“No... we can’t do that”

How to navigate informatics challenges in a private practice setting

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DISCLOSURE

In the past 12 months, I have had a significant financial interest or other relationship with the manufacturer(s) of the following product(s) or provider(s) of the following service(s) that will be discussed in my presentation.

Google (financial)

Hematogones.com (principal developer)
Goals for this discussion

Describe my practice and what “informatics” means in the private practice environment

Describe options for customized solutions

Pros and cons of going it alone

Important considerations after implementation
About my practice

Largest pathology private practice in Central Texas

Service hospitals from Austin to San Antonio

Service a large reference laboratory

Provide all pediatric pathology and neuropathology services in Austin

Provide medical directorship across all service lines

Provide medical student and resident teaching

Provide general consultative service for community physicians pertaining to selection of esoteric testing
About my practice
The landscape of pathology in our Austin market

**Ascension Texas**
- Pathology LIS: Cerner CoPathPlus
- EMR: PowerChart
- Primary Work Type: Hospital based - Surgical pathology, Clinical testing
- Special Services: Neuropathology, Pediatric pathology, Flow cytometry, Esoteric clinical testing

**HCA Texas**
- Pathology LIS: MediTech
- EMR: MediTech
- Primary Work Type: Hospital based - Surgical pathology, Clinical testing
- Special Services: Gyn-Onc surgical pathology, perinatal services

**SHUSA**
- Pathology LIS: LabIS
- EMR: Mysis
- Primary Work Type: Outpatient, Reference clinical laboratory testing
- Special Services: High-volume OP surgical pathology, Flow cytometry, SPEP, HB-electrophoresis
Example of histology workflow among major work spaces

Surgical pathology processed at site, sent to central lab for histology

Surgical pathology processed at site, sent to Sonic for histology

Outpatient pathology processed and histology performed at central lab

Referral testing:
Main logistical obstacles we face

Geographic distribution and unequal support resources

Need to optimize reporting uniformity

Collecting QA metrics across practice

Balancing pathologist workload
What are the options for a private practice to address these challenges?
1. Engage hospital IS to develop needed solutions
2. Hire a developer to create customized system
3. Develop a custom solution using available applications on your own
Examples of solutions implemented in our practice
To play with some of the solutions I will be discussing, please visit:

hematogones.com/play/api
Task

Uniform pathology reports
The Task: Uniform pathology reports

Why?
Client/Patient satisfaction and billing errors are related to uniformity of reporting. Ex: bone marrow biopsies, breast biopsies, Sjogren Focus score

How?
Could use various templates built into CoPath with some additive modules to allow for point-and-click modifiers

We can’t do that!
LIS team in charge of Path LIS can only build static templates, which take a lot of time. No drop-in templates available within Meditech.
Our Solution: Uniform pathology reports

Develop a suite of pathology reporting web apps using HTML/Javascript

Reports are generated as plain text to decrease formatting issues across different Pathology IS

Include logical text parsing and calculations when needed, to aid in report optimization
Histomorphometry

- Number of lobules in biopsy
- Number of atrophic lobules

- Adequate sampling of minor salivary glands
- Suboptimal sample due to small size
- Mostly atrophic lobular changes
- No salivary gland acini present - just fat
- No salivary gland acini present - lymph node

Acinar Histologic Findings

- Normal lobules: description (none with atrophy)
- Mostly normal lobules; few with atrophy
Hematogones.com

Started life in 2012 as a quick and dirty cell counter substitute and evolved as way to migrate MS-Word canned text templates online

Free web apps that predominantly rely on client side scripting. Client side represents work entirely done within the users’ browser environment

Added server side component in 2017 to give registered users more control of their user experience and content
Hematogones.com - The power of javascript

**Popular**

Often touted as the most popular programming language, it is easily accessible to all comers and has a massive community to support it.

**Versatile**

Because of its popularity, there are extensions to the language that are ideal for text and numeric manipulation.
Hematogones.com - The power of javascript

**Javascript** Started life inspired by Java, but is a completely different language that was developed as a scripting language companion to the early web

**Client side** All modern browsers inherently “understand” and compile the javascript language natively within their application. This means everyone can write and execute scripts locally, even when the browser is offline.
Q.

How to deliver a solution to users across different reporting systems and levels of user sophistication?
Leverage a tool that can work anywhere!

Copy and Paste

For example....

Improving information delivered in peripheral blood smears
All pathologists participate in reviewing and reporting peripheral blood smears.

The comfort level among pathologists and uniformity of these reports vary widely within our group.

Pathologists in our group which use the peripheral blood smear app tend to improve the utility of the report and their comfort with integrating CBC data.
Hematogones.com - Scripting within the app
Hematogones.com - App structure

App structure - User Form, App specific script, Text database (all client side)

Browser & UX

Static text data stored in JSON format

Client side JavaScript with listeners for user interactions
Hematogones.com - Wide adoption

1. United States 1,103 (82.81%)
2. India 129 (9.35%)
3. Philippines 112 (8.38%)
4. Canada 65 (4.70%)
5. Saudi Arabia 45 (3.33%)
6. United Kingdom 41 (3.03%)
7. Azerbaijan 28 (2.06%)
8. Australia 25 (1.84%)
9. Brazil 17 (1.26%)
10. Kenya 15 (1.11%)
Task

Uniform pathology reports aided through customized web based tool
Web based solution for uniform pathology reports

Web based solution

- Fully customizable to one’s own practice preferences
- Deploy instantaneously, edit on the fly and debug quickly
- Relies only on browser and copy/paste action
Drawbacks to this system

- **Adoption!**
  - Copy/Paste step is a high inertial barrier

- **Maintenance**
  - Requires familiarity with HTML/javascript or an external dev to address bugs and add features

- **Security**
  - Browser based systems have default restrictions in accessing local environment
Web based solution for uniform pathology reports

Cost

$0* All coding and maintenance is done by a pathologist

$25-$50/hr Range in cost to hire an external developer

~15-150 hrs Estimate in upfront development of a single app
Examples of solutions implemented in our practice
Task

Paperless flow cytometry lab
The Task: Paperless Flow Cytometry

Why?
Hemepaths located across 5 different practice locations. Waiting for courier to carry printed dot plots is inefficient and causes delays

How?
Publish dot-plots online, allow docs to pull cases from secure website and docs can drop flow findings into report

We can’t do that!
Hospital IS will not develop secure website to access saved dot plots by pathologists. Too much resource allocation, too much cost.
Our Solution: Paperless Flow Cytometry

Leverage Adobe PDF capabilities

Enhance PDF flow analysis with AdobeJS scripting

Store files using consistent file naming schema

Route files via secure e-mail for delivery and return
AdobeJS - Adobe’s scripting language roughly based on JavaScript 1.5

One of the easiest and most powerful ways to customize PDF files is by using JavaScript. Based on JavaScript
languages easily integrate Acrobat with Web services using Simple Object Access Protocol (SOAP).

AdobeJS ≠ Javascript
Paperless flow cytometry distribution and storage

Flow is run and data is merged with a customized flow cytometry pdf worksheet for each case.

File is saved using a consistent naming schema: Lastname_F_MRN_SpcCategory_Site.

Deployed to pathologists via hospital secure e-mail.

Returned to archive via secure e-mail.

Network shared drive for data archives.
Flow cytometry worksheet pdf

Scripting is baked into the pdf document

This includes:
- Canned diagnostic templates
- Automatically count antibodies
- Automatically describe CPT codes
- Pull relevant #s into final diagnosis
- Create narrative for drop into report
- Automatically add any disclaimers
- One click return to flow lab via email
Worksheet scripting - Canned flow narrative text
Worksheet scripting - Antibody count & CPT codes

<table>
<thead>
<tr>
<th>CD19+ blasts</th>
<th>CD2+ blasts</th>
<th>CD1a/CD10+</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Antibodies used:</th>
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<tbody>
<tr>
<td>7AAD</td>
</tr>
<tr>
<td>BCELL-POLY</td>
</tr>
<tr>
<td>BLYMPH</td>
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<tr>
<td>TCELL</td>
</tr>
</tbody>
</table>

Other populations

Describe phenotype **%**

CPT codes: 88184 x 1, 88185 x 0, 88187 x 1

TOTAL ABS 1
Worksheet scripting - Auto-formatted for LIS drop

**FLOW CYTOMETRY NUMERIC DATA**

<table>
<thead>
<tr>
<th>Patient Name:orest</th>
<th>DOB: 1/1/2017</th>
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<tbody>
<tr>
<td>Date Received: 3/09/19</td>
<td></td>
</tr>
<tr>
<td>Date Run: 3/09/19</td>
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<tr>
<td>Tech: KT</td>
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<tr>
<td>Accession#: D819-1234</td>
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<tr>
<td>MR#: 12321</td>
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**FLOW CYTOMETRY DIFFERENTIAL**

<table>
<thead>
<tr>
<th>Item</th>
<th>%</th>
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<tbody>
<tr>
<td>Viability</td>
<td>98</td>
</tr>
<tr>
<td>Lymphs</td>
<td>4.3</td>
</tr>
<tr>
<td>Monos</td>
<td>4.4</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>66.4</td>
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<tr>
<td>Blasts</td>
<td>2.1</td>
</tr>
<tr>
<td>CD45Neg/Eryth</td>
<td>5.5</td>
</tr>
<tr>
<td>Abnormal cells</td>
<td>2.0</td>
</tr>
<tr>
<td>Basophils</td>
<td>2.0</td>
</tr>
<tr>
<td>Non-heme</td>
<td>2.0</td>
</tr>
</tbody>
</table>

**Tech Comment**
- Do not transcribe; for communication to pathologist only

**Tech Comment only - Do not transcribe**

**Final Diagnosis**
- To be entered in ‘Results’ or ‘Final Diagnosis’ section of flow report
- Marrow - normal
  - No increase in CD34+ myeloid blasts, 1.7%
  - Mixed lymphocytes without monoclonal B-cells or aberrant T-cell antigen expression

**Phenotypic description (type, copy/paste, or select from dropdown)**

Flow cytometry was performed on the bone marrow to characterize blasts. Gating on blasts (mod CD45+/low SSC) demonstrates few CD34+ events that represent 1.7% of total CD45+ events. These events express the myeloid markers CD117 and CD13, consistent with maturing myeloid progenitors. Some events in this region express CD19 and CD10 and show scatter properties consistent with hematogones. Most analyzed events are maturing granulocytes which show high side-scatter and no aberrancies of analyzed antigens.

The monocytelarge lymphocyte gate (CD45+, moderate SSC/FSC) shows predominantly CD33 bright cells consistent with monocytes. Monocytes do not show...
Task

Paperless flow cytometry lab
Paperless flow cytometry system

Perceived advantages

- Report uniformity
- Standardized appearance of flow interpretations across hospitals
- Reduced erroneous documentation of antibodies and flow cytometry CPT codes
- Reduces turnaround time of cases, improves ordering of IHCs for concurrent surgical specimens
- New pathologists are able to learn and use the system quickly in any LIS
Perceived advantages

Stability: System in place for 8 years without failure

Accessibility: No special software needed on the recipient end as free Adobe reader will suffice

Mobility: Flow accessible anywhere one can access their secure E-mail

Archiving: Easy return of final report ensures high fidelity of our historical archives (both initial analysis and final interpretations)
Paperless flow cytometry system

Drawbacks to this system

Deep understanding of the system architecture is limited to one pathologist

Perpetuation of canned text errors when panel composition is changes (requires careful canned text scrubbing to remove discrepancies)

Limited data validation with current scripting*
Paperless flow cytometry system

Cost

$300 Adobe Acrobat Pro version (per computer)

$45 AdobeJS freelance developer hired to add some of the advanced features

System resources

Secure networked drive to store raw dot-plots, initial analyzed packet and returned packet

Access to network e-mail (or alternative secure email system) is necessary for secure communications
Task

Data collection for daily slide QA activities
Task: Collecting daily slide quality QA reports

Why?
Daily QA activities for slide quality and cytology screening time were not being collected in a consistent and appropriate manner.

How?
QA activities for surgical and cytology slide quality should be recorded in the pathology IS system

We can’t do that!
CoPath: Nobody is trained to develop this in the IS. Bad UX and poor adoption for other currently used modules
MediTech: Don’t even ask
Our Solution: Daily slide QA activities via Gsuite

1. Form
2. Sheet
3. Apps Script
4. Reply
DAILY REMINDER EMAIL TO PATHOLOGISTS

RESPONSES FROM ALL SITES TO DATABASE

DATABASE ENTRIES ARE FILTERED AND COPIED BY CLIA# 

EACH CLIA# DATA IS FILTERED BY MONTH 

MONTHLY CLIA# DATA IS SUMMARIZED AND 
AUTOMATICALLY EMAILED TO CLIA HOLDER FOR REVIEW 
AND FILING
MONTHLY SUMMARY DATA

Surgical and cytology stain quality log - Monthly summary report
February

<table>
<thead>
<tr>
<th>Date</th>
<th>Lab Name</th>
<th>Lot No.</th>
<th>Stain</th>
<th>Lot Quality</th>
<th>Gross Quality</th>
<th>Gross Saving</th>
<th>Stain Saving</th>
<th>Gross Tagged</th>
<th>Stain Tagged</th>
<th>Gross Scan</th>
<th>Stain Scan</th>
<th>Recommended Phenotyping</th>
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<tr>
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<td>123</td>
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<td>No</td>
<td>Poor</td>
<td>No</td>
<td>456</td>
<td>No</td>
<td>456</td>
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<td>456</td>
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<td>23/02/2023</td>
<td>Lab C</td>
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<td>Yes</td>
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<td>789</td>
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<tr>
<td>24/02/2023</td>
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<td>Yes</td>
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<td>Yes</td>
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</table>

CPA DCMC CLIA #252052154

Reviewed by: ________________________________
Date: ________________________________

CPA DCMC CLIA #252052154

Reviewed by: ________________________________
Date: ________________________________

PATHOLOGISTS RECEIVE MONTHLY SUMMARY AUTOMATICALLY
Google apps scripting

1. DAILY REMINDER EMAIL SENDS FORM

1. DATA IS AGGREGATED IN GOOGLE SHEET

1. SORT EACH CLIA SITE’S DATA

1. EMAIL MONTHLY SUMMARY
Google apps scripting - Scheduled tasks
A word about Gsuite and HIPAA compliance

Gsuite can be deployed in a HIPAA compliant manner, but is not by default

Enabling Gsuite HIPAA compliance:

- Sign the Google HIPAA-compliant business associate agreement (BAA)
- Activate appropriate security (2FA)
- Limit access to Email, Drive and App scripts to allowed user groups
Examples of solutions implemented in our practice
Data collection for daily slide QA activities
Collecting daily slide quality QA reports

Perceived advantages

   Paperless system with reminders and automatic site data allocation

   Easily distribute updates and changes throughout and between different hospital systems

   Data is electronically compiled and easy to prepare ahead of inspections
Collecting daily slide quality QA reports

Costs

$0* Can use free Google services to do this

$50/user/yr G-suite account (only one is needed) if you want customer support directly from Google, or if you are storing sensitive data that falls under HIPAA protection
Other examples of solutions implemented in our practice
Shared images for tumor board

Sharing cases remotely for cancer checks

Workload balancing

G Suite

Skype

Praxent

Distributor Workflow