Registry Plus

- Suite of publicly available, free-of-charge, Windows-based software programs for collecting and processing cancer registry data
- Made available by the CDC to implement NPCR
  - Enable central registries to meet NPCR program standards in the face of existing budgetary constraints
- Compliant with national standards
- Fully customizable for state-specific needs
<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract Plus</td>
<td>Abstract and code cancer cases using standard data items and codes</td>
</tr>
<tr>
<td>Web Plus</td>
<td>Abstract, code, and collect cancer data securely over the Internet</td>
</tr>
<tr>
<td>eMaRC Plus (Mapper Plus)</td>
<td>Work with path lab records in HL7/pipe-delimited format, identify cancer records and map to the NAACCR file format</td>
</tr>
<tr>
<td>Data File Mapper Plus</td>
<td>Map data elements from any fixed width or delimited data file to the NAACCR file format</td>
</tr>
<tr>
<td>Prep Plus</td>
<td>Receive and edit batches of abstracts</td>
</tr>
<tr>
<td>CRS Plus</td>
<td>Link and consolidate edited abstracts</td>
</tr>
<tr>
<td>Link Plus</td>
<td>Probabilistically link records</td>
</tr>
<tr>
<td>Registry Plus Online Help</td>
<td>User-friendly, Windows-based Help system; incorporates standard abstracting and coding manuals into one accessible, easy-to-use resource</td>
</tr>
</tbody>
</table>

CDC–NPCR Prep and CRS Plus Contacts

Michelle Esterly, CDC/NPCR Contractor
E-mail: mesterly@cdc.gov

Jennifer Seiffert, CDC/NPCR Contractor
E-mail: jenesei@comcast.net

Kathleen K. Thoburn, CDC/NPCR Contractor
E-mail: kthoburn@cdc.gov

Sanjeev R. Baral, CDC/NPCR Contractor
E-mail: sbaral@cdc.gov
**Prep Plus**

Used to edit NAACCR records and prepare abstracts for processing in CRS Plus

---

**CRS Plus**

Used to perform automated central registry record linkage and data item consolidation on prepared abstracts

---

**Prep Plus**

**General Information**

- Windows-based software, networked, multi-user
- Used to receive and apply data quality/completeness edits to batches of incoming abstracts
  - Uses CDC’s EDITS program/NAACCR standard edits
- Customizable by central registry
- Input is NAACCR records in versions 6 and later from any source
- Output is records in latest NAACCR version, edited and bundled for subsequent processing
**Prep Plus Features**

- Review only records with edit errors and correct the errors
- **OR**
- Visually edit (inspect and modify) all records in the bundle, on screen, without printing hard copies
- User can also *hold* an abstract with or without errors to staff work file
- Report of edit errors can be generated and printed for return to reporting facility

**Prep Plus Customization**

- User can create their own "display type"
  - Interface where user enters data
  - Subset of NAACCR standard data items plus any state-specific items
  - Order of displayed data items can be specified
- User can determine their own edit requirements
- User-defined functions can be invoked for local processing options
Prep Plus Processing

- Open new bundle (file of abstracts)
- User enters source of the file or the source automatically displays if a hospital code table is included in Prep Plus
- Files can be flagged for interstate data exchange or VA reporting to prevent future release of the records
- Files and abstracts are registered
Prep Plus
File Processing

Prep Plus Abstract Processing

Each record is:
- Copied to an archive file
- Converted to the latest NAACCR record layout if necessary
- Assigned a unique permanent ID that carries to CRS Plus (AbsRefID)
- Date-stamped
- Added to tracking database
- Edited according to the state's requirements
- Marked DO NOT RELEASE if necessary
Prep Plus – Visual Review & Resolving Edit Errors

Prep Plus Disposition Tab
Prep Plus Edit Reports - Summary

Prep Plus Edit Reports - Detail
**CRS Plus - (Central Registry System)**

- Used to manage central registry---link, consolidate, and maintain source records in a central database
- Creates consolidated patient and tumor tables for the same person and tumor with the best values from multiple sources
- Provides for automatic determination of multiple primary tumors and consolidation of data items from multiple case reports into incidence records
- Produces standard extracts for NPCR and NAACCR call-for-data submission, user-specified extracts, and NAACCR-formatted files

**CRS Plus Features**

- Customizable to meet your needs
- Retain all source records
- Query tool to extract data
- Provides standard management reports
Administrative Functions

CRS Plus
User Authorization Levels

- Administrator
- Consolidator
- Editor
- Viewer
- Table Editor
Flag for Release of Records

- Carried over from Prep Plus and populated in Unusual Follow-Up Method for Data Exchange and VA records
- Can also be manually updated in CRS Plus for individual cases

Special Import into CRS Plus

- Special Import is a one-time import of registry data from current software into CRS Plus
- Support provided by Registry Plus Team to assist registry and IT staff to ensure successful import of records
- Need your data in 3 files (in NAACCR file format) that correspond to the CRS Plus tables for
  - Demographic Summary (Patients)
  - Medical Summary (Tumors)
  - Abstracts (Facility Records)
Importing Prepped Bundles from Prep Plus

- Select files to import
- Unattended import allows user to import multiple files without manual intervention in between files (can run overnight)
- Import Activity Report
- Import Log
  - Provides tracking of all imports

CRS Plus Import Window

- [Image of CRS Plus Import Window]
CRS Plus Import Report

<table>
<thead>
<tr>
<th>File Name</th>
<th>C:\CDPLUS\PREPLUS\WEB\KBP\J\KBP075\BIK\DOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imported By</td>
<td>DOE</td>
</tr>
<tr>
<td>Date Imported</td>
<td>6/6/08 1:44:20</td>
</tr>
<tr>
<td>Total Records Imported</td>
<td>12</td>
</tr>
<tr>
<td>Total Records Directly to Database</td>
<td>4</td>
</tr>
<tr>
<td>Total New Patients</td>
<td>4</td>
</tr>
<tr>
<td>Total New Tumors added to existing patients</td>
<td>0</td>
</tr>
<tr>
<td>Total New Facility Records added to existing tumore</td>
<td>0</td>
</tr>
<tr>
<td>Total records to pending</td>
<td>5</td>
</tr>
<tr>
<td>In Pending Par:</td>
<td></td>
</tr>
<tr>
<td>Tumor Sequence New Patient</td>
<td>5</td>
</tr>
<tr>
<td>Tumor Sequence New Tumor</td>
<td>0</td>
</tr>
<tr>
<td>Parent Linkage</td>
<td>1</td>
</tr>
<tr>
<td>Tumor Linkage</td>
<td>1</td>
</tr>
<tr>
<td>Data from Consolidation</td>
<td>1</td>
</tr>
<tr>
<td>Duplicates</td>
<td>0</td>
</tr>
<tr>
<td>Etags</td>
<td>0</td>
</tr>
<tr>
<td>Collaborative Sorting</td>
<td>0</td>
</tr>
</tbody>
</table>

TLC Plus (Tumor Linkage & Consolidation)

- Provides automated support for CTR decision-making
  - Do multiple abstracts for the same person represent SAME or DIFFERENT tumors?
  - For multiple abstracts for the same tumor, what consolidated values should be used for analysis?
    - Demographic (Patient tables)
    - Cancer identification (Medical Summary tables)
    - Treatment summary (Medical Summary tables)
- Most TLC Plus decisions can be verified by CTR
- TLC Plus rules can be modified or de-activated by central registry
Abstracts Table-Status1

- Broad status of abstract

<table>
<thead>
<tr>
<th>Status Code1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>Void</td>
</tr>
<tr>
<td>99</td>
<td>Pending</td>
</tr>
<tr>
<td>101</td>
<td>New Case</td>
</tr>
<tr>
<td>102</td>
<td>New Tumor</td>
</tr>
<tr>
<td>103</td>
<td>New Treatment or Facility</td>
</tr>
</tbody>
</table>
Abstracts Table-Status2

- Why the abstract is in pending
- Value greater than 0 indicates pending

<table>
<thead>
<tr>
<th>Status2</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Invalid Tumor Sequence on New Patient</td>
</tr>
<tr>
<td>2</td>
<td>Patient Linkage cannot be determined</td>
</tr>
<tr>
<td>4</td>
<td>Tumor Linkage Manual Review</td>
</tr>
<tr>
<td>8</td>
<td>Incomplete consolidation (manual review required)</td>
</tr>
<tr>
<td>9</td>
<td>Duplicate abstract</td>
</tr>
<tr>
<td>10</td>
<td>Edit Error (failed edits after auto-consolidation)</td>
</tr>
<tr>
<td>11</td>
<td>Collaborative Stage Calculation Error</td>
</tr>
<tr>
<td>12</td>
<td>Invalid Sequence on New Tumor</td>
</tr>
</tbody>
</table>

Defined Data Flow
Pending Status Codes

<table>
<thead>
<tr>
<th>Pending Status</th>
<th>Meaning/Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Linkage</td>
<td>Potential Patient match</td>
</tr>
<tr>
<td>Sequence New Patient</td>
<td>Does not link to patient in database; Seq &gt; 00</td>
</tr>
<tr>
<td>Tumor Linkage</td>
<td>Potential Tumor match</td>
</tr>
<tr>
<td>Sequence New Tumor</td>
<td>Potential new tumor; review sequence number</td>
</tr>
<tr>
<td>Data Item Consolidation</td>
<td>One or more data items requires manual review</td>
</tr>
<tr>
<td>Duplicate Check</td>
<td>Based on Reporting Facility</td>
</tr>
<tr>
<td>Collaborative Stage Calculation Error</td>
<td>Cannot derive CS – one or more CS items invalid</td>
</tr>
<tr>
<td>Edit Error</td>
<td>Sent to pending for edits</td>
</tr>
</tbody>
</table>
Patient Linkage

- First step: Blocking performed to identify all consolidated records similar to the incoming record
  - Soundex of last name
  - Birth date
  - SSN

- Blocking — allows patient linkage to be completed more efficiently
Patient Linkage

- Second step: Matching specific data items from the incoming record against all consolidated records to assign match score

- Data items used to compute score:
  - Date of Birth
  - First Name
  - Middle Name
  - Last Name
  - SSN
  - Sex
  - Race 1

Patient Linkage

- Matching algorithm assigns different scores for matches or partially matched data items

- CRS Plus uses two cut-off scores to identify potential matches
  - Highest possible score – 170
  - All records with a score of 155 or higher are considered definite matches (pt ID transferred)
  - Records with score less than 80 are eliminated as matches (Low score can be determined by Registry)
**Patient Linkage**

**Potential Dispositions**

- **New Patient:** No records with match score => 80
  - Record sent for sequence number check
  - New Patient record and Tumor record created

- **Pending Patient Linkage:** One or more records with scores = 80-154 OR one record with score => 155 but another record matched
  - Record sent to pending for manual patient linkage

- **Linked to Patient:** Only one record with score => 155 OR one record with score => 155 and other records matched with scores significantly lower
  - Patient ID assigned and record proceeds to TLC Plus
**Sequence Number Verification**

- Records designated as New Patient enter sequence number check

- Based on Sequence Number--Hospital
  - Values of 00, 99, or blank – Assign Sequence Number--Central of 00
  - Any other value – abstract sent to pending for manual Sequence Number--Central assignment

---

**Pending: Sequence New Patient**
Tumor Linkage

- TLC Plus – automated tumor linkage process to determine if record can be linked to an existing tumor

- Involves matching of specific data items from incoming abstract against linked consolidated records

- Data items used to determine Tumor Linkage:
  
<table>
<thead>
<tr>
<th>Primary Site</th>
<th>Behavior</th>
<th>Histologic Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laterality</td>
<td>Diagnosis Date</td>
<td>Reporting Facility</td>
</tr>
</tbody>
</table>

Tumor Linkage
Potential Dispositions

- **New Tumor:** Tumor determined to be new primary, not currently on database
  - New Tumor record created and record proceeds to automated consolidation (patient data items only)

- **Pending Tumor Linkage:** Automated Tumor linkage not determined
  - Record sent to pending for manual tumor linkage

- **Consolidate:** Tumor determined to be same primary
  - Record proceeds to TLC Plus for automated consolidation
**Pending: Tumor Linkage**

**Data Item Consolidation**

- **TLC Plus** applies user-defined consolidation rules (TLC_DATA.mdb)

- Consolidation rules define how data from two or more linked records are evaluated to select ‘best’ value

- Application of consolidation rules can be automated, manual, or a combination

- If rules are not defined for a field, the field value from the first abstract received will be maintained but can be manually updated
Data Item Consolidation

- Consolidated record value is not considered
- Consolidation compares values from incoming record to all source records

Data Item Consolidation
Potential Dispositions

- **Update:** All automated consolidation rules processed successfully
  - Consolidated record updated and incoming record disposed to database

- **Manual Review:** Not all automated consolidation rules completed successfully
  - Record sent to pending for manual data item consolidation
  - Values successfully determined through automated consolidation can be updated manually
Data Item Consolidation
Automated Directives

- Example: **Date of Last Contact**
  - KnownOverUnknown;MostCompleteDate;LatestDate

- Example: **CS Extension**
  - KnownOverUnknown;ManualIfAmbiguous

Automated Directives in Practice – How do they work?
Can the Directives be Modified?

- Yes, in the TLC_DATA.mdb
- The order of the directives and directive strings can be modified to meet your needs
- Directives can also be inactivated

Duplicate Check

- Comparison of Reporting Facility is completed for all incoming records linked to an existing patient and existing tumor
- If Reporting Facility numbers different record is disposed to database
- If Reporting Facility numbers are identical record is sent to pending
**Duplicate Check Potential Dispositions**

- **Add:** Facility record is added to the database

- **Void:** Facility record is voided and not included in the database
  - Record is sent to the Non-Analytical section and can be retrieved if accidentally voided

- **Update:** Facility record is added to the database and user is forwarded to the Update Case window to modify values/void the record

---

**Collaborative Stage Algorithm**

- The Collaborative Stage Algorithm runs through the `cstage.dll`

- If records can be processed through the automated tumor linkage and consolidation process successfully, but fail the Collaborative Stage Algorithm, they are sent to pending for review of CS items
Collaborative Stage Recalculation

- CS Recalculation – Batch process to recalculate CS Version Latest on all applicable records in the database when new CS versions are implemented
- Uses cstage.dll
- Option to recalculate CS on tumor records only or on both abstracts and tumor records
- Reports are generated to provide listings of records failing CS Calculation

Suspending Records in Pending

- Records can be suspended or held to staff for several reasons
  - Obtain additional information and dispose record at a later time
  - Training new staff, hold to manager for review
Edit Check

- NAACCR EDITS are run against the consolidated record
- Two edit sets necessary – one to run against the consolidated records and one to run against abstracts
  - Appropriate edit set is defaulted and automatically applied

Compare Results Function

![Compare Results Function](image)
Customizing CRS Plus

- **Control.mdb** – modify display
- **Catvals.mdb** – modify Hospital table (HOSPCODES)
- **TLC_DATA.mdb** – TLC Plus consolidation rules – can add/modify/delete directives

Creating/Modifying the CRS Plus Display

- Through the **Control.mdb** table
- Can be customized by registry
- Entry Sequence
- State-Specific fields can be added
Searching for Patients in Database

Viewing Records

- Viewing Records – For viewing only
  - Updates cannot be made from this screen

- Default Grid Display

- Layout of Screen
CRS Plus View Case

Printing Records in CRS Plus
Updating Records

- How to modify data
- Data Interchange buttons
- Run EDITS
- Collaborative Stage Algorithm in Update Window

CRS Plus Update Window
Running EDITS in Update

CS Algorithm in Update
Edit Case Structure

- Case structure can be modified
  - Voiding Records
  - Updating Sequence Numbers
  - Unlinking Records
  - Sending Abstracts Back to Pending to link appropriately
Non-Analytical Screen – Voided Records

Standard Extracts

- NPCR CSS Submission
- NAACCR Call for Data
- Inter-state Data Exchange
Standard Extract – NAACCR Call for Data

Extract Wizard

- Provides the ability to create customized queries in CRS Plus
  - Specify the record source (consolidated or abstracts) and output format (Type of NAACCR Record, fixed width)
  - Select fields to extract
  - Specify criteria
  - Specify the sort order
Extract Wizard Example

The WHERE clause (Edit text to specify a grouping condition):

MedicalSum.DiState = 'PA'

SQL Statement

SELECT Patients.PatientID, Patients.LastName, Patients.FirstName, MedicalSum.DiState, MedicalSum.DiDate, MedicalSum.HistTypeCD03 FROM Patients, MedicalSum WHERE (Patients.PatientID = MedicalSum.PatientID AND MedicalSum.DiState = 'PA')

SQL Queries

SELECT Patients.PatientID, Patients.LastName, Patients.FirstName, MedicalSum.DiDate, MedicalSum.DiState, MedicalSum.HistTypeCD03 FROM Patients, MedicalSum WHERE (Patients.PatientID = MedicalSum.PatientID AND MedicalSum.DiState = 'PA')
Reports - Current

- Linkage and Consolidation Results Report
- Case Reports Received by Facility
- Frequency of Select Coded Data Items
- Import Case Management Report
- Current Statuses of Abstracts by Date Imported
- Tumors by Diagnosis Year and Behavior

Registry Plus Users Group

- Monthly Registry Plus Users Group (RPUG)
  - Monthly teleconference meeting used to communicate Registry Plus software updates, discuss development plans with users of the applications, and gather feedback from users
  - Promotes exchange of software issues, successes, and ideas for implementation among users
Reports – Future Plans

- RPUG Central Registry Reports Workgroup
  - Allows states to have report specification and prioritization input
- Lead by central cancer registry participant
- Exploring ideas for additional standard reports to enhance management reports

Obtaining Registry Plus

1. Go to NPCR Home Page: http://www.cdc.gov/cancer/npcr
2. In the ‘Tools’ Section, click on Registry Plus
3. Under ‘Registry Plus Components’, click on link for software of interest
4. Click on Technical Information and Installation

OR

E-mail: Cancerinfo@cdc.gov
## Registry Plus Contacts

<table>
<thead>
<tr>
<th>Registry Plus Staff</th>
<th>Area of Expertise</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanjeev Baral</td>
<td>Prep Plus, CRS Plus, Web Plus, Mapper Plus</td>
<td><a href="mailto:zkk5@cdc.gov">zkk5@cdc.gov</a></td>
</tr>
<tr>
<td>Michelle Esterly</td>
<td>Prep Plus, CRS Plus</td>
<td><a href="mailto:mesterly@cdc.gov">mesterly@cdc.gov</a></td>
</tr>
<tr>
<td>Denise Farmer</td>
<td>Abstract Plus</td>
<td><a href="mailto:df7@cdc.gov">df7@cdc.gov</a></td>
</tr>
<tr>
<td>David Gu</td>
<td>Link Plus</td>
<td><a href="mailto:dfg2@cdc.gov">dfg2@cdc.gov</a></td>
</tr>
<tr>
<td>Peter Kim</td>
<td>Collaborative Staging</td>
<td><a href="mailto:pkim@cdc.gov">pkim@cdc.gov</a></td>
</tr>
<tr>
<td>Tom Rawson</td>
<td>Prep Plus, CRS Plus, Link Plus EDITS software, Collaborative Staging</td>
<td><a href="mailto:lkr2@cdc.gov">lkr2@cdc.gov</a></td>
</tr>
<tr>
<td>Joseph Rogers</td>
<td>General Registry Plus</td>
<td><a href="mailto:jdr0@cdc.gov">jdr0@cdc.gov</a></td>
</tr>
<tr>
<td>Jennifer Seiffert</td>
<td>All Registry Plus applications, Collaborative Staging</td>
<td><a href="mailto:janesel@comcast.net">janesel@comcast.net</a></td>
</tr>
<tr>
<td>Sherrie Stein</td>
<td>Abstract Plus</td>
<td><a href="mailto:sstein@cdc.gov">sstein@cdc.gov</a></td>
</tr>
<tr>
<td>Kathleen Thoburn</td>
<td>All Registry Plus applications</td>
<td><a href="mailto:kthoburn@cdc.gov">kthoburn@cdc.gov</a></td>
</tr>
<tr>
<td>Scott Van Heest</td>
<td>General Registry Plus</td>
<td><a href="mailto:sgv1@cdc.gov">sgv1@cdc.gov</a></td>
</tr>
</tbody>
</table>

- patterns of edit errors
- individual edit errors
- automatic linkage & export
- import activity report

**Cutoff Score?**

**Highest is 170**