In the United States, it is estimated that $5 billion, approximately 30% of all annual clinical laboratory testing, is attributed to inappropriate test utilization. In addition to the financial ramifications, inappropriate laboratory testing has been identified as a primary contributor to diagnostic error as well as imposing a significant workflow burden upon clinical laboratories performing the testing.

Inappropriate laboratory test utilization encompasses four primary criteria:
1. A test is ordered when it is not necessary.
2. A test should be ordered, but it is not.
3. A test is ordered, but it is the wrong test.
4. A test is ordered at the wrong time making test results inaccurate.

Several approaches, including Diagnostic Management Teams, physician education and feedback programs, and electronic health record (EHR) alerts, have been studied at other facilities to promote appropriate test utilization. Diagnostic Management Teams are interdisciplinary pathology-led diagnostic teams that develop patient-specific testing algorithms to ensure appropriate testing and reduce time-to-diagnosis. Physician feedback includes providing each service and physician with comparisons and individual rankings among peers for their ordering practices. Electronic medical record alerts include both hard and soft stops plus information to direct physicians to order appropriate tests.

This project was undertaken to identify the types of inappropriate laboratory test utilization that are occurring and quantify the extend of inappropriateness so that appropriate solutions for addressing the issues could be created.

### METHODS

A literature review was performed to identify tests other facilities reported as inappropriate laboratory test utilization. A total of 23 published articles on test utilization were reviewed, 6 were utilized, and a list of targeted tests was created. The targeted tests included:

- Antinuclear Antibody (ANA)
- Factor V Leiden mutation
- Factor V Leiden
- Hemoglobin A1c (HgbA1c)
- Lupus Anticoagulant
- Protein C Activity
- Prothrombin G20210A mutation

Lists of 90 days of patient tests results for each test except HgbA1c was generated from EHR interfaced hc1.com utilization software. Only 30 days of patient test results were generated for HgbA1c. Each test result order was then reviewed in the EHR for appropriateness based on the four criteria listed above and current practice guidelines. Percentages of inappropriate test utilization were determined for each test.

### RESULTS

<table>
<thead>
<tr>
<th>Test Name, n = total ordered</th>
<th>n (%)</th>
<th>Reason Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor V Level, n = 82</td>
<td>53 (65%)</td>
<td>Wrong test selected, should be Factor V Leiden</td>
</tr>
<tr>
<td>Factor V Leiden, n = 22</td>
<td>7 (32%)</td>
<td>Duplicate genetic test</td>
</tr>
<tr>
<td>Prothrombin G20210A, n = 44</td>
<td>14 (32%)</td>
<td>Duplicate genetic test</td>
</tr>
<tr>
<td>HgbA1c, n = 1909</td>
<td>439 (23%)</td>
<td>Repeats &lt;60 days from previous result</td>
</tr>
<tr>
<td>Protein C Activity, n = 77</td>
<td>57 (74%)</td>
<td>Tested while patient on anticoagulants</td>
</tr>
<tr>
<td>Lupus Anticoagulant, n = 55</td>
<td>6 (11%)</td>
<td>Wrong test selected, should be an ANA for SLE</td>
</tr>
<tr>
<td>ANA, n = 487</td>
<td>161 (33%)</td>
<td>Not necessary, ordered after normal PTT result</td>
</tr>
<tr>
<td>ANA ordered for elevated liver functions, n = 18</td>
<td>9 (50%)</td>
<td>Had additional unnecessary confirmatory autoimmune tests at same time as ANA</td>
</tr>
<tr>
<td>ANA results with titer ≥1:160 on symptomatic patients, n = 42</td>
<td>10 (24%)</td>
<td>No follow-up confirmatory testing and no Rheumatology referral, missed diagnosis</td>
</tr>
</tbody>
</table>

### CONCLUSIONS

- Significant levels of inappropriate test utilization was identified on the seven tests reviewed.
- A multifaceted approach, including implementation of Diagnostic Management Teams, physician education and feedback program, and EHR alerts/programming, will be necessary to address these issues.
- Additional research will need to be undertaken on other tests to determine the baseline extent of the problem so that appropriate laboratory test utilization can be effectively promoted for all testing.

### REFERENCES