The Functional Movement Screen: A Reliability Study

**STUDY DESIGN:** Reliability study.

**OBJECTIVES:** To determine intrarater test-retest and interrater reliability of the Functional Movement Screen (FMS) among novice raters.

**BACKGROUND:** The FMS is used by various examiners to assess movement and predict time-loss injuries in diverse populations (eg, youth to professional athletes, firefighters, military service members) of active participants. Unfortunately, critical analysis of the reliability of the FMS is currently limited to 1 sample of active college-age participants.

**METHODS:** Sixty-four active-duty service members (mean ± SD age, 25.2 ± 3.8 years; body mass index, 25.1 ± 3.1 kg/m²) without a history of injury were enrolled. Participants completed the 7 component tests of the FMS in a counterbalanced order. Each component test was scored on an ordinal scale (0 to 3 points), resulting in a composite score ranging from 0 to 21 points. Intrarater test-retest reliability was assessed between baseline scores and those obtained with repeated testing performed 48 to 72 hours later. Intrarater reliability was based on the assessment from 2 raters, selected from a pool of 8 novice raters, who assessed the same movements on day 2 simultaneously. Descriptive statistics, weighted kappa (κw), and percent agreement were calculated on component scores. Intraclass correlation coefficients (ICCs), standard error of the measurement, minimal detectable change (MDCw), and associated 95% confidence intervals (CIs) were calculated on composite scores.

**RESULTS:** The average ± SD score on the FMS was 15.7 ± 0.2 points, with 15.6% (n = 10) of the participants scoring less than or equal to 14 points, the recommended cutoff for predicting time-loss injuries. The intrarater test-retest and interrater reliability of the FMS composite score resulted in an ICCw of 0.76 (95% CI: 0.63, 0.85) and an ICC2,1 of 0.74 (95% CI: 0.60, 0.83), respectively. The standard error of the measurement of the composite test was within 1 point, and the MDCw values were 2.1 and 2.5 points on the 21-point scale for intrarater and interrater reliability, respectively. The interrater agreement of the component scores ranged from moderate to excellent (κw = 0.45-0.82).

**CONCLUSION:** Among novice raters, the FMS composite score demonstrated moderate to good intrarater and interrater reliability, with acceptable levels of measurement error. The measures of reliability and measurement error were similar for both intrarater reliability that repeated the assessment of the movement patterns over a 48- to 72-hour period and interrater reliability that had 2 raters assess the same movement pattern simultaneously. The interrater agreement of the FMS component scores was good to excellent for the push-up, quadruped, shoulder mobility, straight leg raise, squat, hurdle, and lunge. Only 15.6% (n = 10) of the participants were identified to be at risk for injury based on previously published cutoff values.

**KEY WORDS:** Injury prediction, injury prevention, injury risk, intrarater, interrater

More than 10,000 Americans seek medical treatment for sports, recreational activity, and exercise-related injuries on a daily basis. Researchers have estimated that 50% to 80% of these injuries are overuse in nature and involve the lower extremities. In the military, physical training and exercise-related injuries account for 30% of hospitalizations and 40% to 60% of all outpatient visits, with 10 to 12 injuries per 100 soldier-months. Although the risk of musculoskeletal conditions and injuries is multifactorial, preliminary evidence suggests that neuromuscular and strength training programs may be beneficial for preventing the occurrence of these conditions. However, tools that assess movement to help predict those at highest risk for musculoskeletal conditions and injuries have been lacking for both athletic and military populations. The Functional Movement Screen (FMS) is a relatively new tool that attempts to address multiple movement factors, with the goal of predicting general risk of musculoskeletal conditions and injuries.
conditions and injuries. The FMS was designed to identify functional movement deficits and asymmetries that may be predictive of general musculoskeletal conditions and injuries, with an ultimate goal of being able to modify the identified movement deficits through individualized exercise prescription. The FMS consists of 7 fundamental movement component tests (FIGURE 1) that are scored on a scale of 0 to 3, with the sum creating a composite score ranging from 0 to 21 points. The 7 movement patterns that are assessed include the deep squat, in-line lunge, hurdle step, shoulder mobility, active straight leg raise, trunk stability push-up, and quadruped rotary stability.

Preliminary research by Kiesel et al suggests that National Football League (NFL) players (n = 46) who had a composite score less than or equal to 14 on the FMS had an odds ratio of 11.7 (95% confidence interval [CI]: 2.5, 54.5) and a positive likelihood ratio of 5.8 (95% CI: 2.0, 18.4) to sustain a time-loss injury. Although the specificity was relatively high (0.9; 95% CI: 0.8, 1.0), the sensitivity was low (0.5; 95% CI: 0.3, 0.7), indicating that FMS composite scores less than or equal to 14 may suggest higher injury risk but FMS composite scores greater than 14 do not rule out future injury risk. In a separate study on a group of Marines, a composite score less than or equal to 14 on the FMS demonstrated limited ability to predict all future musculoskeletal injuries (traumatic or overuse), with a sensitivity of 0.45 and specificity of 0.71, while the same cutoff value was able to predict a serious injury (any injury that was severe enough to remove the participant from the training program) with a sensitivity of 0.12 and a specificity of 0.94. The FMS was also able to predict injury risk in female collegiate athletes. Finally, in another study, firefighters with a previous history of injury demonstrated lower FMS composite scores. However, it is not clear for which sports or professions the FMS is optimal in predicting injury risk, what types of musculoskeletal injuries are predicted by low FMS composite scores, and whether the original cutoff score of less than or equal to 14 points on the FMS is valid in the different populations.

Additionally, researchers have found that FMS composite scores increased in football players, firefighters, and service members following corrective exercises that addressed possible impairments associated with altered movement patterns noted on the FMS component tests. In a group of Marines, 80% of those with a score less than or equal to 14 also demonstrated lower fitness scores on a standardized fitness test compared to those who had an FMS composite score greater than 14. However, Okada et al found that FMS composite scores were not related to performance or core stability measures among healthy participants. Interpretation of FMS scores is limited by the scant evidence regarding the FMS’s psychometric properties and, in particular, the reliability of both composite and individual component scores. An initial study by Minick et al found acceptable levels of interrater agreement on the FMS component scores among novice and expert raters in a sample of active college-age participants (to include college varsity athletes). However, this study had several limitations: (1) it did not assess test-retest reliability, (2) all raters assessed the same movement pattern via videotaped analysis, and (3) it only assessed agreement of individual FMS component scores and did not assess the overall FMS composite score, which is typically used as the primary indicator of injury risk. Traditionally, the FMS is assessed in real time, without the benefit of video playback. Variability of human movement across trials theoretically should exist; therefore, test-retest analysis could lower the reported agreement values. Additionally, the FMS is often assessed in a group setting (eg, preseason physical or preparticipation screening), requiring the use of multiple raters, who may or may not be the same raters to assess the movement at follow-up testing. Therefore, a more robust reliability study is required to enhance the understanding of the psychometric properties of the FMS.

Although these initial FMS studies, which established the validity of the FMS
for predicting musculoskeletal conditions and injuries and the response to training, are encouraging, their data are preliminary and not published in widely accessible journals. Exploring the psychometric properties of the FMS in a large active population would enhance the generalizability of the previous findings beyond a limited subgroup of professional and collegiate athletes and students. The primary purpose of this study was to determine the intrarater (test-retest) and interrater reliability of the FMS component and composite scores in young, healthy service members, when tested by a counterbalance group of novice raters in real time. Specifically, agreement was assessed on the FMS component scores, whereas reliability, response stability, and error threshold measurements were obtained for the FMS composite scores. A secondary purpose of this study was to describe the FMS component and composite scores in this population.

METHODS

Participants

The convenience sample included participants who were recruited over an 8-week period from service members in training at Fort Sam Houston, TX. Potential participants were provided a briefing about the study and were given the opportunity to volunteer. Participants were eligible for inclusion if they were between the ages of 18 and 35 years or emancipated minors (17-year-olds who are considered adults and allowed to join the armed services), fluent in English, and had no current or previous complaint of lower extremity pain, spine pain, or medical or neuromusculoskeletal disorders that limited participation in work or exercise in the last 6 months. Participants were excluded if they were currently seeking medical care for lower extremity injuries or had previous medical history that included any surgery for lower extremity injuries. Participants were also excluded if they were unable to participate in physical training due to other musculoskeletal injuries; had a history of fracture (stress or traumatic) in the femur, pelvis, tibia, fibula, talus, or calcaneus; or were known to be pregnant.

Potential participants were provided an overview of the research study and specific details of the entrance criteria. After the presentation was completed, those who met the entrance criteria were asked to squat and then hop unilaterally in the group setting. Individuals who met the entrance criteria and did not have pain on the squat and hop tests were informed about upcoming data collection dates. Those individuals who opted to volunteer returned the following week to sign informed consent forms and were enrolled in the study. Within the military training environment, these procedures allowed potential participants the option to not return if they were not interested in volunteering in the study, and were designed to minimize any potential perception of coercion. All participants signed consent forms approved by the Brooke Army Medical Center Institutional Review Board.

Examiners

The novice examiners participating in this study consisted of 8 physical therapy students enrolled in their second and third semesters of a doctor of physical therapy training program prior to their 1-year clinical internship. Before testing, all examiners underwent 20 hours of FMS training led by 4 physical therapists and 1 research assistant. Four physical therapy students were randomly assigned to the participants to assess intrarater test-retest reliability by assessing the FMS on day 1 and day 2. The goal of randomly selecting a rater to perform the intrarater test-retest reliability was to increase the variability in the study design. Each rater used for the intrarater test-retest reliability measured between...
Sixty-four participants (53 males, 11 females) met the inclusion and exclusion criteria and completed the study (Table 1). The mean ± SD age of the participants was 25.2 ± 3.8 years and their body mass index was 25.1 ± 3.1 kg/m². Overall, the participants included routine exercisers who endorsed a statement that they exercised a minimum of 4 days per week (n = 54, 78.2%). Although the participants were attending training for their military occupation, the majority of the participants were routine exercisers for more than 3 years. Specifically, 29 (45.3%) participants reported performing routine exercise for more than 5 years, 21 (32.8%) for 3 to 5 years, 9 (14.1%) for 1 to 3 years, and 5 (7.8%) for less than 1 year. Descriptive statistics on FMS performance are provided in Table 2. None of the participants had pain on the 3 FMS clearing tests. Interrater reliability was calculated on 63 participants, based on an illness of 1 of the raters on day 2 of testing. Only 15.6% (n = 10) of the participants were identified to be at risk for injury, based on an FMS composite score of less than or equal to 14 points.

Agreement of the 7 component tests of the FMS (scored 0 to 3) demonstrated moderate to excellent interrater agreement (Table 3). Specifically, the novice raters demonstrated excellent interrater agreement on the trunk stability push-up; substantial interrater agreement on the quadruped rotary stability, deep squat, active straight leg raise, hurdle step, and shoulder mobility component tests; and moderate interrater agreement on the in-line lunge. Intrarater (test-retest) agreement scores at 48 to 72 hours demonstrated substantial agreement on the trunk stability push-up, shoulder mobility, active straight leg raise, deep squat, and in-line lunge component tests; moderate agreement on the hurdle step; and poor agreement on the quadruped rotary

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**RESULTS**

Sixty-four participants (53 males, 11 females) met the inclusion and exclusion criteria and completed the study (Table 1). The mean ± SD age of the participants was 25.2 ± 3.8 years and their body mass index was 25.1 ± 3.1 kg/m². Overall, the participants included routine exercisers who endorsed a statement that they exercised a minimum of 4 days per week (n = 54, 78.2%). Although the participants were attending training for their military occupation, the majority of the participants were routine exercisers for more than 3 years. Specifically, 29 (45.3%) participants reported performing routine exercise for more than 5 years, 21 (32.8%) for 3 to 5 years, 9 (14.1%) for 1 to 3 years, and 5 (7.8%) for less than 1 year. Descriptive statistics on FMS performance are provided in Table 2. None of the participants had pain on the 3 FMS clearing tests. Interrater reliability was calculated on 63 participants, based on an illness of 1 of the raters on day 2 of testing. Only 15.6% (n = 10) of the participants were identified to be at risk for injury, based on an FMS composite score of less than or equal to 14 points.

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The interrater reliability (same day) of the FMS composite score (scored 0-21) resulted in an ICC 2,1 of 0.76 (95% CI: 0.63, 0.85) and was considered good (TABLE 4). The SEM for interrater reliability of the composite test was 0.92 points, and the MDC95 was 2.54 points on the 21-point scale. Visual representation of the FMS composite scores between raters is provided in FIGURE 2. The intrarater reliability (test-retest at 48 to 72 hours) of the FMS composite scores resulted in an ICC3,1 of 0.74 (95% CI: 0.60, 0.83) and was considered to be moderate (TABLE 4). Visual representation of the intrarater test-retest FMS composite scores is provided in FIGURE 3. The SEM for intrarater test-retest reliability was 0.98 points and the MDC95 was 2.07 points.

**DISCUSSION**

The FMS has an adequate level of reliability when assessed in healthy service members by novice raters. The interrater agreement of the FMS component scores ranged from moderate to excellent, with 6 of the 7 tests categorized as having substantial agreement (κw > 0.60). The intrarater and interrater point estimates of the FMS composite score reliability ranged from 0.74 to 0.76, with the 95% CIs suggestive of moderate to good reliability. The SEMs for both interrater and intrarater reliability were less than 1 point, while the MDC95 ranged from 2.1 to 2.5 points on the 21-point scale. The SEM and MDC values were similar for both intrarater reliability that repeated the assessment of the movement patterns over a 48- to 72- hour period and interrater reliability that had 2 raters assess the same movement pattern simultaneously. Therefore, one can expect the error of measurement to be within 1 point across raters and across time, while a minimum improvement between 2 and 3 points on the 21-point scale would be required to demonstrate a real change over time.

These results are consistent with a prior publication on FMS reliability. Minick et al16 reported substantial to excellent interrater agreement on individual FMS component scores when using 2 novice and 2 expert raters assessing videotape performance of active college-age students and varsity athletes. Adding to the literature, our study provides detailed information on the intrarater and interrater reliability of both FMS component and composite scores by randomly assigned novice raters. Specifically, our study utilized 8 entry-level physical therapy students as raters to collect data prior to their clinical internship. Additionally, these raters measured all movements in real time, without the benefit of being able to replay a videotape (the methodology used by Minick et al16). The increased number of raters and real-time analysis of movement in multiple participants in our study mimic a preparticipation screening environment, thus enhance the generalizability of the results. Further research is needed to assess the stability of the FMS scores over longer periods. Ultimately, the reliability of this group of novice raters was comparable to previously published research and provides further support for the FMS as a reliable tool to screen in a relatively diverse, noncollegiate but physically active population.16

Only 15.6% (n = 10) of the participants in this study had an FMS composite score less than or equal to 14 points.
Although this may not seem surprising, given that the participants were relatively healthy, it supports the suggestion by Cook et al.\(^3\)\(^4\) that FMS scores can identify altered movement patterns in generally healthy and pain-free participants. Our results are similar to those published by O’Connor et al.,\(^2\)\(^1\) who found that 10% of the 874 Marine officer candidates scored less than or equal to 14 points on the FMS. If the initial research that identified the cutoff value were validated, it would suggest that the FMS would be capable of identifying a subset of individuals at increased risk for time-loss injury within a population of young, healthy service members. Based on the use of the FMS for mass screenings (eg, preseason or annual physical examinations), an injury prediction screening that could identify only 15.6% of the population as having a high injury risk would allow the associated medical staff to prioritize the allocation of limited resources toward the development of individualized injury prevention interventions (eg, corrective exercise prescriptions) for this group. However, the validity of the 14-point cutoff score for this sample cannot be verified in this study, because longitudinal follow-up was not performed to assess actual injury rates. Based on the SEM of 1 point and the MDC\(_{\text{95}}\) value between 2.1 and 2.5 points, it would be more conservative to use a cutoff score of 15 (based on SEM) or 16 to 17 (based on MDC\(_{\text{95}}\)) to determine those who may benefit from corrective exercise prescription to help mitigate injury risk, until the validity of the 14-point cutoff value can be determined.

One of the limitations noted in the FMS component tests was a restriction in the range of scores. Specifically, based on our inclusion/exclusion criteria, no participants scored a 0 on any of the FMS component tests, and only 18 of the 446 scored movement patterns resulted in a score of 2; the remaining movement patterns either received a score of 2 or 3. This restriction in range might have reduced the reliability estimates of the FMS component scores. For example, the in-line lunge was determined to have a weighted kappa of 0.45; for this test, no movements were scored as a 0 or 1. Additionally, only 11 of the 63 paired ratings had a disagreement, with 25 agreements for a score of 2 and 27 agreements for a score of 3. Compared to the other FMS component scores, the in-line lunge and the quadruped rotary stability had the biggest discrepancy between the percent agreement (68% and 83%, respectively) and weighted kappa (0.45 and 0.29, re-
respectively). Interestingly, the lowest levels of agreement between novice raters for both our study and Minick et al involved the in-line lunge and quadruped rotary stability tests. Difficulty in performing the quadruped rotary stability test (only 5 of the 64 participants obtained a score of 3 on day 1) also limited variability and potentially intrarater agreement of this measure. Although the restricted range might have influenced statistical calculations, it is important to point out that rater experience and lack of clearly defined scoring criteria, especially mid-range performance, may have also influenced results for these select measures. Future research should determine whether better criteria may help to differentiate levels of performance on the quadruped rotary stability test or to determine the influence of removing the quadruped rotary stability test on the predictive validity of the FMS composite score.

Future study designs should assess the reliability of the FMS using novice raters and participants with varying activity levels and sport-specific requirements. Additional longitudinal studies are also required to establish the predictive validity and optimal cut score for various populations. This level of critical investigation would help to enhance the external validity of the FMS and to substantiate its use in the general clinical population, as well as in specific sports settings. Future research should also determine whether there is a ceiling effect in the ability of the FMS to detect change over time. Based on the MDC95 of 2.1 to 2.5 points, positive change may not be able to be noted for individuals who score greater than 18 points at baseline testing. Different scoring criteria or cutoff values may be needed to better differentiate high-end performance on the FMS.

CONCLUSIONS

Among novice raters, the FMS composite score demonstrated moderate to good interrater and intrarater reliability, and acceptable levels of measurement error. The measures of reliability and measurement error were similar for both intrarater reliability that repeated the assessment of the movement patterns over a 48-to-72–hour period and interrater reliability that had 2 raters assess the same movement pattern simultaneously. The interrater agreement of the FMS component scores was good to excellent for the push-up, quadruped, shoulder mobility, straight leg raise, squat, hurdle, and lunge. Only 15.6% (n = 10) of the participants were identified as being at risk for injury based on previously published cutoff values.

KEY POINTS

FINDINGS: When using novice raters, the FMS composite scores had moderate to good reliability (ICC = 0.74 and 0.76; SEM, 1.0 points; MDC95, 2.1 and 2.5 points) and the FMS component scores ranged from moderate to excellent agreement (κ = 0.29-0.82).

IMPLICATIONS: The FMS has adequate reliability when assessed in young, healthy service members by novice raters over a 48–to-72–hour period.

CAUTION: Reliability data must be interpreted within the context of the sample tested and the methods used (ie, time between testing for test-retest reliability estimates).

ACKNOWLEDGEMENTS: This study was done in collaboration with research assistants from the University of Texas Health Science Center, Physical Therapy Department, San Antonio, TX: Mark Bauernfeind, Francis Bisagni, Jordan Boldt, Cindy Boyer, Cara Dobbertin, Steve Elliott, Angela Gass, Germaine Herman, Lacey Jung, Jake Mitcheff, Teddy Ortiz, Kelly Rabon, Jason Smith, Megan Swint, Joshua Trax, and Jerry Yeung. Additional research assistants from US Army-Baylor University, Department of Physical Therapy, US Army Medical Department Center and School, San Antonio, TX: First Lieutenant Moshe Greenberg, Captain Sarah Hill, First Lieutenant Crystal Strasseke, First Lieutenant Sarah Villena, First Lieutenant Christina Yost, First Lieutenant Kristen Zosel, First Lieutenant Rick Warren, and First Lieutenant Sam Wood. Illustrations for the APPENDIX were provided by Elizabeth Holder.

REFERENCES

13. Kiesel K, Plishky P, Butler R. Functional move-


APPENDIX

FUNCTIONAL MOVEMENT SCREEN

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Deep Squat</td>
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</tbody>
</table>

3 • Upper torso is parallel with tibia or toward vertical
• Femur below horizontal
• Knees are aligned over feet
• Dowel aligned over feet

2 Performed with heels on 2 × 6-in board
• Upper torso is parallel with tibia or toward vertical
• Femur below horizontal
• Knees are aligned over feet
• Dowel aligned over feet

1 Performed with heels on 2 × 6-in board
• If any of the 4 criteria are not met when the squat is performed with heels on 2 × 6-in board, the score is 1

0 • Pain during test
### APPENDIX

#### Score Criteria Illustration

**Hurdle Step (test both right and left sides)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
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</table>
| 3     | • Foot clears cord (does not touch) and remains dorsiflexed as leg is lifted over hurdle  
• Hips, knees, and ankles remain aligned in the sagittal plane  
• Minimal to no movement is noted in lumbar spine  
• Dowel and hurdle remain parallel | ![Hurdle Step Illustration](image) |
| 2     | • Alignment is lost between hips, knees, and ankles  
• Movement is noted in lumbar spine  
• Dowel and hurdle do not remain parallel | |
| 1     | • Contact between foot and hurdle  
• Loss of balance is noted | |
| 0     | • Pain during test | |

**In-line Lunge (test both right and left sides)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
</tr>
</thead>
</table>
| 3     | • Knee touches board behind heel  
• Dowel and feet remain in sagittal plane  
• Dowel contacts remain (head, thoracic spine, sacrum)  
• Dowel remains vertical, no torso movement noted | ![In-line Lunge Illustration](image) |
| 2     | • Knee does not touch behind heel  
• Dowel and feet do not remain in sagittal plane  
• Dowel contacts do not remain  
• Dowel remains vertical  
• Movement is noted in torso | |
| 1     | • Loss of balance is noted  
• Inability to achieve start position  
• Inability to touch knee to board | |
| 0     | • Pain during test | |

**Active Straight Leg Raise (test both right and left sides)**

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
</tr>
</thead>
</table>
| 3     | • Malleolus of tested lower extremity located in the region between mid-thigh and anterior superior iliac spine of opposite lower extremity (green region)  
• Opposite hip remains neutral (hip does not externally rotate), toes remain pointing up  
• Opposite knee remains in contact with board | ![Active Straight Leg Raise Illustration](image) |
| 2     | • Malleolus of tested lower extremity located in the region between mid-thigh and knee joint line of opposite lower extremity (yellow region) while other criteria are met | |
| 1     | • Malleolus of tested lower extremity located in the region below knee joint line of opposite lower extremity (red region) while other criteria are met | |
| 0     | • Pain during test | |
## APPENDIX

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>• Fists are within 1 hand length</td>
<td>*<strong>Shoulder Mobility (test both right and left sides)</strong></td>
</tr>
<tr>
<td>2</td>
<td>• Fists are within 1.5 hand lengths</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>• Fists are not within 1.5 hand lengths</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>• Pain during test</td>
<td></td>
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<tr>
<td></td>
<td><strong>Shoulder mobility clearing test</strong>: if pain is noted as elbow is lifted,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>shoulder mobility is scored as 0</td>
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<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
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<tbody>
<tr>
<td>3</td>
<td>• Perform 1 repetition; the thumbs are aligned with forehead for males</td>
<td><em><strong>Trunk Stability Push-up</strong></em></td>
</tr>
<tr>
<td></td>
<td>and chin for females</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Body is lifted as 1 unit (no sag in lumbar spine)</td>
<td></td>
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<tr>
<td>2</td>
<td>• Perform 1 repetition; the thumbs are aligned with chin for males and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>clavicle for females</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Body is lifted as 1 unit (no sag in lumbar spine)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>• Unable to perform 1 repetition with thumbs aligned with chin for males</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and clavicle for females</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>• Pain during test</td>
<td></td>
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<tr>
<td></td>
<td><strong>Extension clearing test</strong>: if pain is noted during a prone press-up,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>push-up is scored as 0</td>
<td></td>
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</tbody>
</table>
# APPENDIX

## Score Criteria Illustration

### Quadruped Rotary Stability (test both right and left sides)*

<table>
<thead>
<tr>
<th>Score</th>
<th>Criteria</th>
<th>Illustration</th>
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<tbody>
<tr>
<td>3</td>
<td>- 1 unilateral repetition (lift arm and leg from same side of body)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Keep spine parallel to board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Knee and elbow touch in line over the board and then return to the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- start position</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>- 1 diagonal repetition (lift arm and leg from opposite sides of body)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Keep spine parallel to board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Knee and elbow touch in line over the board and then return to the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- start position</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>- Inability to perform diagonal repetition</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>- Pain during test</td>
<td></td>
</tr>
</tbody>
</table>

*Flexion clearing test: if pain is noted during quadruped flexion, rotary stability is scored as 0.

*For component tests that are scored for both the right and left sides, the lower score is used when calculating the Functional Movement Screen composite score.

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