70 patients with primary radical prostatectomies had whole mount histology with Mp-MRI performed pre-biopsy.

All cancer lesions were measured in axial planes on mp-MRI and histology, taking 2 readings per modality per lesion.

The model was constructed based on several variables, including the PIRADSV2 score, PSA density (PSAD) and MRI volume of each lesion. Receiver operator characteristic (ROC) curves were generated and the area under curves (AUC) were compared. Statistical significance was defined as p < 0.05.
# Research Highlights

Table 1. Multivariate mixed effects logistic regression model performed on subset of lesions of PIRADSv2 3, 4, 5, showing association of MRI features with High Grade histology (N=169)

<table>
<thead>
<tr>
<th>Features</th>
<th>β (95% CI)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIRADSv2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>4</td>
<td>1.717 (0.764, 2.671)</td>
<td>5.570 (2.146, 14.458)</td>
</tr>
<tr>
<td>5</td>
<td>2.412 (1.093, 3.732)</td>
<td>11.159 (2.982, 41.755)</td>
</tr>
<tr>
<td>PSA density (ng/ml²)</td>
<td>1.019 (-0.244, 2.282)</td>
<td>2.770 (0.783, 9.797)</td>
</tr>
<tr>
<td>MRI volume of lesion (ml)</td>
<td>0.058 (0.004, 0.113)</td>
<td>1.060 (1.004, 1.119)</td>
</tr>
</tbody>
</table>
Our model for the predicted probability of HG cancer, $P(HG)$ is displayed below.

$$P(HG) = \frac{\exp(-2.371 + 1.717 \text{ PIRADS4} + 2.412 \text{ PIRADS5} + 1.019 \text{ PSAD} + 0.058 \text{ Lesion Volume})}{1 + \exp(-2.371 + 1.717 \text{ PIRADS4} + 2.412 \text{ PIRADS5} + 1.019 \text{ PSAD} + 0.058 \text{ Lesion Volume})}$$

where

- PIRADS4 = 1 when PIRADSv2 = 4;
- PIRADS5 = 1 when PIRADSv2 = 5;
- PIRADS4 = 0 and PIRADS5 = 0 when PIRADSv2 = 3 (i.e. reference category);
- PSAD: value of PSA density in ng/ml$^2$;
- Lesion Volume: mpMRI lesion volume in ml
Figure 2. Receiver operating characteristics (ROC) curve of prediction model.

Figure 3. Calibration plot of actual versus predicted probability of HG. The dashed line indicates an ideal calibration curve and the solid line shows the bias-corrected calibration curve developed from bootstrap resamples. The vertical bars display the observed frequency of HG with 95% confidence interval for the 4 risk groups proposed.
Research Highlights

- Based on this plot, we propose a 4-tier risk stratification groups to predict the likelihood of HG cancer: <20% (low risk), 20-50% (moderate risk), 50-70% (high risk) and >70% (very high risk).

- Based on our model, using a 20% cutoff for predicted probability of finding HG cancer, the negative predictive value (NPV) is 88% for P(HG) <20 and the positive predictive value (PPV) is 60% for P(HG) ≥20.

- This implies that for patients in the low risk group, there likelihood of LG cancer is 87.5% and HG is 12.5%.