Table A1. Levels of agreement for statements included within the first-round survey - Full statements and values

	Statement	No. of responders (n)	% Strongly disagree	% Disagree	% Neither agree nor disagree	% Agree	% Strongly agree	Overall % Disagreement	Overall % Agreement
1	The literature relating to outcomes following treatment of multiligament knee injuries (MLKIs) is heterogeneous with a variety of diagnostic and treatment protocols being advocated, mostly based on small retrospective studies or pooled analyses of these studies.	39	2.6%	0.0%	2.6%	23.1%	71.8%	2.6%	94.9%
2	Significant heterogeneity in reporting of variables that may influence outcome following MKLI limits comparisons between studies and adequate pooling of data.	39	2.6%	0.0%	2.6%	23.1%	71.8%	2.6%	94.9%
3	Given limitations in existing literature, there is a need to develop consensus among experts to guide best practice in the diagnosis and management strategies for MLKIs.	39	2.6%	2.6%	2.6%	10.3%	82.1%	5.1%	92.3%
4	MLKIs can be defined as 'a traumatic clinically significant disruption of at least 2 of the major ligaments of knee, comprising the anterior cruciate ligament [ACL], posterior cruciate ligament [PCL], posteromedial corner [PMC] (comprising superficial and deep medial collateral ligament [MCL], posterior oblique ligament [POL]), or	39	0.0%	5.1%	7.7%	30.8%	56.4%	5.1%	87.2%
5	There is a need for improving classification systems for MLKI, specifically a system that incorporates MLKI that are not caused by a knee dislocation.	39	0.0%	10.3%	15.4%	25.6%	48.7%	10.3%	74.4%
6	MLKI can be associated with high energy trauma, and thus assessment using Advanced Trauma Life Support (ATLS) principles should occur.	38	0.0%	2.6%	7.9%	50.0%	39.5%	2.6%	89.5%
7	Each MLKI should be treated as a true knee dislocation with a high suspicion for associated neurovascular injury until proven otherwise.	38	0.0%	2.6%	5.3%	34.2%	57.9%	2.6%	92.1%
8	Clinical examination, although valuable, risks subjective variation and error.	39	2.6%	7.7%	5.1%	56.4%	28.2%	10.3%	84.6%
9	Clinical examination of pedal pulses alone is insufficient for the accurate diagnosis of vascular injury associated with MLKI	37	5.4%	8.1%	5.4%	27.0%	54.1%	13.5%	81.1%
10	All patients with MLKI should undergo ankle brachial pressure index readings (ABPI).	37	5.4%	8.1%	21.6%	27.0%	37.8%	13.5%	64.9%
11	All patients should undergo a careful assessment of the neurological status of the affected limb.	38	0.0%	0.0%	0.0%	18.4%	81.6%	0.0%	100.0%
12	Selected patients should undergo CT angiography based on mechanism, physical examination and ABPI findings (ABPI<0.9)	34	0.0%	8.8%	5.9%	23.5%	61.8%	8.8%	85.3%
13	All patients with suspected MLKI should undergo MRI.	37	0.0%	0.0%	0.0%	32.4%	67.6%	0.0%	100.0%
14	Stress radiographs may be valuable as an adjunct to MRI in decision-making by quantifying the degree of ligament competence.	37	0.0%	8.1%	10.8%	40.5%	40.5%	8.1%	81.1%

Table A1. Levels of agreement for statements included within the first-round survey - Full statements and values

15	Stress radiographs are a useful adjunct to clinical examination to objectively monitor progress in recovery following MLKI.	37	0.0%	16.2%	40.5%	21.6%	21.6%	16.2%	43.2%
16		37	2.7%	16.2%	40.5%	35.1%	5.4%	18.9%	40.5%
17	For the LCL, an increase in lateral joint space of >2.7 mm in side-to-side difference on varus stress radiographs (with the knee at 20 degrees of flexion) indicates a clinically significant LCL rupture.	35	2.9%	2.9%	28.6%	40.0%	25.7%	5.7%	65.7%
18	For the MCL, an increase in medial joint space of >3.2 mm in side-to-side difference on valgus stress radiographs (with the knee at 20°) indicates a clinically significant MCL rupture	35	0.0%	5.7%	25.7%	42.9%	25.7%	5.7%	68.6%
19	For the PCL, an increase in posterior tibial translation of >7 mm in side-to-side difference (with the knee at 90°) indicates a complete lesion of the posterior cruciate ligament.	36	0.0%	16.7%	16.7%	47.2%	19.4%	16.7%	66.7%
20	Posterior stress radiographs at 90° knee flexion with >12 mm of posterior tibial displacement and a Grade 3 posterior drawer test are equally indicative of a combined PCL and PLC, PMC injury, or decreased tibial slope.	35	0.0%	11.4%	17.1%	37.1%	34.3%	11.4%	71.4%
21	Objective comparisons of 'operative' and 'nonoperative' management strategies is limited by variation in timing, ligament injuries studied, surgical technique and rehabilitation strategy.	39	0.0%	2.6%	2.6%	41.0%	53.8%	2.6%	94.9%
22	Published pooled analyses all favour operative management of MLKI compared with nonoperative management, reporting significantly higher rates of return to work or sport, and functional outcome following operative intervention.	39	0.0%	5.1%	10.3%	53.8%	30.8%	5.1%	84.6%
23	An external fixator should be used in very limited specific indications (including vascular injury, irreducible joint) and not routinely.	35	0.0%	2.9%	2.9%	37.1%	57.1%	2.9%	94.3%
24	There is insufficient evidence to advocate early or delayed treatment of MLKI	39	0.0%	12.8%	10.3%	41.0%	35.9%	12.8%	76.9%
25	Early intervention is defined as surgery being undertaken within three weeks of injury and delayed intervention is defined as taken beyond three weeks.	37	0.0%	10.8%	10.8%	54.1%	24.3%	10.8%	78.4%
26	Early intervention should be performed where practical	39	2.6%	7.7%	25.6%	41.0%	23.1%	10.3%	64.1%
27	There is insufficient evidence to definitively support staged or single stage surgery in the setting of MLKI	35	5.7%	11.4%	11.4%	54.3%	17.1%	17.1%	71.4%
28	Single surgery is preferred to staged surgery for MLKI when facility and surgical resources permit.	35	8.6%	5.7%	20.0%	40.0%	25.7%	14.3%	65.7%
29	Ligamentous reconstruction should be performed only once vascular injury has been excluded or addressed.	38	2.6%	0.0%	0.0%	44.7%	52.6%	2.6%	97.4%
30	Ligamentous reconstruction can be performed concurrently with fracture management if fixation hardware does not interfere with possible ligament reconstruction tunnels. Otherwise	33	3.0%	6.1%	15.2%	54.5%	21.2%	9.1%	75.8%

Table A1. Levels of agreement for statements included within the first-round survey - Full statements and values

	there is a need to wait for fracture healing and once interfering ORIF hardware can be safely removed.								
31	Extra-and intra-articular ligament injuries should be entirely reconstructed	38	2.6%	23.7%	34.2%	23.7%	15.8%	26.3%	39.5%
32	Extra-and intra-articular ligament injuries should be repaired (without reconstruction) where possible	38	5.3%	26.3%	39.5%	26.3%	2.6%	31.6%	28.9%
33	The decision to repair or reconstruct ligaments in the context of MLKI should be considered, within the context of the severity of injury and the pattern of MLKI encountered.	38	0.0%	5.3%	5.3%	55.3%	34.2%	5.3%	89.5%
34	Where possible, the ACL should be reconstructed rather than repaired.	39	2.6%	2.6%	12.8%	33.3%	48.7%	5.1%	82.1%
35	Where possible, the PCL should be reconstructed rather than repaired.	38	2.6%	2.6%	28.9%	21.1%	44.7%	5.3%	65.8%
36	Where possible, the PLC should be reconstructed rather than repaired.	38	2.6%	5.3%	34.2%	21.1%	36.8%	7.9%	57.9%
37	Avulsion fractures can be treated with concurrent ligament reconstruction as necessary.	37	2.7%	5.4%	13.5%	43.2%	35.1%	8.1%	78.4%
38	Where extraarticular and intraarticular ligaments are injured in the context of KD III and IV MLKI, a single-stage strategy should be employed where the extraarticular ligaments are acutely repaired and reconstruction of the cruciate ligaments and PLC is undertaken.	34	5.9%	14.7%	23.5%	35.3%	20.6%	20.6%	55.9%
39	Where extraarticular and intraarticular ligaments injured in any other KD pattern, a staged strategy should be considered where extraarticular ligaments are acutely repaired and a delayed reconstruction of the cruciate ligaments and PLC is undertaken based on early functional outcome and patient preference.	34	11.8%	26.5%	26.5%	26.5%	8.8%	38.2%	35.3%
40	Early (within one week) rehabilitation protocols consisting of daily prone knee range of motion exercises (0-70 degrees) and immediate quadriceps activation appear to be more beneficial than rehabilitation strategies involving early immobilization (a period of at least three weeks of immobilisation) when the PCL is involved	36	0.0%	2.8%	16.7%	47.2%	33.3%	2.8%	80.6%
41	Weightbearing strategies following surgical treatment of MLKI vary widely, but most consider a period of non- or touch-weightbearing within a hinged knee brace.	38	2.6%	2.6%	7.9%	60.5%	26.3%	5.3%	86.8%
42	The most common period of restricted weightbearing advised following surgical treatment of MLKI is six weeks.	38	5.3%	7.9%	13.2%	55.3%	18.4%	13.2%	73.7%
43	Duration of bracing varies widely within the literature; however, the literature most commonly advises a period of bracing of at least three months following surgical treatment for MLKI.	38	2.6%	13.2%	15.8%	55.3%	13.2%	15.8%	68.4%
44	Further evidence is required to advocate specific ROM limitations following treatment for MLKI.	38	2.6%	2.6%	5.3%	57.9%	31.6%	5.3%	89.5%

Table A1. Levels of agreement for statements included within the first-round survey - Full statements and values

45	Minimum reporting standards are required to allow for accurate pooling of data and meaningful conclusions to be drawn regarding recommended strategies for diagnosis, management and rehabilitation of MLKI.	39	0.0%	0.0%	0.0%	30.8%	69.2%	0.0%	100.0%
46	There is a need for more specific evidence on timing of intervention for MLKI, with a rationale for defining effective 'windows' for intervention, as current definitions of 'early' and 'late' intervention are arbitrary and have no robust evidence base.	39	0.0%	0.0%	12.8%	35.9%	51.3%	0.0%	87.2%
47	Consensus is required regarding standardisation of stress radiography techniques.	37	0.0%	0.0%	10.8%	48.6%	40.5%	0.0%	89.2%
48	Further high-quality studies are required to assess the relative benefits of single versus staged surgery for MLKI stratified by KD classification, incorporating a policy of acute repair and delayed reconstruction when staged procedures are being undertaken	37	0.0%	0.0%	8.1%	54.1%	37.8%	0.0%	91.9%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

Statement	No. of responders (n)	% Strongly disagree	% Disagree	% Neither agree nor disagree	% Agree	% Strongly agree	Overall % Disagreement	Overall % Agreement
Q1. The literature relating to outcomes following treatment of multiligament knee injuries (MLKIs) is heterogeneous with a variety of diagnostic and treatment protocols being advocated, mostly based on small retrospective studies or pooled analyses of these studies.	39	2.6%	0.0%	0.0%	10.3%	87.2%	2.6%	97.4%
Q2. Significant heterogeneity in reporting of variables that may influence outcome following MKLI limits comparisons between studies and adequate pooling of data.	39	0.0%	0.0%	0.0%	20.5%	79.5%	0.0%	100.0%
Q3. Given the limitations in existing literature, there is a need to develop consensus among experts to guide best practice in the diagnosis and management strategies for MLKIs.	39	0.0%	0.0%	5.1%	15.4%	79.5%	0.0%	94.9%
Q5. MLKIs can be defined as 'a traumatic MRI-proven high-grade partial or complete discontinuity of at least 2 of the major ligaments of knee verified on physical exam or stress radiography. These ligaments comprise the anterior cruciate ligament [ACL], posterior cruciate ligament [PCL], posteromedial corner [PMC] (comprising superficial and deep medial collateral ligament [MCL], posterior oblique ligament [POL]), or posterolateral corner [PLC] (comprising fibular collateral ligament [FCL]/lateral collateral ligament (LCL), popliteus tendon, popliteofibular ligament [PFL]).	39	2.6%	10.3%	2.6%	28.2%	56.4%	12.8%	84.6%
Q6. There is a need to establish consensus on standardized nomenclature relating to MLKIs.	39	0.0%	2.6%	2.6%	25.6%	69.2%	2.6%	94.9%
Q7. Most MLKI are not caused by knee dislocations and use of the term knee dislocation should be discouraged unless referring specifically to this mechanism of injury.	39	2.6%	12.8%	10.3%	35.9%	38.5%	15.4%	74.4%
Q8. There is a need for improving classification systems for MLKI, specifically a system that incorporates MLKI that are not caused by a knee dislocation.	39	0.0%	2.6%	10.3%	35.9%	51.3%	2.6%	87.2%
Q9. In classifying MLKIs, the anatomical structures involved and the injury mechanism should be described separately.	39	0.0%	10.3%	2.6%	38.5%	48.7%	10.3%	87.2%
Q11. MLKIs occurring in the setting of high energy trauma, should be assessed using Advanced Trauma Life Support (ATLS) principles.	37	2.7%	2.7%	8.1%	40.5%	45.9%	5.4%	86.5%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

Q12. Each suspected MLKI should be assessed as a true knee dislocation with a high suspicion for associated neurovascular injury until proven otherwise.	38	0.0%	2.6%	2.6%	26.3%	68.4%	2.6%	94.7%
Q13. All patients should undergo a careful assessment of the neurological and vascular status of the affected limb.	39	0.0%	0.0%	0.0%	17.9%	82.1%	0.0%	100.0%
Q14. Clinicians should have a particularly high index of suspicion for associated neurovascular injury following diagnosis of MLKIs associated with PCL or PLC disruption.	38	0.0%	2.6%	2.6%	28.9%	65.8%	2.6%	94.7%
Q15. Clinical examination of pedal pulses alone is insufficient for the accurate diagnosis of vascular injury associated with MLKI.	37	0.0%	10.8%	8.1%	29.7%	51.4%	10.8%	81.1%
Q16. There should be a low threshold for proceeding to vascular assessment with CT angiography or MRA in patients presenting with acute high energy MLKI, knee dislocation, suspected bicruciate ligament or PLC injury and equivocal clinical examination findings.	37	0.0%	2.7%	8.1%	24.3%	64.9%	2.7%	89.2%
Q17. MRI can provide valuable information in assessing preoperative nerve injury and/or identify nerves at risk for further iatrogenic damage.	36	5.6%	19.4%	22.2%	33.3%	19.4%	25.0%	52.8%
Q18. All patients with suspected MLKI should undergo MRI where available and not contraindicated.	39	0.0%	0.0%	2.6%	28.2%	69.2%	0.0%	97.4%
Q19. Stress radiographs are valuable in the pre-operative phase as an adjunct to MRI in decision-making by quantifying the degree of ligament competence, particularly when performed under anaesthesia.	38	2.6%	5.3%	7.9%	44.7%	39.5%	7.9%	84.2%
Q20. For the LCL, an increase in lateral joint space of >3 mm in side-to-side difference on manual varus stress radiographs (with the knee at 20 degrees of flexion) can be a useful adjunct to indicate a clinically significant LCL rupture which may require surgical intervention, when combined with suitable clinical examination findings.	36	2.8%	2.8%	13.9%	50.0%	30.6%	5.6%	80.6%
Q21. For the MCL, an increase in medial joint space of >3 mm in side-to-side difference on manual valgus stress radiographs (with the knee at 20°) is a useful adjunct to support the diagnosis of a clinically significant MCL rupture that may require surgical intervention.	36	0.0%	5.6%	19.4%	50.0%	25.0%	5.6%	75.0%
Q22. For the PCL, an increase in posterior tibial translation of >7 mm in side-to-side difference (with the knee at 90°) on manual stress radiographs is a useful adjunct to	37	0.0%	8.1%	8.1%	54.1%	29.7%	8.1%	83.8%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

support the diagnosis of a complete rupture of the posterior cruciate ligament that may require surgical intervention.								
Q23. Posterior manual stress radiographs at 90° knee flexion with >12 mm of posterior tibial displacement and a Grade 3 posterior drawer test are a useful adjunct to support a diagnosis of a combined PCL and PLC or PMC injury.	35	0.0%	5.7%	11.4%	42.9%	40.0%	5.7%	82.9%
Q24. For the assessment of ACL injuries, a cut-off of >5 mm in side-to-side difference for anterior tibial translation on manual stress radiographs (with the knee at 20 degrees of flexion) may be used as an adjunctive indication for surgical intervention in addition to suitable clinical examination findings (such as positive pivot shift, hyperextension).	36	2.8%	13.9%	22.2%	41.7%	19.4%	16.7%	61.1%
Q25. Clinical examination of knee stability in the outpatient setting for chronic MLKIs can be valuable, but may risk subjectivity and should be followed up by the investigative adjuncts of stress radiography and/or examination under anaesthesia where there is diagnostic uncertainty.	39	0.0%	10.3%	10.3%	35.9%	43.6%	10.3%	79.5%
Q26. Stress radiographs can do more damage and are less helpful in determining a course of treatment. Therefore, it is not suitable as a follow-up test regardless of the location of the ligaments.	36	33.3%	36.1%	5.6%	16.7%	8.3%	69.4%	25.0%
Q28. Objective comparisons of 'operative' and 'nonoperative' management strategies are limited by variation in timing, ligament injuries studied, surgical technique and rehabilitation strategy.	39	0.0%	2.6%	2.6%	35.9%	59.0%	2.6%	94.9%
Q29. Published pooled analyses generally favour operative management of MLKI compared with nonoperative management. Studies are particularly favourable of operative management in young patients (<50), reporting significantly higher rates of return to work or sport, and functional outcome following operative intervention.	39	0.0%	2.6%	7.7%	48.7%	41.0%	2.6%	89.7%
Q30. An external fixator should be used rarely, and only for very limited specific indications (including but not limited to vascular injury, open injuries, an irreducible or grossly unstable joint not contained by a brace) and not routinely.	36	0.0%	5.6%	0.0%	41.7%	52.8%	5.6%	94.4%
Q32. Early intervention is defined as surgery being undertaken within 21 days of injury and delayed intervention is defined as taken beyond 21 days	39	2.6%	10.3%	15.4%	51.3%	20.5%	12.8%	71.8%
Q33. There is no benefit of employing a chronological cut-off to define early versus late surgery for the management of MLKI, and this concept should be considered historic.	39	7.7%	43.6%	20.5%	18.0%	10.3%	51.3%	28.2%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

Q34. There is insufficient evidence to advocate early or delayed treatment of MLKI.	39	7.7%	15.4%	5.1%	48.7%	23.1%	23.1%	71.8%
Q35. The timing of surgical intervention should be tailored to each individual ligament within MLKI and is determined by a range of factors including MLKI injury severity, pattern, associated neurovascular injury and patient factors.	39	0.0%	0.0%	0.0%	43.6%	56.4%	0.0%	100.0%
Q37. Current evidence comparing staged or single stage surgery comprises data which is too heterogeneous in this regard to draw valuable conclusions regarding optimal staging strategy.	37	2.7%	8.1%	8.1%	59.5%	21.6%	10.8%	81.1%
Q38. The decision to pursue single or staged surgery for MLKI depends on a variety of factors including pattern of injury and associated injuries.	37	0.0%	5.4%	2.7%	48.6%	43.2%	5.4%	91.9%
Q39. Recommendations regarding staging strategy should be based on injury factors and individual surgeon preference.	37	0.0%	0.0%	16.2%	48.6%	35.1%	0.0%	83.8%
Q40. Ligamentous reconstruction should be performed only once vascular injury has been excluded or addressed.	38	0.0%	0.0%	7.9%	18.4%	73.7%	0.0%	92.1%
Q41. Ligamentous reconstruction should generally not be performed concurrently with initial fracture management and should be delayed until initial fracture management has been performed and there is clear evidence of progression towards bony union.	33	6.1%	18.2%	33.3%	27.3%	15.2%	24.2%	42.4%
Q42. Ligamentous reconstruction can be performed concurrently with fracture management if fixation hardware does not interfere with possible ligament reconstruction tunnels.	33	6.1%	9.1%	21.2%	48.5%	15.2%	15.2%	63.6%
Q43. Ligament reconstruction should be delayed until after fracture healing and once interfering ORIF hardware can be safely removed.	33	3.0%	21.2%	30.3%	33.3%	12.1%	24.2%	45.5%
Q45. The decision to repair or reconstruct ligaments in the context of MLKI should be considered, within the context of the severity of injury, location of tear within specific ligament (proximal, mid-substance, distal), pattern of MLKI encountered, and functional demands of patient.	37	0.0%	0.0%	2.7%	54.1%	43.2%	0.0%	97.3%
Q46. Where possible, the ACL should be reconstructed rather than repaired, with the exception of bony or pure avulsions.	36	2.8%	5.6%	13.9%	30.6%	47.2%	8.3%	77.8%
Q47. Where possible, the PCL should be reconstructed rather than repaired, with the exception of bony or pure avulsions.	36	2.8%	5.6%	19.4%	30.6%	41.7%	8.3%	72.2%
Q48. Avulsion fractures can be treated with concurrent ligament reconstruction as necessary.	35	2.9%	0.0%	2.9%	62.9%	31.4%	2.9%	94.3%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

Q50. Weightbearing strategies following surgical treatment of MLKI vary widely and do not have a robust evidence base, with current strategies based on expert opinion - most consider a period of non- or touch-weightbearing within a hinged knee brace.	39	0.0%	2.6%	0.0%	46.2%	51.3%	2.6%	97.4%
Q51. There is currently insufficient high-quality evidence to advocate a specific time-period of restricted weightbearing following surgical treatment of MLKI, however a period of four-six weeks can be considered acceptable based on current low-order evidence and expert opinion.	39	0.0%	5.1%	2.6%	53.9%	38.5%	5.1%	92.3%
Q52. Further high-quality evidence is required to make specific recommendations regarding the duration of bracing following MLKI. Currently this may be determined by surgeon/center preference.	39	2.6%	0.0%	0.0%	48.7%	48.7%	2.6%	97.4%
Q53. Further evidence is required to advocate specific ROM limitations following treatment for MLKI.	39	2.6%	0.0%	0.0%	48.7%	48.7%	2.6%	97.4%
Q54. PCLR rehabilitation protocols that include early (within one week) daily prone knee range of motion exercises (0-90 degrees) and immediate quadriceps activation appear to be more beneficial than rehabilitation strategies involving early immobilization (a period of at least three weeks of immobilisation).	39	5.1%	0.0%	23.1%	41.0%	30.8%	5.1%	71.8%
Q56. Minimum reporting standards are required to allow for accurate pooling of data and meaningful conclusions to be drawn regarding recommended strategies for diagnosis, management and rehabilitation of MLKI.	39	0.0%	0.0%	0.0%	35.9%	64.1%	0.0%	100.0%
Q57. There is a need for more specific evidence on timing of intervention for MLKI, with a rationale for defining effective 'windows' for intervention, as current definitions of 'early' and 'late' intervention are arbitrary and have no robust evidence base.	39	0.0%	5.1%	5.1%	48.7%	41.0%	5.1%	89.7%
Q58. Consensus is required regarding standardisation of stress radiography techniques.	35	0.0%	0.0%	16.2%	43.2%	40.5%	0.0%	83.8%
Q59. Further high-quality studies are required to assess the relative benefits of single versus staged surgery for MLKI stratified by KD classification, incorporating a policy of acute repair and delayed reconstruction when staged procedures are being undertaken	38	0.0%	2.6%	7.9%	47.4%	42.1%	2.6%	89.5%
Q60. A multicentre registry of MLKIs would be valuable.	39	2.6%	0.0%	0.0%	30.8%	66.7%	2.6%	97.4%
Q61. Patient Reported Outcomes specific for Multiple ligament Injured Knee patients should be adopted by all researchers (ex. ML-QOL and Promise scores) in order to	38	0.0%	2.6%	7.9%	42.1%	47.4%	2.6%	89.5%

Table A2. Levels of agreement for statements included within the second-round survey - Full statements and values

better the unique patient population. As opposed to only IKDC and Lysholm scores which are not specific for MLKI.								
Q62. More important than diagnosis and management standardization are standardization and reporting of outcome measures and long term outcomes regarding PTOA.	38	5.3%	7.9%	39.5%	18.4%	28.9%	13.2%	47.4%
Q63. Research studies are require to evaluate the effects of geographic location, socioeconomic factors and patient demographics on injury treatments and outcomes.	39	0.0%	2.6%	7.7%	43.6%	46.2%	2.6%	89.7%

Table A3. Levels of agreement for statements included within the final-round survey - Full statements and values

Statement	No. of responders (n)	% Strongly disagree	% Disagree	% Neither agree nor disagree	% Agree	% Strongly agree	Overall % Disagreement	Overall % Agreement
Q1. The literature relating to outcomes following treatment of multiligament knee injuries (MLKIs) is heterogeneous with a variety of diagnostic and treatment protocols being advocated, mostly based on small retrospective studies or pooled analyses of these studies.	39	0.0%	0.0%	2.5%	18.0%	79.5%	0.0%	97.5%
Q2. Significant heterogeneity in reporting of variables that may influence outcome following MKLI limits comparisons between studies and adequate pooling of data.	39	0.0%	0.0%	2.5%	30.8%	66.7%	0.0%	97.5%
Q3. Given the limitations in existing literature, there is a need to develop consensus among experts to guide best practice in the diagnosis and management strategies for MLKIs.	39	2.6%	0.0%	2.5%	18.0%	76.9%	2.6%	94.9%
Q5. MLKIs can be defined as 'a traumatic high-grade partial or complete discontinuity of at least 2 of the following structures verified on physical exam or stress radiography: anterior cruciate ligament [ACL], posterior cruciate ligament [PCL], posteromedial corner [PMC] (comprising superficial and deep medial collateral ligament [MCL], posterior oblique ligament [POL]), or posterolateral corner [PLC] (comprising fibular collateral ligament [FCL]/lateral collateral ligament (LCL), popliteus tendon, popliteofibular ligament [PFL]).	39	0.0%	2.6%	0.0%	43.5%	53.9%	2.6%	97.4%
Q6. There is a need to establish consensus on standardized nomenclature relating to MLKIs.	39	0.0%	0.0%	10.3%	28.2%	61.5%	0.0%	89.7%
Q7. Most MLKI are not caused by knee dislocations and use of the term knee dislocation should be discouraged unless referring specifically to this mechanism of injury.	39	0.0%	5.1%	15.4%	38.5%	41.0%	5.1%	79.5%
Q8. There is a need for improving classification systems for MLKI, specifically a system that incorporates MLKI that are not caused by a knee dislocation.	39	0.0%	2.6%	10.2%	35.9%	51.3%	2.6%	87.2%
Q9. A classification system for MLKIs should reflect the range of possible injuries and their severity	39	0.0%	0.0%	2.6%	35.9%	61.5%	0.0%	97.4%
Q10. In classifying MLKIs, the anatomical structures involved, the location of injury within these structures, and the injury mechanism (including velocity e.g. high vs. low vs ultra-low velocity (ULV)) should be described separately.	39	0.0%	0.0%	5.1%	56.4%	38.5%	0.0%	94.9%

Table A3. Levels of agreement for statements included within the final-round survey - Full statements and values

Q11. An MLKI classification system should facilitate treatment decisions for each categorized injury.	39	2.6%	2.6%	2.6%	46.1%	46.1%	5.2%	92.2%
Q12. An MLKI classification system should take into consideration associated non-ligamentous structures injured in addition to the ligamentous components.	39	0.0%	0.0%	5.1%	41.0%	53.9%	0.0%	94.9%
Q14. MLKIs occurring in the setting of high energy trauma, should be assessed using Advanced Trauma Life Support (ATLS) principles.	37	2.7%	0.0%	2.7%	32.4%	62.2%	2.7%	94.6%
Q15. Each suspected MLKI should be assessed as a true knee dislocation with a high suspicion for associated neurovascular injury until proven otherwise.	38	0.0%	0.0%	0.0%	18.4%	81.6%	0.0%	100.0%
Q16. All patients should undergo a careful assessment of the neurological and vascular status of the affected limb.	38	0.0%	0.0%	0.0%	10.5%	89.5%	0.0%	100.0%
Q17. Clinicians should have a particularly high index of suspicion for associated neurovascular injury following diagnosis of MLKIs associated with PCL or PLC disruption, or a hyperextension MLKI.	38	0.0%	0.0%	0.0%	21.1%	78.9%	0.0%	100.0%
Q18. Clinical examination of pedal pulses alone is insufficient for the accurate diagnosis of vascular injury associated with acute MLKIs involving a higher energy mechanism.	36	0.0%	2.8%	2.8%	27.8%	66.6%	2.8%	94.4%
Q19. There should be a low threshold for proceeding to vascular assessment with CT angiography in patients presenting with acute high-energy MLKI, knee dislocation, suspected bi-cruciate ligament or PLC injury, and equivocal clinical examination and ABI findings.	35	0.0%	0.0%	0.0%	17.1%	82.9%	0.0%	100.0%
Q20. As an adjunct to a thorough clinical examination, MRI can provide valuable information in preoperatively assessing nerves at risk for further iatrogenic damage.	35	0.0%	11.4%	14.3%	31.4%	42.9%	11.4%	74.3%
Q21. All patients with suspected MLKI should undergo MRI if available.	37	0.0%	0.0%	0.0%	21.6%	78.4%	0.0%	100.0%
Q22. Stress radiographs are valuable in the pre-operative phase as an adjunct to MRI in decision-making by quantifying the degree of ligament competence, particularly when performed under anaesthesia.	35	0.0%	5.7%	5.7%	54.3%	34.3%	5.7%	88.6%
Q23. For the LCL an increase in lateral joint space of >3 mm in side-to-side difference on manual varus stress radiographs (with the knee at 20 degrees of flexion) can be a useful adjunct to indicate a clinically significant LCL rupture which may require surgical intervention, when combined with suitable MRI findings.	33	0.0%	3.0%	9.1%	57.6%	30.3%	3.0%	87.9%
Q24. For the MCL, an increase in medial joint space of >3 mm in side-to-side difference on manual valgus stress radiographs (with the knee at 20°) is a useful	34	0.0%	5.9%	11.8%	52.9%	29.4%	5.9%	82.3%

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adjunct to support the diagnosis of a clinically significant MCL rupture that may require surgical intervention								
Q25. For the PCL, an increase in posterior tibial translation of >8 mm in side-to-side difference (with the knee at 90°) on manual stress radiographs or intraoperative fluoroscopy is a useful adjunct to support the diagnosis of a complete rupture of the posterior cruciate ligament that may require surgical intervention.	32	0.0%	3.1%	6.3%	53.1%	37.5%	3.1%	90.6%
Q26. Posterior manual stress radiographs at 90° knee flexion with >12 mm of posterior tibial displacement and a Grade 3 posterior drawer test are a useful adjunct to support a diagnosis of a combined PCL and PLC or PMC injury or a PCL tear with reduced posterior tibial slope.	32	0.0%	3.1%	3.1%	43.8%	50.0%	3.1%	93.8%
Q27. For the assessment of ACL injuries, a cut-off of >5 mm in side-to-side difference for anterior tibial translation on manual stress radiographs (with the knee at 20 degrees of flexion) may be used as an adjunctive indication for surgical intervention in addition to suitable clinical examination findings (such as positive pivot shift, hyperextension).	36	2.8%	5.6%	16.7%	44.5%	30.5%	8.3%	75.0%
Q28. Clinical examination of knee stability in the outpatient setting for chronic MLKIs can be valuable, but may risk subjectivity and should be followed up by stress radiography and/or examination under anesthesia in combination with MRI where there is diagnostic uncertainty	38	0.0%	2.6%	5.3%	47.4%	44.7%	2.6%	92.1%
Q29. Stress radiographs are a useful adjunct in monitoring and quantifying the effects of a course of treatment during rehabilitation but should only be employed postoperatively after 4 months following the intervention.	35	0.0%	14.3%	37.1%	28.6%	20.0%	14.3%	48.6%
Q30. Ultrasound is a useful investigative adjunct, when available, to determine nerve injury in the acute assessment of neural injury in the setting of MLKI.	33	0.0%	27.3%	33.3%	30.3%	9.1%	27.3%	39.4%
Q32. Objective comparisons of ‘operative’ and ‘nonoperative’ management strategies are limited by variation in timing, ligament injuries studied, operative technique, returning level, type of activity desired and rehabilitation strategy.	39	0.0%	0.0%	2.6%	38.4%	59.0%	0.0%	97.4%
Q33. Published pooled analyses of low-level evidence generally favour operative management of MLKI compared with nonoperative management. Studies are particularly favourable of operative management in young patients (<50yrs), reporting significantly higher rates of return to work or sport, and functional outcome following operative intervention.	39	0.0%	5.2%	5.1%	41.0%	48.7%	5.2%	89.7%

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Q34. An external fixator should be used rarely, and only for very limited specific indications (including but not limited to vascular injury, open injuries, obesity, an irreducible or grossly unstable joint not contained by a brace) and not routinely. If applied, particular care should be taken not to capture the quadriceps mechanism.	33	0.0%	3.0%	6.1%	36.4%	54.5%	3.0%	90.9%
Q35. Early operative intervention is defined as occurring within 21 days of injury and delayed intervention is defined as surgery after 21 days	38	2.6%	2.6%	18.5%	50.0%	26.3%	5.2%	76.3%
Q36. The timing of operative intervention should be tailored to each individual ligament within MLKI and is determined by a range of factors including MLKI injury severity, pattern, associated neurovascular injury and patient factors.	37	0.0%	0.0%	5.4%	37.8%	56.8%	0.00%	94.6%
Q37. Early surgery (within 21 days) should be performed whenever possible depending on concomitant injuries and the resources available	37	5.4%	10.8%	32.4%	24.3%	27.1%	16.2%	51.4%
Q38. The decision to pursue single or staged surgery for MLKI depends on a variety of factors including pattern of knee injury and associated injuries in polytrauma patients.	36	0.0%	0.0%	8.3%	36.1%	55.6%	0.0%	91.7%
Q39. Recommendations regarding staging strategy should be based on injury factors, patient factors, surgical team, resources and best available evidence.	37	0.0%	0.0%	5.4%	35.1%	59.5%	0.0%	94.6%
Q40. Ligamentous reconstruction should be performed only once vascular injury has been excluded or addressed.	36	0.0%	0.0%	8.3%	16.7%	75.0%	0.0%	91.7%
Q41. Single stage surgery should be performed whenever possible to facilitate early rehabilitation, reduce rehabilitation time and avoid overloading the reconstructed ligaments with staging.	36	0.0%	0.0%	19.4%	47.2%	33.4%	0.00%	80.6%
Q42. The decision to repair or reconstruct ligaments in the context of MLKI should be considered, within the context of the severity of injury, location of tear within specific ligament (proximal, mid-substance, distal) and pattern of MLKI encountered.	36	0.0%	0.0%	5.6%	47.2%	47.2%	0.0%	94.4%
Q43. Where possible, the ACL should be reconstructed rather than repaired, with the exception of bony or pure avulsions.	38	5.3%	0.0%	5.2%	34.2%	55.3%	5.3%	89.5%
Q44. Where possible, the PCL should be reconstructed rather than repaired, with the exception of bony or pure avulsions (peel off lesions).	38	2.6%	2.6%	10.5%	31.6%	52.6%	5.3%	84.2%
Q46. Weightbearing strategies following surgical treatment of MLKI vary widely and do not have a robust evidence base, with current strategies based on expert opinion - most consider a period of non- or touch-weightbearing within a hinged knee brace.	38	2.6%	0.0%	2.6%	36.9%	57.9%	2.6%	94.8%

Table A3. Levels of agreement for statements included within the final-round survey - Full statements and values

Q47. There is currently insufficient high-quality evidence to advocate a specific time-period of restricted weightbearing following surgical treatment of MLKI, however a period of four-six weeks can be considered acceptable based on current low-order evidence and expert opinion.	38	5.3%	0.0%	2.6%	50.0%	42.1%	5.3%	92.1%
Q48. Further high-quality evidence is required to make specific recommendations regarding the duration of bracing following MLKI.	38	2.6%	0.0%	2.6%	34.2%	60.6%	2.6%	94.8%
Q49. Further evidence is required to advocate specific ROM limitations following treatment for MLKI.	38	0.0%	0.0%	2.6%	36.8%	60.6%	0.0%	97.4%
Q50. PCLR rehabilitation protocols that include early (within one week) daily prone knee range of motion exercises (0-90 degrees) and immediate quadriceps activation appear to be more beneficial than rehabilitation strategies involving early immobilization (a period of at least three weeks of immobilization).	38	2.6%	2.6%	13.2%	44.8%	36.8%	5.2%	81.6%
Q52. Minimum reporting standards are required to allow for accurate pooling of data and meaningful conclusions to be drawn regarding recommended strategies for diagnosis, management and rehabilitation of MLKI.	39	0.0%	0.0%	2.6%	28.2%	69.2%	0.0%	97.4%
Q53. There is a need for more specific evidence on timing of intervention for MLKI, with a rationale for defining effective 'windows' for intervention, as current definitions of 'early' and 'late' intervention are arbitrary and based on expert opinion alone.	39	0.0%	0.0%	5.2%	41.0%	53.8%	0.0%	94.8%
Q54. Further high-quality studies are required to assess the relative benefits of single versus staged surgery for MLKI stratified by KD classification, incorporating a policy of acute repair and delayed reconstruction when staged procedures are being undertaken	38	0.0%	2.6%	2.6%	47.4%	47.4%	2.6%	94.8%
Q55. A multicentre registry of MLKIs would be valuable.	39	0.0%	0.0%	2.6%	33.3%	64.1%	0.0%	97.4%
Q56. Patient Reported Outcomes specific for Multiple ligament Injured knee patients should be adopted by all researchers to better understand the unique patient population as opposed to scores which are not specific for MLKI.	39	0.00%	7.7%	2.6%	33.3%	56.4%	7.7%	89.7%
Q57. Achieving standardization of diagnosis, management and of outcome measures following MLKI would be of value	39	0.0%	0.0%	5.1%	25.6%	69.3%	0.0%	94.9%
Q58. Research studies are required to evaluate the effects of geographic location, socioeconomic factors and patient demographics (including sex and racial differences) on injury treatments and outcomes.	39	0.00%	0.00%	5.1%	41.0%	53.9%	0.0%	94.9%

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Q59. Research is required to assess stress radiographs in clinic and in the anaesthetized patient, in order to determine the relative accuracy and differences in findings regarding laxity/endpoints in these two settings.	38	0.0%	5.3%	13.1%	44.7%	36.7%	5.3%	81.6%