INTRODUCTION
Patello-femoral instability affects 40 individuals per 100,000 population and carries a significant morbidity. The causes of patello-femoral instability are multi-factorial, and an isolated anatomical abnormality does not necessarily indicate instability.

Patello-femoral subluxation ranges from 0% (stable patella tracking) to 100% (complete dislocation) and there is an established relationship between the amount of subluxation and anterior knee pain [1]. Imaging modalities such as magnetic resonance (MR) imaging and standard radiographs are used to guide the clinician towards a suitable corrective procedure for patello-femoral instability.

The multi-factorial nature of patello-femoral instability is not addressed with current imaging techniques. This study aims to address which anatomical variables assessed on MR images are most relevant to patello-femoral instability. This information will aid surgical decision making, particularly in selecting the most appropriate reconstructive surgery.

METHOD
A retrospective analysis of MR studies of 60 patients with suspected patello-femoral instability was performed. All patients were graded for degree of radiological instability using a dynamic MR scan [2].

The patient scans were assessed for the presence of a specific range of anatomical variables:

- patella alta, (ratio of length of patella to length of patella tendon)
- patella type, (Wiberg classification)
- trochlea sulcus angles for bone and cartilage surfaces,
- the distance of the vastus medialis obliquus (VMO) muscle from the patella,
- trochlea and patella cartilage thickness,
- the horizontal distance between the tibial tubercle and the midpoint of the femoral trochlea (TTD),
- patella engagement. This represents the percentage of the patella height that is captured in the trochlea groove when the knee is in full extension (Figure 1).

RESULTS
The shape of the trochlea groove (sulcus angles), TTD and the distance of the VMO from the patella showed the most significant relationships with patello-femoral subluxation (Table 1).

Patella engagement showed a significant relationship (p <0.05) with radiological instability (Figure 2). There was a significant difference between the mild and moderate groups (p<0.001), but no significant difference between the moderate and severe groups.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wilks Lambda</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trochlea sulcus angle bone top</td>
<td>0.565</td>
<td>&lt;0.001</td>
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<tr>
<td>VMO distance from patella</td>
<td>0.720</td>
<td>&lt;0.001</td>
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<td>TTD</td>
<td>0.758</td>
<td>&lt;0.001</td>
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<tr>
<td>Patella Alta</td>
<td>0.804</td>
<td>0.002</td>
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<tr>
<td>Patella Engagement</td>
<td>0.807</td>
<td>0.002</td>
</tr>
<tr>
<td>Sulcus angle cartilage top</td>
<td>0.890</td>
<td>0.039</td>
</tr>
</tbody>
</table>

Table 1. Showing significance of measured variables to radiological instability

DISCUSSION
This study agrees with previous work showing a significant correlation between radiological stability and trochlea sulcus angle and TTD.

This is the first study to establish a significant correlation between patella engagement and radiological instability. The lower the percentage engagement of the patella in the trochlea, the greater the degree of patello-femoral instability.

We report a new method of predicting patello-femoral instability by measuring the overlap of the patella in the trochlea groove.

REFERENCES

Figure 1. Showing Patella Engagement E (Percentage overlap of patella cartilage in trochlea cartilage)

The Wilk’s Lambda test for multi-variate analysis was used to establish whether any relationship was present between the degree of patello-femoral instability and bony or soft tissue anatomical variables. The Wilk’s Lambda is a direct measure of the proportion of variance in a combination of different variables that is unaccounted for by the independent variable.

Non-parametric statistical tests were applied across the groups and within the groups to assess their relative significance.

Figure 2. Relationship between patella engagement in extension and radiological stability.