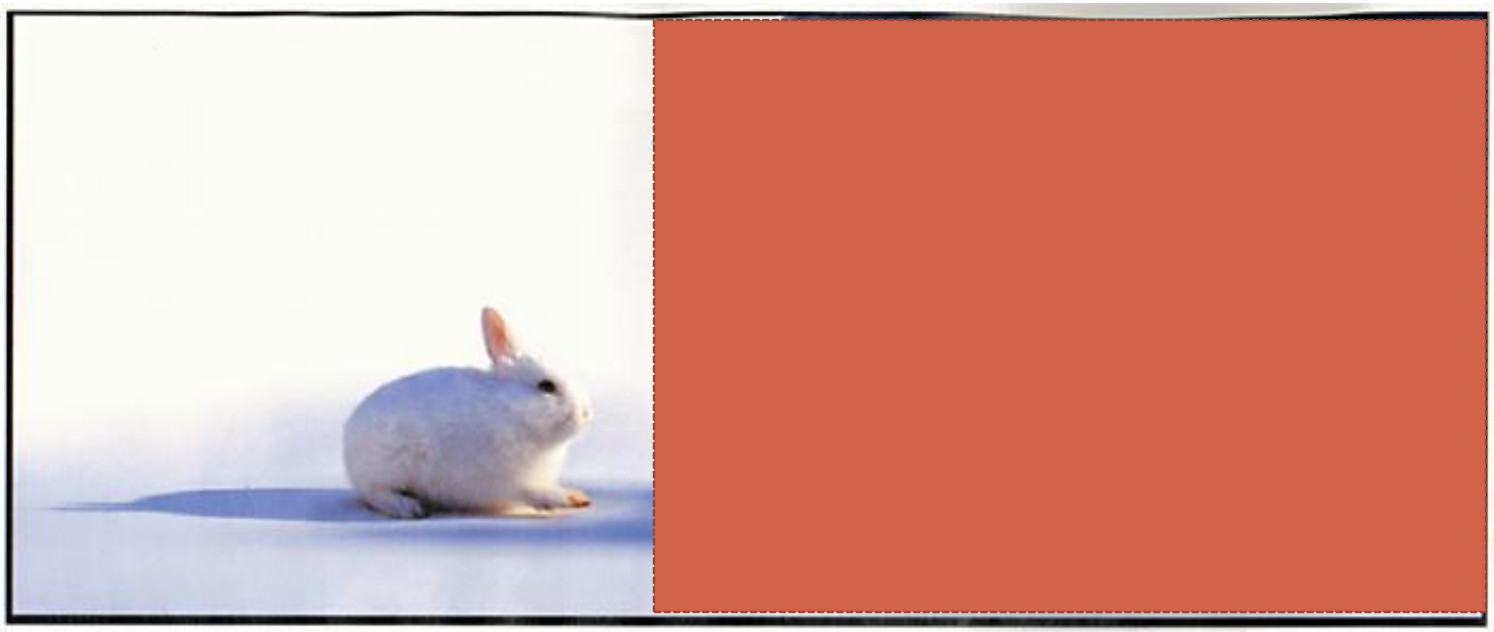


Problem scenario

- Esophagus/Cardia of Stomach
- Intrahepatic bile duct/Extrahepatic bile duct
- URINARY
- **Sites with different CS Schema are a MAJOR problem.**

Action/Plan:

1. Continue to review cases
2. Consider adding logic that chooses site based on higher stage.
3. In-depth analysis to resolve problem of sites with multiple CS Schemas.



General Findings

- Determined certain scenarios don't have to be reviewed
  - Dxdates in different years (on analytic records)
- Identified improvements for automatically selecting best information
  - Changing Class of Case hierarchy for Site
    - From (10, 00, 20) to (10, 20, 00)
- Identified numerous rules/guides to add to Data Acquisition Manual
  - When bilateral is an appropriate laterality to code (beyond the known Wilms, Retinoblastoma, etc
- Identified educational moments for hospital registrars.
  - "Did you know…"
- **Identified SERIOUS difficulties in consolidating tumors where there are multiple CS Schemas**

Brief Methodology

- Multiple in person meetings
  - CTR's and IT staff and decision maker
- **Extensive** Testing prior to implementation
  - Corrected errors in logic and/or Software
  - Enhanced logic
  - Developed and utilized end-user testing software
    - Created a test case to validated each logic statement
    - Can re-consolidate the test cases when logic changes
- Full documentation
  - Structured – Same format and details for each data element
  - Logic written as English statements
    - Understandable by CTRs
    - Programmable by IT staff

Documentation

I. Input Fields
II. Output Fields
III. Data Item Status Indicators
IV. Reference Tables
V. Record Selection
VI. Logic for consolidating data item
VII. Logic for consolidating data item status indicator
VIII. Secondary data items and carry-along fields
IX. QC Ad hoc evaluation queries
    - To identify special scenarios needing review that are not handled within the algorithm

Action/Plans

- Continue to enhance logic, evaluate ways to further reduce QC review
- **Develop logic or procedures resolve the problem of choosing the best site and stage when there are multiple CS Schemas**

Conclusion

- Automated consolidation accurately determines the best information
  - Will NEVER be 100% automated
- Setting status indicators identifies scenarios of interest for data accuracy (routine registry analysis and for special studies)
- System is capable of "learning"
  - Evaluating results of QC review identifies ways to improve logic
- Do edits on source records, then TRUST your DATA
- Like manual consolidation, text is required for CTR review to be useful.

Community efforts in consolidation

Documentation has been shared with the

NAACCR Registry Operations Committee

Thank you!