Strategies and Tools to Inform Cancer Diagnosis
The Continuum of Care and Services

- Education
- Prevention
- Screening
- Diagnostics
- Treatment
- Survivorship
- Palliative Care
- Early Detection Care
Matching Tools for Impact with Cancers

Diseases amenable to risk reduction
- Tobacco related – lung, head and neck, bladder
- HPV – cervical, head and neck
- Hepatitis, alcohol - hepatocellular

Diseases curable with early detection and treatment including surgery
- Breast cancer
- Cervical cancer

Diseases curable with affordable chemotherapy
- Non-Hodgkin’s Lymphoma (Burkitt’s/Large cell), Hodgkin’s Lymphoma, Testicular cancer,
  Sarcoma in children, Acute Lymphoblastic Leukemia in children

Diseases palliated with systemic treatment
- Chronic Myelogenous Leukemia
- Kaposi’s sarcoma
The “Standard” Process of Cancer Diagnosis

- Repeat Biopsy
- Special Stains
  - IHC
  - Molecular
- Biopsy
- Results
- Internist
- Oncologist
- Surgeon
- Pathologist
- Cytologist
- Surgery
  - Dermatology
  - GI
  - GYN
- Inadequate
- Insufficient
- Correlation
- Clinical
- Stage
- Excision
Repeat Biopsy

Surgery
Dermatology
GI  GYN

Biopsy

Pathologist
Cytologist

Inadequate
Insufficient Correlation

?
The Cogs of the Wheel

Surgeons without pathologists can not:
Predict recurrence
Plan additional surgery
Inform patient of results

Pathologists without clinicians:
Are not held to turn around time
Are reporting results to the air
Do not contribute to outcomes

Delays in diagnosis:
Invalidate results (good or bad)
Cause apathy among surgeons and clinicians
Decrease the quality of care for all patients

Without an intact system, healthcare is inferior and non-functional
Number of People Per Pathologist:
UK*: 15,108
US**: 19,232

*Royal College of Pathologists, 2012,
**Anatomic and Clinical Pathologists, AAMC, 2007
CASE STUDY
Large abdominal wall mass...What do you do?

Biopsy?
Large lesion... non-diagnostic?
Have to do additional surgery?
Benign or malignant?
Patient's desires?

Resection?
Large lesion... repair of wall?
Definitive diagnosis
Patient's desires?
Final Anatomical Diagnosis

Monophasic Synovial Sarcoma (malignant)
IHC* + for TLE-1 and EMA, - for keratin/CD34

Margins of resection are clear

Had adjuvant radiotherapy due to location

Patient disease free at 2 years with minimal abdominal wall scar

Important Features for a Successful Outcome in This Case…
Clinical photographs
Wide resection margins
Gross photo of tumor
Tissue placed in appropriate amount of formalin
Wide sampling of tumor
Access to immunohistochemistry
Site Assessment is the key to deploying the right tools

Site has…
   Nothing

Site has…
   Pathologist(s) but no lab

Site has…
   Lab but no pathologist(s)

Site has…
   Lab, pathologist but understaffed

Site has…
   Lab, sufficient staff, but not meeting standard of care

Site has…
   Lab, sufficient staff, and meets standard of care

Note:
1. “Site” could be any geographical area
2. Presence/absence of Oncologist/Surgeons
<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Clinical History</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>F</td>
<td>Abdominal girth increase</td>
<td>Wilm’s tumor</td>
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<tr>
<td>10</td>
<td>F</td>
<td>Eye tumor</td>
<td>High grade sarcoma</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>9 mo h/o neck mass</td>
<td>EBV and poorly differentiated carcinoma</td>
</tr>
<tr>
<td>12</td>
<td>F</td>
<td>Massive adenopathy, fevers, and fatigue</td>
<td>Precursor T lymphoblastic leukemia</td>
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<tr>
<td>15</td>
<td>F</td>
<td>Neck mass, h/o head, and neck cancer</td>
<td>Nondiagnostic (blood)</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
<td>Anterior thigh mass</td>
<td>Malignant lymphoma (unusual Hodgkin)</td>
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<tr>
<td>20</td>
<td>F</td>
<td>2 y h/o rash on face, trunk, skin biopsy</td>
<td>Non-specific inflammatory, organisms not detected</td>
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<tr>
<td>24</td>
<td>F</td>
<td>Multiple lip lesions</td>
<td>Condylomata</td>
</tr>
<tr>
<td>24</td>
<td>F</td>
<td>Eye protrusions × 3 y</td>
<td>Rosai-Dorfman disease</td>
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<tr>
<td>26</td>
<td>F</td>
<td>HIV –, rapid lymphadenopathy</td>
<td>T cell lymphoma</td>
</tr>
<tr>
<td>27</td>
<td>F</td>
<td>HIV+, CD4: 56, protosis, multiple skin nodules</td>
<td>Diffuse large B cell</td>
</tr>
<tr>
<td>28</td>
<td>F</td>
<td>Lymphadenopathy, HIV+, CD4: 520</td>
<td>Caseating granuloma, organisms not detected</td>
</tr>
<tr>
<td>30</td>
<td>F</td>
<td>Neck mass</td>
<td>Nondiagnostic (blood)</td>
</tr>
<tr>
<td>33</td>
<td>F</td>
<td>Fatigue, WBC &gt; 100,000</td>
<td>BCR-ABL translocation detected</td>
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<tr>
<td>35</td>
<td>F</td>
<td>Albino w/5 cm facial mass</td>
<td>Squamous cell carcinoma</td>
</tr>
<tr>
<td>35</td>
<td>F</td>
<td>Soft tissue mass on nose × 8 y</td>
<td>Pleomorphic adenoma</td>
</tr>
<tr>
<td>40</td>
<td>F</td>
<td>8 y h/o facial mass</td>
<td>Rosai-Dorfman disease</td>
</tr>
<tr>
<td>40</td>
<td>F</td>
<td>6 mo h/o palpable breast mass</td>
<td>Non-specific involutional changes and inflammation</td>
</tr>
<tr>
<td>40</td>
<td>F</td>
<td>Lymphadenopathy, HIV+, AIDS</td>
<td>Necrotizing granuloma, acid fast bacilli present</td>
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<tr>
<td>43</td>
<td>F</td>
<td>Chronic myelogenous leukemia</td>
<td>9q34 ABL rearrangement c/w CML</td>
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<tr>
<td>48</td>
<td>F</td>
<td>Exophytic breast mass</td>
<td>Benign breast tissue</td>
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<tr>
<td>70</td>
<td>F</td>
<td>2 y h/o right leg mass</td>
<td>Porocarcinoma</td>
</tr>
<tr>
<td>73</td>
<td>F</td>
<td>Lymphadenopathy, fever, weight loss, night sweats</td>
<td>Necrotizing granuloma, acid fast bacilli present</td>
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<tr>
<td>73</td>
<td>F</td>
<td>6 mo h/o toe mass</td>
<td>Non-specific inflammatory, did not correlate with “mass”</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>Cervical adenopathy, fatigue, and fevers</td>
<td>Precursor B-cell acute lymphoblastic lymphoma</td>
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<tr>
<td>8</td>
<td>M</td>
<td>HIV+, 6 mo h/o neck mass</td>
<td>Atypical Burkitt lymphoma</td>
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<tr>
<td>16</td>
<td>M</td>
<td>4 mo h/o ocular pain, headache, adenopathy, and vision loss</td>
<td>Nasopharyngeal carcinoma</td>
</tr>
<tr>
<td>18</td>
<td>M</td>
<td>1 y h/o lesions on leg</td>
<td>Non-specific inflammatory, organisms not detected</td>
</tr>
<tr>
<td>21</td>
<td>M</td>
<td>5 mo h/o thigh mass</td>
<td>Malignant peripheral nerve sheath tumor</td>
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<tr>
<td>24</td>
<td>M</td>
<td>HIV+, with plaques on lower extremities</td>
<td>Kaposi sarcoma</td>
</tr>
<tr>
<td>28</td>
<td>M</td>
<td>Soft tissue lesion</td>
<td>Squamous cell carcinoma</td>
</tr>
<tr>
<td>29</td>
<td>M</td>
<td>1 y h/o lymphadenopathy</td>
<td>Metastatic undifferentiated carcinoma</td>
</tr>
<tr>
<td>36</td>
<td>M</td>
<td>HIV+, skin lesions</td>
<td>Kaposi sarcoma</td>
</tr>
<tr>
<td>41</td>
<td>M</td>
<td>Albinism and HIV+, with posterior neck lesion</td>
<td>Invasive squamous cell carcinoma</td>
</tr>
<tr>
<td>45</td>
<td>M</td>
<td>2 mo h/o enlarging gingival lesion, neck mass</td>
<td>Squamous cell carcinoma</td>
</tr>
<tr>
<td>47</td>
<td>M</td>
<td>2 y h/o leg mass</td>
<td>Chromoblastomycosis</td>
</tr>
<tr>
<td>51</td>
<td>M</td>
<td>Fatigue</td>
<td>BCR-ABL translocation detected</td>
</tr>
<tr>
<td>64</td>
<td>M</td>
<td>Pleural effusion</td>
<td>Suspicious cells present</td>
</tr>
<tr>
<td>65</td>
<td>M</td>
<td>HIV+, on HAART with skin lesion</td>
<td>Kaposi sarcoma</td>
</tr>
<tr>
<td>68</td>
<td>M</td>
<td>14 mo h/o palate lesion</td>
<td>Actinomyces</td>
</tr>
<tr>
<td>9</td>
<td>U</td>
<td>Abdominal mass</td>
<td>Wilm’s tumor</td>
</tr>
</tbody>
</table>
**Entity Partnerships**

**Example: Partners in Health -> DFCI/BWH**

Multiple sites with limited access to pathology

Clinicians/surgeons biopsy (by discretion)
Paid field workers of PIH

Pathologists review and report cases
Pro bono and absorb costs of processing

Clinical Oncologists provide therapy (as needed)
Pro bono and donate therapeutics
Entity Partnerships

**PROS**
- Access to highest quality care
- Cutting edge diagnostic
- Serial follow up
- Continuity of information

**CONS**
- Sustainability
- Volunteer fatigue
- Under utilization
- Capacity building?

**COSTS:** $$$$$$
Success in Entity Partnership

Requirements

Country commitment

Functioning, self-sustaining laboratory

Permanent, highly skilled pathologist(s)

Pathways to success

Data on outcome improvement, cancer statistics, morbidity/mortality

QA/QI, compliance, inspection

External/internal training with restrictions
Individual Volunteers

Volunteers travel to foreign site

2 weeks to 6 weeks

Requires vacation time or departmental leave

Airfare, miscellaneous costs by volunteer

-Tax deductible?

Foreign site provides workspace, caseload, administrative support

Requires working laboratory with technicians and supplies to produce slides
Individual Volunteers - Malawi

Personal Experience

Visiting Malawi for 16 years

Two functioning pathologist
One is head of department, does all teaching of pathology in the medical school vice-principal of the college of medicine, runs the national cancer registry, etc…

Two is listed as 10% clinical service

Arrive January 3
Cases are from August

Depart January 24
Last case signed out is from January
Individual Volunteers - Malawi

Current Plan

Visiting Malawi for 16 years

Five to Seven permanent pathologists after 5 years
Two recruited/in training, Four additional being recruited (funded)

Volunteers from US/Europe/Canada welcome for the next 4 to 5 years (began in 2011)

Continuous coverage = improved turn around time

Continuous results = “retraining” of non-pathologist physicians

Restructuring flow of specimens with redistribution
Individual Volunteers

**PROS**
- Access to highest quality care
- Improved turn around time
  - With continuous volunteers
- Increased volume
- Needs assessment
- Teaching resources

**CONS**
- Sustainability
  - Bridge to ?
- Capacity building
  - Trainees ?
  - Physical Resources ?
Success in Individual Volunteers

Requirements:
- Financial support
  - Local plan for permanent pathologists to be placed

Pathways to success:
- Fundraising
  - Local pathologists empowered to trained new pathologists through sponsored programs (MEPI/Afrohealth)

Costs: $$$$$
What can we provide?

Accurate timely anatomic diagnoses for a range of surgical and oncological patients as part of staging, definitive treatment, or follow-through medical treatment

Work up and results are guided by endpoint resources

What can we gain?

Access to a wide range of exotic and challenging diagnostic material at home and abroad

Improvement in our own diagnostics processes
376 Hemepath PIH Cases Received at BWH (~2007-present)
Diagnostic Panel for PIH Hemepath Cases and Confirmatory Study

Available therapies

- Hodgkin lymphoma: ABVD
- Non-Hodgkin lymphoma: CHOP
- Burkitt lymphoma: COMP/COP
- ALL: combination regimen
- CLL: Chlorambucil oral or COP
- CML: Gleevec (**ONLY if confirmed BCR-ABL***)
- Myeloma: in process
- AML: only palliative steroids/hydroxyurea
- MDS: no therapy
- Aplastic anemia: no therapy

If morphology suboptimal, also consider small NHL ddx
Leapfrog Histopathology / Telepathology Process
Locations

1. Haiti
2. Mali
3. Liberia
4. Ivory Coast
5. Ghana
6. Ethiopia
7. Kenya
8. Uganda
9. Rwanda
10. Tanzania
11. Congo
12. Zambia
13. Malawi
14. Mozambique
15. Swaziland
16. Lesotho
17. South Africa
18. Botswana
Care & Treatment
Location Education & Training
Lessons Learned

Country Readiness Assessment

Collaboration with Ministries

Expand Partners Network

Funding
Our Partners

[Logos of various partners including NIH, National Cancer Institute, CDC, and others]
Thank You!