Background
The Prostate Imaging Reporting and Data System (PI-RADS) classification was introduced in 2012 to standardise acquisition, interpretation and reporting of multiparametric prostate MRI (mpMRI). mpMRI combines T2-weighted (T2W), diffusion weighted imaging (DWI) and dynamic contrast-enhanced (DCE) imaging to improve the detection of clinically significant prostate cancer.

PI-RADS was revised in 2015 resulting in the publication of PI-RADS version 2 (PI-RADSv2). This newer edition places emphasis on high b value (≥1400 sec/mm²) DWI and apparent diffusion coefficient (ADC) maps for peripheral zone tumours, with DCE imaging playing an ancillary role in the characterisation of equivocal lesions. For transitional zone tumours, T2W sequences are now the dominant imaging parameter.

Aims
1. Evaluate the diagnostic accuracy of PI-RADSv2, correlating mpMRI and histological outcomes in patients with clinically significant prostate cancer.
2. Analyse the prognostic value of prostate specific antigen density (PSAD), evaluating the threshold yielding the highest positive predictive value (PPV) and negative predictive value (NPV).

Methods
We retrospectively analysed data from 96 patients referred into the prostate cancer pathway between December 2017 and August 2018. All patients underwent mpMRI. Studies were double reported by radiologists trained in prostate MRI. In our institution, transperineal biopsy (TP-Bx) is performed in patients with a PSAD of 0.12×ng/ml and above and/or a PI-RADS score of 3 and above.

Correlation was made between PI-RADSv2 score, PSAD and histological grade. Tumours with a Gleason grade of 4+3 and above and/or a core tumour length equal to and above 6mm were considered clinically significant.

Results
The mean patient age was 68.9 years. Mean prostate specific antigen (PSA) and PSAD were 15.3 and 0.25 respectively. Average time from mpMRI to TP-Bx was 20.4 days.

The overall incidence of cancer was 76%, of which 82% (62/75) were clinically significant. Twenty-eight mpMRI studies were reported as PI-RADS 3; malignant cells were identified in 46% and 28% of these were clinically significant cancers. In the PI-RADS 4 group, malignant cells were detected in 83%, 67% of which were clinically significant cancers. Malignant cells were detected in 87% of those with a PI-RADS score of 5, 82% were clinically significant tumours.

A Gleason grade of 3+3 was the most frequently reported histological outcome. The most aggressive tumours were identified exclusively within the PI-RADS 4 and 5 groups however.

<table>
<thead>
<tr>
<th>PI-RADS Score</th>
<th>Number of patients</th>
<th>Lowest Gleason grade</th>
<th>Highest Gleason grade</th>
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<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3+3</td>
<td>3+3</td>
</tr>
<tr>
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</tr>
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</tr>
<tr>
<td>4</td>
<td>10</td>
<td>3+3</td>
<td>5+5</td>
</tr>
</tbody>
</table>

Twenty-one patients had a PSAD of 0.12 or below, 48% of which received a diagnosis of cancer. Benign disease was identified in 20% of patients with a PSAD of 0.12 or above. The PPV and NPV were 80% and 57% respectively. At a PSAD threshold of 0.13, the PPV and NPV were 83% and 46% respectively. The highest PPV and NPV were achieved at a PSAD threshold of 0.14 [89% and 87% respectively]. Conversely, at a PSAD threshold of 0.15, PPV and NPV were found to be 84% and 34% respectively. No statistically significant correlation was identified between pre-operative PSAD and histological outcome.

Clinical Relevance
Incorporation of both PI-RADSv2 score and pre-operative PSAD provides valuable prognostic information in the evaluation of prostate cancer. In our study, both incidence of prostate cancer and tumour aggressiveness increased with PI-RADSv2 score, although this did not achieve statistical significance. The majority of clinically significant cancers were correctly identified using the PI-RADSv2 framework. As expected, improved diagnostic accuracy was achieved with higher PI-RADSv2 scores where the probability of cancer was highest.

While a PSAD threshold of 0.12 correctly identifies the majority of patients with cancer, the low NPV reduces the confidence and probability that a negative result truly equates to absence of clinically significant disease. This in turn potentially increases the likelihood of unnecessary patient investigation and cost. The PPV and NPV appear to be improved and highest when a PSAD threshold of 0.14 is employed.

References