**Supplementary Table S1:** Test Descriptions

|  |  |
| --- | --- |
| Test | Description |
| YBT-UQ (cm, %)(19, 36) | The YBT-UQ has been shown to be a promising screening tool for predicting risk of general MSK injury in a military population(27). However, the ability to predict UQIs specifically has not been tested. This test measures dynamic balance. The participant maintains stability in a three-point plank position (two legs, one arm) while reaching as far as possible with the unweighted upper extremity in three directions. The maximum reach in each direction and composite score are recorded. |
| YBT-LQ (cm, %)(37) | The YBT-LQ has been shown to predict lower extremity injury(26) and general MSK injury in athletes(35).This test measures dynamic balance. The participant maintains stability in a single leg stance (two arms, one leg), while reaching as far as possible with the unweighted leg in three directions. The maximum reach in each direction and composite score are recorded. |
| Modified Sorensen (s)(23)  | This test measures isometric endurance of the trunk extensor muscles and hip extensors. The participant lays prone with the lower body fixed to a table with straps. The participant maintains the unsupported upper body in a horizontal plane for as long as possible and the holding time is recorded to a maximum of three minutes.  |
| Modified Lunge Ankle Dorsiflexion (degrees)(24, 39) | This test measures ankle dorsiflexion during a split kneel lunge using a phone application to record the angle.  |
| 100-point FMS(20) | The FMS has been shown to have promise as a screening tool to predict MSK injury in various populations. A low FMS score was associated with MSK injury in athletes(10), and military personnel(11, 16, 27). Yet other studies in military personnel(9, 14, 37) and active adults(38) did not find prediction of MSK injury. Performance on specific components of the FMS or pain on the clearing tests can also be predictive of MSK injury(14). The FMS examines movement quality during seven standardized functional movement patterns: deep squat, in-line lunge, hurdle step, shoulder mobility, active straight-leg raise, trunk stability push-up, and rotary stability. The quality of each movement is scored on a continuum from 1 (unable to complete any component of the movement) to the maximum score (one complete repetition without compensation or substitution).  |
| Modified-modified Schober (cm)(22) | This test measures lumbar flexion and extension mobility. The examiner marks the level of the posterior superior iliac spines and 15 cm above the first mark. The participant then bends forward and the distance between the two marks is recorded as lumbar flexion. For spinal extension assessment, the participant bends backward. The distance between the two marks while in full lumbar extension was subtracted from 15 cm so that larger values indicated greater spinal extension. |
| Side Bridge (s)(23) | This test measures core stability endurance. The participant is on their side with their knees extended, hips raised off the ground, and their weight supported on one elbow and both feet. The test is stopped when the participant is unable to maintain the test position despite two corrections or the hold time exceeds three minutes. |
| Passive Lumbar Extension(26) | This test measures lumbar instability. The participant is in the prone position and both legs are elevated passively to approximately 30 cm above the bed while maintaining the knees in extension and gently pulling on the legs. The test is positive if the participant complains of strong pain in the lumbar region during elevation of the legs and such pain disappears when the legs are lowered to the initial position. |
| SFMA Lumbar Flexion, Extension, and Rotation(21) | Interventions focused on the thoracic spine have been shown to alter shoulder symptoms(39). This concept of regional interdependence suggests that impairments in remote anatomical locations may contribute to the primary injury(39). This SFMA component measures lumbar flexion, extension, and rotation while standing. For flexion, participants are asked to bend forward and touch their toes without bending their knees. For extension, participants are asked to bend backwards with their arms extended in line with their ears. For rotation, the participant is asked to rotate their body to the side while maintaining their feet pointing forward. Criteria rated by a trained rater determine if the movement is functional or dysfunctional. Pain provoked by the movement is also recorded.  |

**Supplementary Table S2:** Previously Published Test Reliability for Baseline Tests

|  |  |  |
| --- | --- | --- |
| Test | Intra-rater Reliability (ICC) | Inter-rater Reliability (ICC) |
| YBT-UQ(19, 36) | 0.91-0.92 | 1.00 |
| 100-point FMS(20) | -  | 0.91-1.0 |
| Side Bridge(23) | 0.82 left, 0.91 right | 0.99 |
| SFMA(21) | 0.72-0.91 | 0.72 |
| YBT-LQ(37) | 0.85-0.91 | 0.99-1.0 |
| Modified Sorensen(23)  | 0.85 | 0.99 |
| Ankle Dorsiflexion iHandy tool(24) | 0.97 | 0.76 |
| Modified Lunge Ankle Dorsiflexion(39) | 0.68-0.89 | 0.55-0.82 |
| Modified-modified Schober(22) | 0.95 | 0.91 |
| Passive Lumbar Extension(40) | - | kappa = 0.76, 0.46 |

**Table S3:** Comparisons of the participants with and without missing follow-up data.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Descriptive Variable | Category | Frequency (%) Complete Follow-up | Frequency (%) Missing Follow-up | Chi Square (p value) |
| Sex | Male | 390 (78.9) | 64 (13.0) | ***p*=0.003\*** |
| Female | 40 (8.1) | 0 (0) |
| Rank | Junior non-commissioned | 356 (72.1) | 60 (12.1) | ***p*=0.033\*** |
| Senior non -commissioned  | 36 (7.3) | 4 (0.8) |
| Officer | 38 (7.7) | 0 (0) |
| Combat vs support | Combat | 176 (35.6) | 39 (7.9) | ***9.072******p*=0.003** |
| Support | 254 (51.4) | 25 (5.1) |
| Mels in last year | No | 324 (65.6) | 43 (8.7%) | 1.943*p*=0.109 |
| Yes | 106 (21.5) | 21 (4.3%) |
| Smoking Status | Non-smoker (0) | 260 (52.7) | 30 (6.1) | 4.335*p*=0.037 |
| Smokers (1+2) | 169 (34.3) | 34 (6.9) |
| >1 previous UQI | No | 336 (68.0) | 54 (10.9) | 1.303*p*=0.254 |
| Yes | 94 (19.0) | 10 (2.0) |
| Previous UQI episode duration >8weeks | No | 377 (76.3) | 55 (11.1) | 0.153*p*=0.696 |
| Yes | 53 (10.7) | 9 (1.8) |
| Baseline UQ Function ≤90% | No | 391 (79.1) | 58 (11.7) | 0.006 *p*=0.937 |
| Yes | 39 (7.9) | 6 (1.2) |
| YBT-UQ Superolateral Worst ≤57.75 cm  | No | 264 (53.5) | 48 (9.7) | 4.344 *p*=0.037 |
| Yes | 165 (33.5) | 16 (3.2) |
| YBT-UQ Composite Worst ≤81.10% | No | 312 (63.3) | 52 (10.5) | 2.094 *p*=0.148 |
| Yes | 117 (23.7) | 12 (2.4) |
| Shoulder Clearance | Negative | 381 (77.8) | 56 (11.4) | 0.216*p*=0.642 |
| Positive | 45 (9.2) | 5 (1.6) |
| InIn-line Lunge Total Score <15InIn | No | 320 (64.8) | 47 (9.5) | 0.028*p*=0.867 |
| Yes | 110 (22.3) | 17 (3.4) |
| In-line Lunge Asymmetry >1 | No | 250 (50.6) | 40 (8.1) | .437*p*=0.509 |
| Yes | 180 (36.4) | 24 (4.9) |
| Sorensen time <72.14a | No | 312 (63.3) | 46 (9.3) | 0.02*p*=0.887 |
| Yes | 117 (23.7) | 18 (3.7) |
| UQP with SFMA Rotationa | No | 429 (86.8) | 64 (13) | *p=1.00* |
| Yes | 1 (0.2) | 0 (0) |
| UQP with Side Bridge | No | 397 (80.4) | 59 (11.9) | 0.001*p*=0.969 |
| Yes | 33 (6.7) | 5 (1.0) |
| UQP with Hurdle Stepa | No | 428 (86.6) | 64 (13.0) | *p*=1.00 |
| Yes | 2 (0.4) | 0 (0) |

\*Fisher’s exact p-value.

**Supplementary Table S4:** Full reporting of dichotomous and ordinal potential predictor variable frequencies observed for the whole group (overall) and for those with and without upper quadrant injury (UQI), with Chi-square tests and odds ratios reflecting the association between predictors and UQI event. Where stated, analysis for entire group and for males only are indicated. Where not stated, analysis is for entire group.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Descriptive Variable | Category | Frequency (%) Overall | Frequency (%) No UQI | Frequency (%) UQI | Chi Square (p value) | Odds Ratio |
| Sex | Male | 390(90.7) | 365(84.9) | 25(5.8) | p=0.53\* | 0.93 |
| Female | 40(9.3) | 38(8.8) | 2(0.5) |
| Rank (all participants) | Junior Non-Commissioned Officer | 356 (82.8) | 333 (77.4) | 23 (5.3) | p =1.00\* |  |
| Senior Non-Commissioned Officer | 36 (8.4) | 34 (7.9) | 2 (0.5) |
| Officer | 38 (8.8) | 36 (8.4) | 2 (0.5) |
| Rank (males only) | Junior Non-Commissioned Officer | 323 (82.8) | 302 (77.4) | 21 (5.4) | *p* = 1.00\* |  |
| Senior Non-Commissioned Officer | 33 (8.5) | 31 (7.9) | 2 (0.5) |
| Officer | 34 (8.7) | 32 (8.2) | 2 (0.5) |
| Trades (all participants) | Combat | 176 (40.9) | 168 (39.1) | 8 (1.9) | 1.52 (.22) |  |
| Support | 254 (59.1) | 235 (54.7) | 19 (4.4) |
| Trades (males only) | Combat | 172 (44.1) | 164 (42.1) | 8 (2.1) | *p* = .15\* | 1.73  |
| Support | 218 (55.9) | 201 (51.5) | 17 (4.4) |
| Percent time spent with physical demands (all participants) | 0-25% of Work Time/week | 140 (32.6) | 131 (30.5) | 9 (2.1) | *p* = .36\* |  |
| 25-50% | 158 (36.8) | 151 (35.2) | 7 (1.6) |
| 50-75% | 92 (21.4) | 83 (19.3) | 9 (2.1) |
| 75-100% | 39 (9.1) | 37 (8.6) | 2 (0.5) |
| Percent time spent with physical demands (males only) | 0-25% of Work Time/week | 126 (32.4) | 118 (30.3) | 8 (2.1) | *p* = 0.30\* |  |
| 25-50% | 142 (36.5) | 136 (35.0) | 6 (1.5) |
| 50-75% | 84 (21.6) | 75 (19.3) | 9 (2.3) |
| 75-100% | 37 (9.5) | 35 (9.0) | 2 (0.5) |
| Time in Military (all participants) | < 1 year | 14 (3.3) | 14 (3.3) | 0 (0) | *p* = .33\* |  |
| 1 - <5 years | 168 (39.1) | 157 (36.5) | 11 (2.6) |
| 5 - <10 years  | 147 (34.2) | 137 (31.9) | 10 (2.3) |
| 10 - <20 years | 79 (18.4) | 76 (17.7) | 3 (0.7) |
| >20 years | 22 (5.1) | 19 (4.4) | 3 (0.7) |
| Time in Military (males only) | < 1 year | 13 (3.3) | 13 (3.3) | 0 (0) | *p* = 0.26\* |  |
| 1 - <5 years | 154 (39.5) | 144 (36.9) | 10 (2.6) |
| 5 - <10 years  | 132 (33.8) | 123 (31.5) | 9 (2.3) |
| 10 - <20 years | 71 (18.2) | 68 (17.4) | 3 (0.8) |
| >20 years | 20 (5.1) | 17 (4.4) | 3 (0.8) |
| **Smoking Status** | **Non-smoker (0)** | **260 (60.6)** | **249 (58.0)** | **11 (2.6)** | **p = 0.03\*** | **2.33** |
| **Smokers (1+2)** | **169 (39.4)** | **153 (35.7)** | **16 (3.7)** |
| Previous MELs for ≥8 weeks’ duration | No | 403(93.7) | 379(88.1) | 24(5.6) | p=0.24\* | 2.21 |
| Yes | 27(6.3) | 3(0.7) | 24(5.6) |
| **>1 previous UQI** | **No** | **336(78.1)** | **319(74.2)** | **17(4.0)** | **3.89(0.05)** | **2.27** |
| **Yes** | **94(21.9)** | **84(19.5)** | **10(2.3)** |
| **Baseline UQ Function ≤90%** | **No** | **391(90.9)** | **370 (86)** | **21 (4.9)** | **6.04 (0.03)** | **3.34** |
| **Yes** | **39(9.1)** | **33 (7.7)** | **6 (1.4)** |
| SFMA Flexion | No | 260(60.9) | 240(56.2) | 20(4.7) | 2.10(0.10) | 0.55 |
| Yes | 167(39.1) | 160(37.6) | 7(1.6) |
| SFMA Extension | No | 353(82.7) | 329(77.0) | 24(5.6) | p=0.28\* | 0.66 |
| Yes | 74(17.3) | 71(16.6) | 3(0.7) |
| SFMA Rotation Asymmetry | No | 423(98.4) | 397(92.3) | 26(6.0) | p=0.37\* | 3.46 |
| Yes | 7(1.6) | 6(1.4) | 1(0.2) |
| **YBT-UQ Superolateral Worst ≤57.75 cm**  | **No** | **264(61.5)** | **252(58.7)** | **12(2.8)** | **3.56(0.05)** | **2.08** |
| **Yes** | **165(38.5)** | **150(35.0)** | **15(3.5)** |
| **YBT-UQ Composite Worst ≤81.10%** | **No** | **312(72.7)** | **298(69.5)** | **14(3.3)** | **6.33(0.01)** | **2.66** |
| **Yes** | **117(27.3)** | **104(24.2)** | **13(3.0)** |
| Shoulder Mobility Worst Score | 0 | 142(33.1) | 131(30.5) | 11(2.6) | 2.88(0.25) |  |
| 2 | 126(29.4) | 116(27.0) | 10(2.3) |
| 4 | 161(37.5) | 155(36.1) | 6(1.4) |
| Shoulder Mobility Asymmetry | 0 | 275(64.1) | 260(60.6) | 15(3.5) | 1.26(0.54)\* |  |
| 2 | 117(27.3) | 108(25.2) | 9(2.1) |
| 4 | 37(8.6) | 34(7.9) | 3(0.7) |
| Shoulder Mobility Total Score  | 0 | 63(14.7) | 58(13.5) | 5(1.2) | 3.57(0.46)\* |  |
| 2 | 42(9.8) | 39(9.1) | 3(0.7) |
| 4 | 88(20.5) | 81(18.9) | 7(1.6) |
| 6 | 75(17.5) | 69(16.1) | 6(1.4) |
| 8 | 161(37.5) | 155(36.1) | 6(1.4) |
| **Shoulder Clearance** | **Negative** | **381(89.4)** | **359(84.3)** | **22(5.2)** | **1.93(0.14)** | **2.17** |
| **Positive** | **45(10.6)** | **40(9.4)** | **5(1.2)** |
| Rotary Stability Worst Score | 0 | 53(12.3) | 48(11.2) | 5(1.2) | 1.93(0.34)\* |  |
| 2 | 366(85.1) | 345(80.2) | 21(4.9) |
| 6 | 11(2.6) | 10(2.3) | 1(0.2) |
| Rotary Stability Asymmetry  | 0 | 377(87.7) | 354(82.3) | 23(5.3) | 0.68(0.71)\* |  |
| 2 | 18(4.2) | 17(4.0) | 1(0.2) |
| 4 | 35(8.1) | 32(7.4) | 3(0.7) |
| Rotary Stability Total Score | 0 | 35(8.1) | 31(7.2) | 4(0.9) | 3.48(0.43)\* |  |
| 2 | 18(4.2) | 17(4.0) | 1(0.2) |
| 4 | 331(77.0) | 313(72.8) | 18(4.2) |
| 8 | 35(8.1) | 32(7.4) | 3(0.7) |
| 12 | 11(2.6) | 10(2.3) | 1(0.2) |
| Trunk Stability Push-up Score | 0 | 91(21.3) | 88(20.6) | 3(0.7) | 2.26(0.33) |  |
| 5 | 106(24.8) | 97(22.7) | 9(2.1) |
| 12 | 231(54) | 216(50.5) | 15(3.5) |
| In-Line Lunge Worst Score | 0 | 37(8.6) | 32(7.4) | 5(1.2) | 5.72(0.28)\* |  |
| 2 | 13(3.0) | 12(2.8) | 1(0.2) |
| 4 | 20(4.7) | 19(4.4) | 1(0.2) |
| 6 | 51(11.9) | 46(10.7) | 5(1.2) |
| 8 | 142(33.0) | 135(31.4) | 7(1.6) |
| 10 | 167(38.8) | 159(37.0) | 8(1.9) |
| UQP with SFMA Flexion | No | 429(99.8) | 402(93.5) | 27(6.3) | p=0.94\* | 4.88 |
| Yes | 1(0.2) | 1(0.2) | 0(0.0) |
| UQP with SFMA Extension | No | 427(99.3) | 400(93.0) | 27(6.3) | p=0.82\* | 2.08 |
| Yes | 3(0.7) | 0(0.0) | 3(0.7) |
| **UQP with SFMA Rotationa** | **No** | **429(99.8)** | **403(93.7)** | **26(6.0)** | **p=0.06\*** | **45.72** |
| **Yes** | **1(0.2)** | **0(0.0)** | **1(0.2)** |
| **UQP with Side Bridge** | **No** | **397(92.3)** | **374(87.0)** | **23(5.3)** | **p=0.14\*** | **2.43** |
| **Yes** | **33(7.7)** | **29(6.7)** | **4(0.9)** |
| **UQP with Hurdle Stepa** | **No** | **428(99.5)** | **402(93.5)** | **26(6.0)** | **p=0.12\*** | **15.21** |
| **Yes** | **2(0.5)** | **1(0.2)** | **1(0.2)** |
| UQP with Deep Overhead Squat  | No | 416(96.7) | 389(90.5) | 27(6.3) | p=0.40\* | 0.49 |
| Yes | 14(3.3) | 14(3.3) | 0(0.0) |
| UQP with In Line Lunge | No | 424(98.6) | 397(92.3) | 27(6.3) | p=0.68\* | 1.11 |
| Yes | 6(1.4) | 6(1.4) | 0(0.0) |
| In**In-line Lunge Total Score <15**InIn | **No** | **320 (74.4)** | **304 (70.7)** | **16 (3.7)** | ***P=* 3.48 (.06)** | **2.11**  |
| **Yes** | **110 (25.6)** | **99 (23)** | **11 (2.8)** |
| **In-line Lunge Asymmetry >1** | **No** | **250 (58.1)** | **239 (55.6)** | **11 (2.6)** | **3.583.58 (.05)** | **2.12** |
| **Yes** | **180 (41.9)**  | **164 (38.1)** | **16 (3.7)** |
| UQP with Trunk Instability Push Up | No | 420(97.7) | 393(91.4) | 27(6.3) | p=0.52\* | 0.68 |
| Yes | 10(2.3) | 10(2.3) | 0(0.0) |
| UQP with Extension Clearance  | No | 429(99.8) | 402(93.5) | 27(6.3) | p=0.94\* | 4.88 |
| Yes | 1(0.2) | 1(0.2) | 0(0.0) |
| UQP with Rotary Stability | No | 429(99.8) | 402(93.5) | 27(6.3) | p=0.94\* | 4.88 |
| Yes | 1(0.2) | 1(0.2) | 0(0.0) |
| UQP with Flexion Clearance | No | 426(99.1) | 399(92.8) | 27(6.3) | p=0.77\* | 1.61 |
| Yes | 4(0.9) | 4(0.9) | 0(0.0) |
| UQP with Shoulder Mobility | No | 364(84.7) | 342(79.5) | 22(5.1) | 0.22(0.40) |  |
| Yes | 66(15.3) | 61(14.2) | 5(1.2) |
| **Sorensen time <72.14a** | **No** | **312 (72.7)** | **297 (69.2)** | **15 (3.5)** | **4.28 (.04)** | **2.26** |
| **Yes** | **117 (27.3)** | **105 (24.5)** | **12 (2.8)** |

Variables potentially predictive of UQI are bolded (p<0.20 and OR ≥2.0). aNot included in the logistic regression model for collinearity or lack of theoretical relevance to upper quadrant injury. \*Fisher’s exact p-value.

**Additional References for Supplementary Tables**

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