Faculty and student collaboration: A SARP success story

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Scholarly Activity and Research Program (SARP)

SARP is a three-credit, mentor guided, hands-on research experience done while in medical school. It provides medical students with an opportunity to design and execute independent scholarship or research projects under the guidance of faculty mentors.
Research project ideas
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I want to do a project using an iPhone microscope
Research project ideas

Sure
Leeuwenhoek microscope
Leeuwenhoek microscope

Antoni van Leeuwenhoek (1632-1723)
Leeuwenhoek microscope

Figure 1 - Diagram of the microscope constructed by Antoni van Leeuwenhoek in the XVIII century
Leeuwenhoek microscope
The Foldoscope
The Foldoscope
The Foldoscope
The Foldoscope
Evaluating the performance of a low-cost mobile phone attachable microscope in Cervical Cytology
Cancer remains a leading cause of death among women in developing countries. PAP smears allow for preventive screening of cervical cancer but widespread implementation is limited due to a lack in resources. The affordable Foldscope microscope may have a significant effect on screening barriers in the developing countries.
N=40 cytology samples (10 Normal, 10 LSIL, 10 HSIL, and 10 Cancer) were deidentified and randomized into 2 groups. A single region of interest (ROI) most representative of the classification was selected for imaging. Images taken with the Foldoscope or a conventional microscope, and then reviewed by two pathologists in a blind fashion.
Conventional vs. Foldoscope

Normal Cytology

LSIL
Conventional vs. Foldoscope

HSIL

HSIL
## Inter-rater agreement

<table>
<thead>
<tr>
<th>Inter-Rater Agreement Table between Foldscope and Conventional</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Foldscope</td>
<td>HSIL/MAL</td>
<td>LSIL</td>
<td>Normal</td>
<td>Total</td>
</tr>
<tr>
<td>HSIL/MAL</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>LSIL</td>
<td>4</td>
<td>7</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Normal</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>10</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

In total 30/40 (75%) of classifications were perfectly matched. 6 mismatches were observed between LSIL and HSIL/MAL while 3 mismatches were observed between LSIL and Normal. Only one mismatch was observed between Normal and HSIL/MAL.
Intra-rater agreement

In total 32/40 (80%) of classifications were perfectly matched.
There was “substantial” agreement between the foldscope and conventional microscopy. Within the 6 categories of the Koch classification this falls within the 5th “Substantial” category which is only a single category away from “Almost Perfect” with its lower cut off kappa at .8.
We found that diagnostic features of dysplasia were clear in the majority of Foldscope images allowing for accurate classification. The Foldscope was found to have “substantial” agreement with the much more expensive conventional microscope.

Conclusions
Public health impact

The ability to instantly send cytology images to trained pathologist through messenger applications can become revolutionary, not only for cervical cancer screening but for other cytopathological diagnosis.

The potential use and cost reduction of the Foldscope, if implemented correctly, could have a significant impact on the future of diagnostic pathology.