A Laboratory's Perspective with LIS and EHR Integration

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ABSTRACT

Aim: Merger of hospital systems has become increasingly prevalent. When Wake Forest Baptist Medical center merged with Atrium Health to become Atrium Health Wake Forest Baptist, a merger of the different instances of each systems electronic health records (EHR) software (Epic Systems Co) was needed. In addition, each center has an HLA laboratory, with different laboratory information systems; Wake Forest uses mTilda (CareDx) and Atrium Health uses HistoTrac (Thermo-Fisher). Each EHR Instance, at Wake called Wake One and at Atrium called Encompass needed harmonization, as well as each laboratory's LIS ordering and resulting processes. This abstract covers the Wake Forest HLA experience.

Methods: The first step was to do a comprehensive review of the labs billing codes and test names. Through several meetings we aligned our tests that were similar, and those that were unique to each lab. The process needed clarification since each center labs performed HLA typing's for various clinics at various resolutions. Each center also has a different combination of solid organ and hematopoietic transplant programs. After aligning our tests, we then worked with the Epic and mTilda teams to build out the tests in Epic and what we wanted to flow from mTilda into EPIC for results. This involved defining the tests use, what elements would need to be chosen when the provider was ordering the test, and what the result elements would look like flowing back into Encompass. Once the testing names and codes were harmonized with the various Current Procedural Terminology (CPT) codes; hospital billing codes, formerly independent at each institution, were then harmonized with the billing system codes for processing through the EHR system. For testing purposes, we made fake patients in our test EHR and mTilda databases. We then ordered the appropriate tests, received them into mTilda, resulted them and sent them back to the EHR.

Results: The biggest change in the Wake LIS/EHR harmonization was to revamp the PRA ordering and resulting processes. At Wake, tests that had previously been ordered in mTilda by laboratory staff based on paper requisitions were changed to being ordered in the hospital EHR by providers and results sent back to that system. This also involved designing a new workflow for laboratory staff, including the lab assistants entering the test order into mTilda from Epic all the way to the financial secretary sending the billing system the invoices for each patient's test.

Conclusion: Although abbreviated in this abstract, the entire process took more than two years, with periodic adjustments still happening. All phases of patient testing, from provider ordering to test resulting then billing had to deal with a significant learning curve with how to order the new tests and what the results would look like when sent back.

INTRODUCTION:

Merger of medical systems come with costs that are not reflected in a mere ledger. At the Wake Forest HLA laboratory, the task of merging LIS and EHR patient records and physician ordering systems within the combined entity's HER system became an odyssey that required a significant amount of time, over the course of a two years, from a senior laboratory technologist, the senior laboratory assistant, and the administrative assistant. Occasional time also was required of the laboratory's manger and director. Time was also required of the billing and laboratory staff at Atrium.

METHODS & RESULTS:

Initially, a listing of the tests performed by the Wake Forest laboratory was drawn up and compared to a similar list from the Atrium laboratory (Table 1). This was necessary because each center labs performed HLA typing's for various clinics at various resolutions. Each center also has a different combination of solid organ and hematopoietic transplant programs.

WF Test Name	Test order	Atrium Test Name	Test Order	Match?
HLA A29, B27, B51 Genotyping	LAB6085	HLA B27	LAB6064	Match
HLA Allo Crossmatch (T and B-cell Combined)	LAB3830	HLA Crossmatch	LAB6070	Needs Review
HLA APOL1 Phenotyping	LAB6016	N/A	N/A	Unique to WF
HLA Auto Crossmatch (T and B-cell Combined)	LAB3829	HLA Crossmatch	LAB6070	Needs Review
HLA B27 Genotyping	LAB6083	HLA B27	LAB6064	Match
HLA Celiac Testing, DR/DQ Low Resolution	LAB6011	HLA Class II Low Resolution (DR,DQ)	LAB6074	Needs Review
HLA Chimerism - Post-transplantation (WFBH)	LAB6062	N/A	N/A	Unique to WF
HLA Chimerism - Post-transplantation BLOOD (WFBH)	LAB6042	N/A	N/A	Unique to WF
HLA Chimerism - Pre-transplantation (WFBH)	LAB6061	N/A	N/A	Unique to WF
HLA Chimerism - Pre-transplantation BLOOD (WFBH)	LAB6041	N/A	N/A	Unique to WF
HLA Class I and Class II PRA & ID- BMT	LAB3833	HLA Class I Antibody Screen	LAB6076	Needs Review
HLA Class I and Class II Single Antigen	LAB6015	HLA Class I Single Antigen Antibody Identification	LAB6078	Needs Review
HLA Class I Disease Association (removed test)	LAB6010	HLA Class I Antibody Screen	LAB6076	Needs Review
HLA Class I Single Antigen	LAB6014	HLA Class I Single Antigen Antibody Identification	LAB6078	Match
HLA Deceased Donor Typing A, B, C, DR, DQA, DQB, DPA, DPB	LAB3821	Deceased Donor HLA Typing	LAB6071	Match
HLA High Res A,B,C,DRB1,DQB1,DPB1 (NGS)	LAB6115	High Resolution HLA Typing by NGS	LAB6123	Needs Review
HLA High Resolution A, B, C (NGS1)	LAB6112	High Resolution HLA Typing by NGS	LAB6123	Needs Review
HLA High Resolution DRB1, DQA1, DQB1, DPA1, DPB1 (NGS2)	LAB6113	High Resolution HLA Typing by NGS	LAB6123	Needs Review
HLA Living Donor Nephrectomy	LAB6174	N/A	N/A	Unique to WF
HLA Platelet Transfusion Testing (CL1 ID and RT ABC)	LAB6346	N/A	N/A	Unique to WF
HLA Post tx DSA PRA LUMSC1, LUMSC2= SA1/2	LAB6087	N/A	N/A	Unique to WF
HLA Pre tx PRA LUMSC1, LUMSC2	LAB6086	N/A	N/A	Unique to WF
HLA Verification ABCDR Low Resolution	LAB6013	HLA Complete Low-Resolution (A,B,C,DR,DQ)	LAB6072	Needs Review

Table 1: Comparison of Wake Forest laboratory orders (1st column) with the Atrium laboratory's orders (2nd column). The third column described how much of a match the same test orders were at Wake vs Atrium and whether a test was unique to one lab or the other.

After aligning our tests, we then worked with the Epic and MTilda teams to build out the tests in Epic and what we wanted to flow from MTilda into Epic for results (Figure 1).

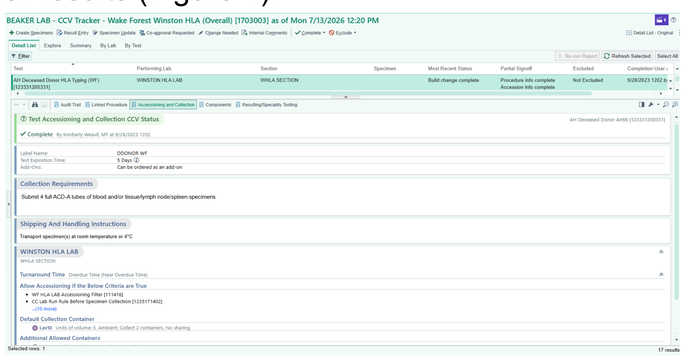


Figure 1: Beaker module page of the data from a fictional deceased donor transferred from mTilda to EPIC.

This involved defining the tests use, what elements would need to be chosen when the provider was ordering the test, and what the result elements would look like flowing back into Encompass. After the initial transition and ensuring the test flowed as expected, we worked withAtrium Charlotte to further refine shared tests (e.g. BMT, PRA, etc.)

Billing also changed with this process. Previously, we had billed several tests separately from Wake One. We would now need to put them into Encompass for billing. We then had to build new test types which required us to manually enter the patients or anonymous donors into Encompass before ordering the tests. A combined billing table was tested through both laboratories' instances of Encompass from each lab's LIS (Table 2).

Lab Code	Test	Restricted/Not	Sample Number	Worked As Expected	Format Right
LAB8767	DD Confirmatory	Yes	25WHLA-098H0012	yes	yes
LAb8840	BMD Typing	Yes	25WHLA-098H0013	yes	yes
LAB6071	DD LifeShare	Yes	25WHLA-098H0014	yes	Yes
LAB7341	Auto	Yes	25WHLA-098H0005	yes	Yes
LAB7477	Allo	Yes	25WHLA-098H0009	Yes	Yes
LAB7339	Verification	Yes	25WHLA-098H0011	yes	yes
LAB7516	SA1	Yes		yes	yes
LAB7517	SA2	Yes		yes	yes
LAB6211	PRE TX PRA	Yes	25WHLA-098H0004	yes	yes
LAB6081	PTX PRA	Yes	25WHLA-098H0006	yes	yes
LAB6123	NGS	Yes	25WHLA-098H0003	Yes	yes
LAB7338	PLT	No		yes	yes
LAB7340	PLT PRA	No	25WHLA-098H0010	yes	yes
LAB7342	APOL1	No		yes	yes
LAB7344	ABC	No	25WHLA-098H0007	yes	yes
LAB7345	DR/DQ	No	25WHLA-098H0008	yes	yes

Table 2: New billing codes shared by both laboratories and successfully tested through combine instances of EPIC.

DISCUSSION:

This entire process took more than two years, with periodic adjustments still happening. All phases of patient testing, from provider ordering to test resulting then billing had to deal with a significant learning curve with how to order the new tests and what the results would look like when sent back. This will continue to be an ongoing process as we add new test types, technology changes, and providers needs change. Every update to either mTilda or EPIC will require testing to ensure none of the features present change, and the builds function as expected.

One of the biggest changes in the Wake LIS/EHR harmonization was revamping the PRA ordering and resulting processes. After the harmonization, each sample had to be created for the patient and the test ordered in Encompass. Paper requisitions had to be scanned into Encompass for billing purposes. This involved creating an entirely new workflow.

A relatively shocking discovery about halfway through this process was that discrete data was being released to patients that was not authorized for release. We then had to redesign information flow to not allow for potential HIPAA violations of donor information to flow to patients' charts. This involved training all techs that on the use of EPIC for logging in samples.