



Tumor Linkage - California's Approach



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Background

The California Cancer Registry utilizes the Eureka Data Management System to store all statewide cancer data. Some of the processes occur automatically within the system while other processes require some degree of manual work effort. As resources and budgets shrink, a business decision was made to evaluate those manual processes and analyze the feasibility of applying automation solutions as an alternative and as a means to re-direct staff resources to the more complex processes that are not readily adaptable to an automation solution thereby requiring skilled CTRs to manually complete.

One of the processes deemed a possible candidate for automation was linking an incoming admission to an existing patient/tumor. In California, the Eureka-DMS database is structured to identify patients, tumors and admissions. Linkage occurs between patients and tumors as well as between tumors and admissions. Prior to this linkage automation project, the process of linking patients, tumors or admissions remained essentially a manual work effort performed by regional staff.

Objective

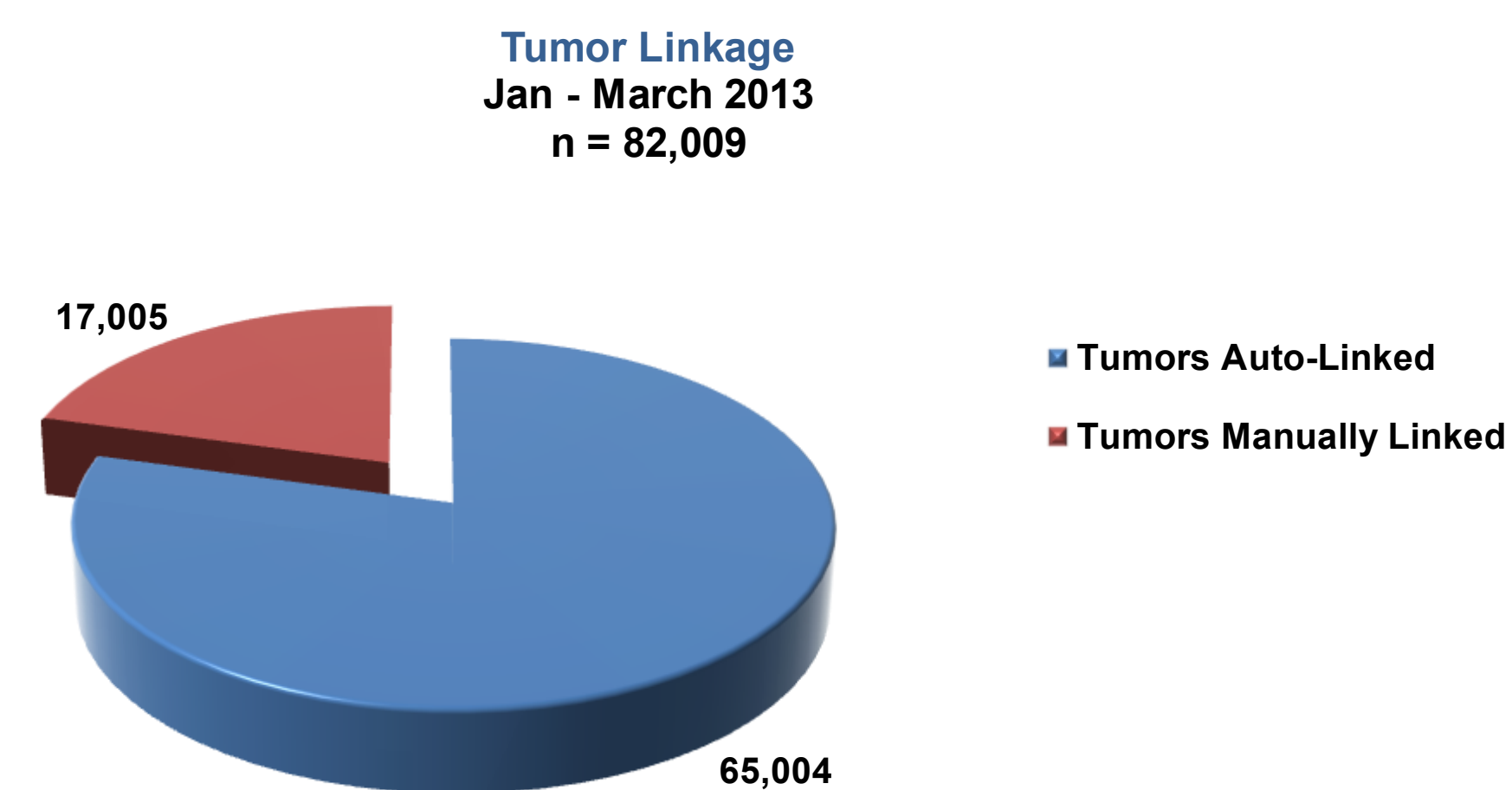
- Reduce the per-unit cost of Regional Registry cancer case collection and source document processing
- Improve data quality and move towards system-wide "Continuous Quality Control"
- Move towards "Straight Through Processing" of cancer cases in "real time"
- Provide more timely information to researchers

Methodology

The automation project was assigned to the CaCARES Program Production Automation and Quality Control (PAQC) Unit. A project management approach was utilized with team members consisting of a combination of programmers, systems architect, and business analysts (CTRs). Team members met bi-weekly with staff assignments tracked through the project management approach. The overall objective of this automation work effort was to reduce the manual work effort directed towards the process of linkage.

Baseline numbers were obtained to determine the number of cases being manually processed at the beginning of this project.

From Jan - March of 2013 the number of cases manually processed was 20.74% as illustrated in the graph below:



Overall Results

Business Analysts/CTRs developed a set of rules based on site specific criteria in the SEER Multiple Primary and Histology Coding (MP/H) Manual with extensive input from programmers to ensure all aspects were evaluated that would affect the database. The decision was made to create automation rules for exact match scenarios wherein an incoming tumor exactly matched an existing patient/tumor in the database, per the SEER MP/H specifications.

An initial draft of the linkage rule was started in March of 2013 with a planned implementation date of December 2013. Twenty revisions to the original draft were required with multiple reviews, feedback and collaboration on the part of all team members.

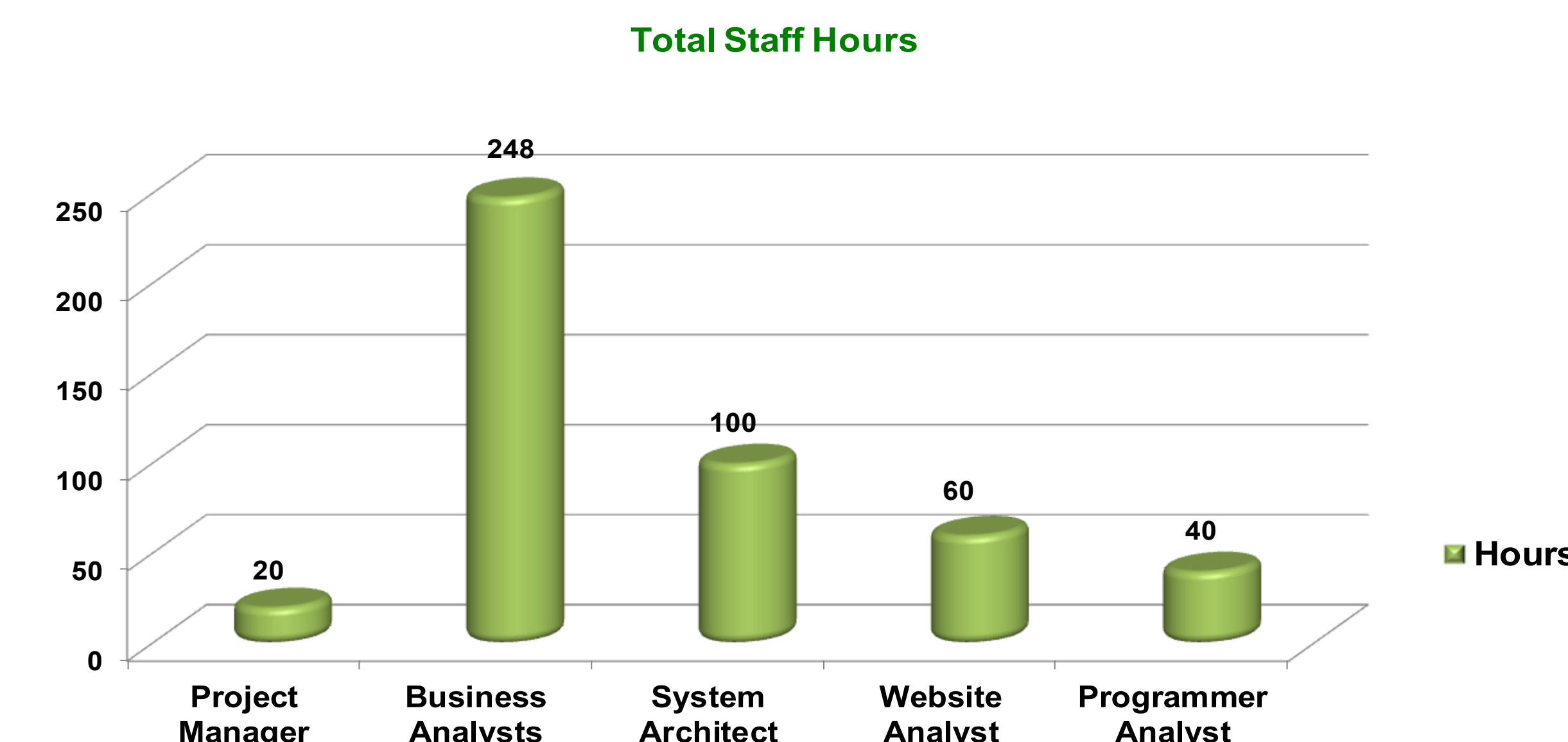
Extensive testing was performed prior to implementation. Fictitious cases were created in a test environment using a "File Builder" which enabled us to download a "real" case and manipulate the data being tested. Two outcomes were expected: The incoming tumor automatically linked to the patient and tumor or the tumor did not link and went to manual linkage resolution because it was not an exact match. Below is an excerpt from the test spreadsheet.

QA Test Results - On File Upload (File Builder)

1a Change Date Dx to EXACTLY one year of original Date Dx (Table1)									
Name	New	New	New	Original	Original	New	Y or N	Y or N	
Adm ID (generated)/DOB/SSN	Adm id	Hosp No	Site	Date Dx	Date Dx	VE Rqd	Auto linked	MS	
Lname, Fname	XXXXXX	XXXXXX	C569	20120701	20130630	Yes	Yes	X	
(Adm id), (DOB), (SSN) (prior)									

Work Effort

A total of 468 hours were dedicated to this project. The following graph illustrates the breakdown of the hours by staff:



Duplicate Tumors in the Database

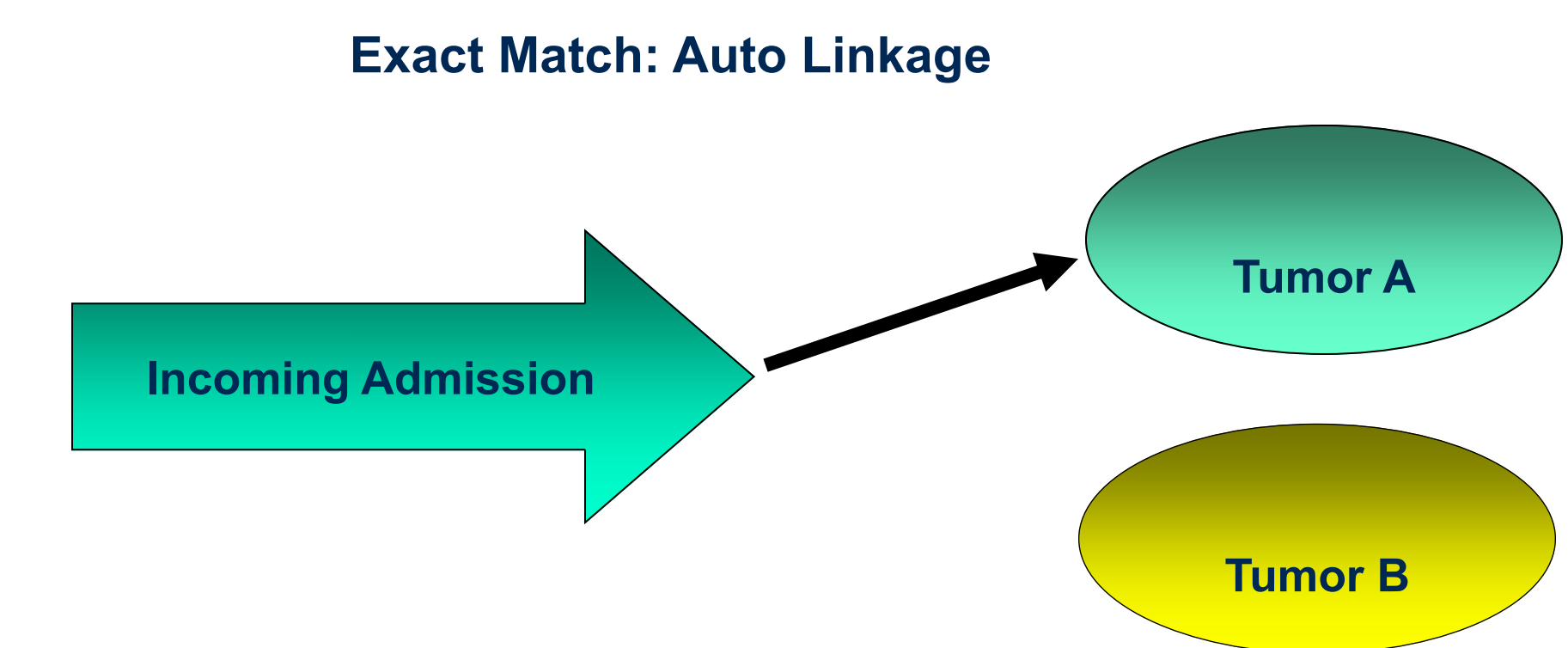
If there are duplicate tumors in the database, the most correct outcome is for the tumors to be merged, and the incoming record to be linked to the resultant tumor. As this is an exceptional case, ideally this should be done manually, with a CTR being provided the tools necessary to make an informed decision. There are two main scenarios when the linkage rules may interact with that situation.

Scenario 1 - Both Tumors Link:

Scenario 1 involves both tumors being similar enough that linkage rules will identify both tumors as a linkage. For this condition to be properly recognized by the system we may simply enforce that for an automatic linkage to happen, exactly one tumor is identified as a positive deterministic linkage. If there is more than one tumor identified as a positive match, the process must not automate the linkage and instead allow for a manual resolution of the data condition.

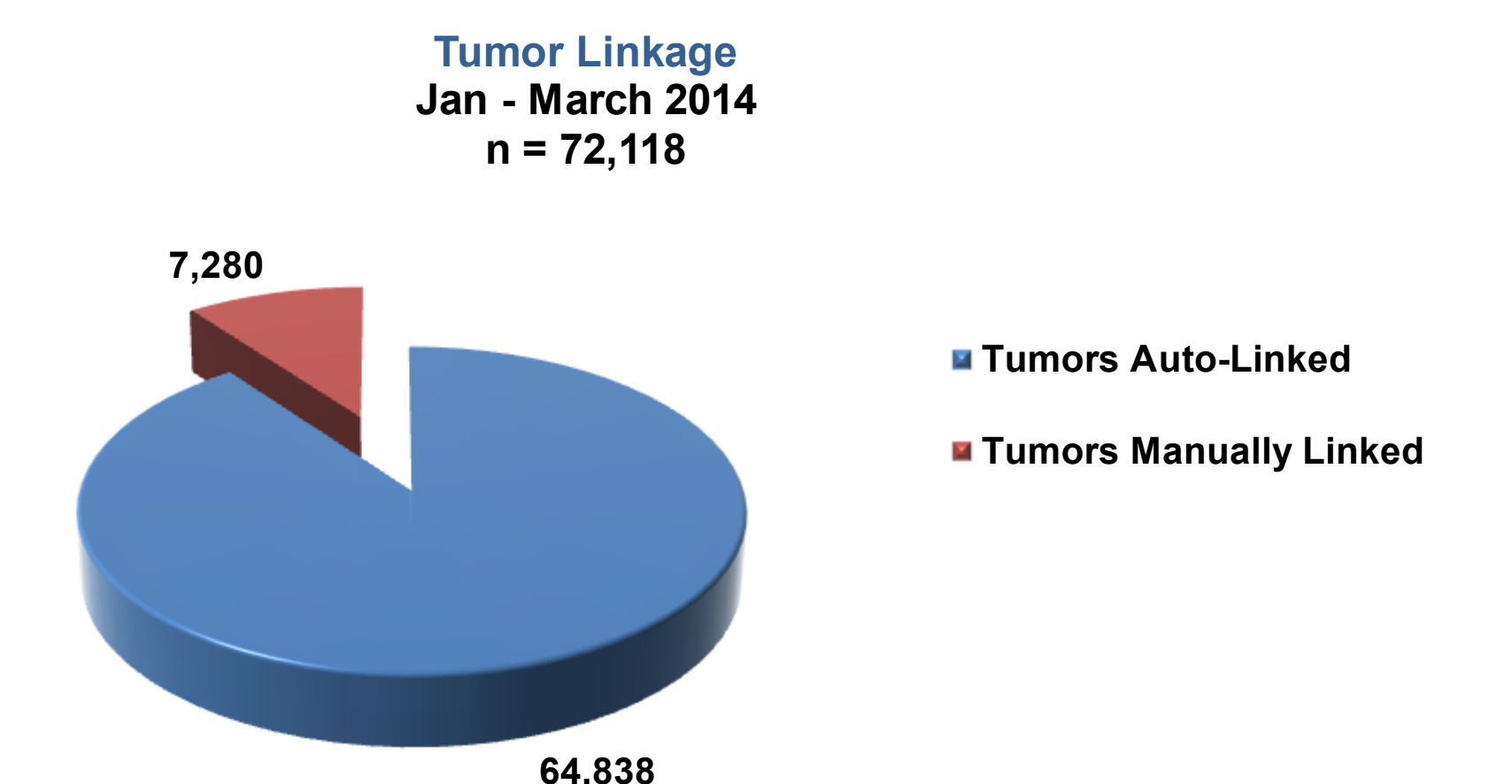
Scenario 2 - One Tumor Links:

Scenario 2 is the situation in which linkage rules identify only one of the two duplicates as a link; Tumor A is identified as a positive linkage, while Tumor B has no deterministic result. In the context of an incomplete tumor linkage rule set, this is an identical result as Tumor A being identified as a positive link and Tumor B not being covered by implemented rules yet. Given correct rules, the resultant linkage to Tumor A is a correct linkage, and an automatic linkage to only Tumor A is an acceptable outcome. Ideally if we do not have a deterministic result for Tumor B, we should make a note of that for later analytics, as a complete rule set should have deterministic results for every single tumor being addressed.



Results

Following implementation of the automation linkage rule, Jan - March 2014 numbers were obtained to provide a comparison to baseline numbers. As noted in the chart below, post-implementation of the linkage automation rule demonstrated a significant decrease (10.09%) in the number of Patients and Tumors requiring manual intervention.



Conclusion

Implementing an automation solution for new tumor linkage to patient processes in lieu of the current method of manual processing will free up regional staff time and allow regions to reallocate staff resources appropriately. Business rules that result in an automatic action will eliminate a manual decision. Thus, as each new business rule is implemented, less manual work will be required, and the California Cancer Registry will incrementally move closer to straight-through-processing, continuous quality control, and exception-based processing.

The following staff contributed to the Tumor Linkage Project: Cheryl Moody, Mary Brant, Jenna Mazreku, Tanweer Ahmad, Scott Wood, Ben Wormeli, Ghenadie Ciornii