

## ORIGINAL ARTICLE

# The AuSpinal: a test of hand function for people with tetraplegia

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**Study design:** Five-phased reliability and validity study.

**Objectives:** To develop and test an assessment tool designed to quantify unilateral hand function in people with tetraplegia.

**Setting:** Seven spinal injury units in Australia.

**Methods:** The AuSpinal is a new assessment tool comprising seven tasks designed to quantify unilateral hand function in people with tetraplegia. There were five phases in this study: (1) development of the AuSpinal; (2) testing the test-retest and intrarater reliability of repeat ratings of 84 videos as determined by 13 therapists; (3) testing the interrater reliability and internal consistency of simultaneous real-life ratings of eight hands as determined by six therapists; (4) testing the range of scores from cross-sectional data obtained from 50 hands; and (5) quantifying sensitivity to change from longitudinal data collected over the course of rehabilitation from 16 hands.

**Results:** The test-retest, intrarater and interrater reliabilities were high (intraclass correlation coefficients ranged from 0.79 to 0.98, 95% CI ranged from 0.72 to 1.0) with a Cronbach  $\alpha$ -value of 0.93. There was a reasonable range in the scores obtained from the cross-sectional data of the 50 hands (interquartile range extended from 6 to 14). There was an obvious and marked change in AuSpinal scores over the course of patients' rehabilitation in 8 of the 16 hands.

**Conclusion:** The AuSpinal provides a quick and reliable instrument to test hand function in people with tetraplegia. It is useful for people with poor hand function but requires the addition of more complex tasks for those with good hand function.

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**Keywords:** spinal cord injury; tetraplegia; hand function; outcome assessment

## Introduction

Quantitative assessment of hand function in people with tetraplegia is important not only for day-to-day clinical practice but also for evaluating emerging therapies. Despite the large number of hand assessments,<sup>1</sup> none of them are ideal.<sup>2</sup> Most were designed for patients with injuries other than tetraplegia,<sup>3–8</sup> and those that were designed for tetraplegia evaluate the success of tendon transfers, functional electrical stimulation or neuroprosthetic implantations.<sup>8–11</sup> Consequently, such tests have floor effects and little sensitivity to change when used in the majority of patients. The few assessments that are potentially appro-

priate include timed and/or bilateral hand tasks.<sup>3,6,8,12</sup> Inclusion of such tasks creates a problem for clinical practice and research. For example, scores recorded as units of time are problematic for statistical analysis if patients are unable to complete tasks. Assessments involving both hands introduce confounders if patients have asymmetrical hand function or if clinical trials involve therapy for just one hand. A potentially suitable unilateral hand assessment was recently developed, but the scoring is heavily weighted on the type of hand grasp used by individuals, which is arguably of little importance provided individuals can use their hands effectively.<sup>13</sup> Therefore, the purpose of this study was to devise a simple, sensitive and reliable instrument to quantify unilateral hand function in people with tetraplegia, which has enough scope to cater to those with initially poor hand function. The instrument was named the AuSpinal.

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## Methods and Results

There were five phases in this study. For simplicity, the methods and results of each phase will be presented together. All descriptive data are expressed as means and standard deviations (s.d.) unless otherwise stated. The authors certify that all applicable institutional and governmental regulations with regard to the ethical use of human volunteers were followed during the course of this research.

### *Phase 1: Development of the AuSpinal*

**Methods.** The tasks of 20 existing hand assessments were reviewed and the seven most appropriate tasks for people with tetraplegia selected. A scoring system was then devised. To assess the face validity of the tasks and scoring system, both were presented to people with tetraplegia and therapists experienced in handling spinal cord injury (SCI), using an unstructured interview format. The goal of the interviews was to ensure that the tasks and scoring system were relevant for people with tetraplegia, and to adjust both as necessary, until a consensus was reached.<sup>14</sup> For example, interviews were conducted with people with tetraplegia on a one-to-one basis by one of the investigators. In addition, therapists experienced in the hand management of people with SCI and representing all SCI units in Australia met through teleconferences and at a national scientific meeting to refine and discuss the selected tasks and scoring system. Some tasks were modified to reflect real-life situations more accurately. For example, a coin task was modified to include manipulating it from a hip bag strapped around participants' waists.

**Results.** The final version of the AuSpinal consisted of seven tasks (see Appendix). Four of the seven tasks were based on elements of the Sollerman Hand Function Test<sup>7</sup> and involved manipulating a key, coin, telephone and metal nut. Two tasks were modified from the Rehabilitation Engineering Laboratory Hand Function Test For Functional Electrical Stimulation Assisted- Grasping,<sup>11</sup> and included manipulating a can of soft drink and a credit card. The last task was modified from the Upper Extremity Function Test,<sup>4</sup> but instead of manipulating small ball bearings, it involved manipulating a small, chocolate-covered candy mimicking a pill. Administration of the AuSpinal takes approximately 15 min per hand.

To establish a scoring paradigm, each task was divided into 3–6 subcomponents on the basis of an analysis of the critical steps that are involved in successful task performance. A unique aspect of the scoring system was that all decisions were dichotomized. For example, scoring for one of the subcomponents of the key task simply reflected whether the participant could, or could not, insert the key in the lock. The subcomponents were given different weightings using a theoretical approach to score allocation.<sup>14</sup> The score for each subcomponent was summed to obtain a total score for each task. The total scores differed between tasks reflecting their number of subcomponents (determined by the task analysis). Scores for each task were summed with a maximum possible score of 86.

### *Phase 2: Test-retest and intrarater reliability (from videos)*

**Methods.** Test-retest and intrarater reliability were assessed by asking therapists to rate performance after watching videos on two separate occasions. Eight people with tetraplegia were included in the videos. The median (interquartile range) time since injury was 4 years (3–12 years). All participants had bilateral motor complete lesions of C6 or C7, according to the International Standards for Neurological Classifications of SCI. Videos of both hands were made while participants completed the AuSpinal. The performances were not scripted or practiced. Ten performances reflecting a range of abilities were selected for each of the seven tasks. Two of these 10 performances (that is, 14 videos in total) were digitally manipulated to create an identical but mirrored version (that is, the right hand appeared like the left hand and vice-versa). This resulted in a compilation of 12 performances for each of the 7 tasks, making a total of 84 (12 × 7 tasks) videos. The digitally mirrored videos were randomly dispersed throughout and not disclosed to therapists. Labview Software (National Instruments, Austin, TX, USA) was used, enabling therapists to electronically rate each video.

A total of 17 therapists independently rated the 84 videos on one occasion and 13 therapists rated the same 84 videos on two occasions, separated by approximately 2 weeks. The therapists had varying amounts of SCI experience, ranging from 6 months to 25 years. None of them had used the AuSpinal before participation, but all were provided with written instructions about testing and scoring. The order of the videos for each task was randomized, but the order of the tasks was not. For example, all key tasks were randomized, but presented first and one after another. Therapists were able to view the videos for each task as often as necessary before rating them, but were unable to freely move backwards and forwards between tasks or revise a rating once nominated. Therapists' scores for each task and their total scores obtained during the first session were compared with the equivalent scores obtained during the second session to determine test-retest reliability. Therapists' scores for digitally mirrored videos were compared with each other to assess intrarater reliability. The reliability of the different data sets was determined using typical errors,<sup>15</sup> mean change scores, pairwise comparisons and intraclass correlations (and corresponding 95% CI).

**Results.** The test-retest reliability for each of the tasks rated across the two occasions is shown in Table 1. The intraclass correlation coefficients ranged from 0.79 to 0.98 (95% CI ranged from 0.72 to 0.96). The mean difference for each task was 0.5 points or less (95% CI ranged from -0.4 to 0.7). There were, however, small systematic test-retest differences for the two tasks presented first in the software package (that is, the key and coin tasks). The mean (95% CI) test-retest difference for the total score was 1.5 points (-0.1–3.1). The intrarater reliability from the comparison of digitally mirrored videos is shown in Table 2. The mean (95% CI) difference between ratings of digitally mirrored videos ranged between -0.2 and 0.3 points (95% CI ranged from

**Table 1** Results from phase 2: Test-retest reliability

Task	Maximal possible score	Mean difference (95% CI)	Typical error (95% CI)	ICC (95% CI)
Key	14	0.5 (0.2–0.7)	1.1 (0.9–1.2)	0.89 (0.85–0.92)
Coin	14	0.4 (0.1–0.6)	1.1 (1.0–1.2)	0.90 (0.86–0.92)
Nut and bolt	12	–0.1 (–0.4–0.1)	1.1 (1.0–1.2)	0.92 (0.89–0.94)
Card	14	0.1 (–0.1–0.4)	1.1 (0.9–1.2)	0.89 (0.85–0.92)
Candy	10	0.1 (–0.3–0.1)	0.8 (0.7–0.9)	0.79 (0.72–0.85)
Telephone	10	0.0 (–0.1–0.2)	0.6 (0.5–0.7)	0.90 (0.86–0.93)
Can	12	0.0 (–0.2–0.2)	0.8 (0.7–0.9)	0.95 (0.93–0.96)
Total	86	1.5 (–0.1–3.1)	1.6 (1.1–2.8)	0.98 (0.93–1.00)

The test-retest reliability for each of the tasks rated across the two occasions from the 84 videos. The mean difference, typical error and intraclass correlation coefficients (ICC) for each task and the total score are shown. The 95% confidence intervals (95% CI) are also provided.

**Table 2** Results from phase 2: Intra-rater reliability

Task	Mean difference (95% CI)	Typical error (95% CI)
Key	0.0 (–0.4–0.4)	0.0 (0.0–0.0)
Coin	0.3 (–0.3–0.9)	0.2 (0.2–0.3)
Card	0.0 (–0.2–0.1)	0.0 (0.0–0.0)
Candy	0.1 (–0.2–0.3)	0.0 (0.0–0.0)
Bolt	–0.2 (–0.5–0.2)	0.1 (0.1–0.1)
Phone	0.2 (–0.2–0.6)	0.1 (0.1–0.2)
Can	0.1 (–0.1–0.3)	0.1 (0.1–0.1)

The within-session reliability from the comparison of the digitally mirrored videos. The mean difference and typical error between the first and second viewing of the same but digitally mirrored video are shown. Data from the first viewing were pooled with the corresponding data from the second viewing two weeks later. The 95% confidence intervals (95% CI) are also provided.

–0.5 to 0.9). These differences were slightly less than the test-retest variability.

*Phase 3: Interrater reliability and internal consistency (from real-life performances)*

**Methods.** Interrater reliability and internal consistency of scores were assessed by asking six therapists to simultaneously watch and rate real-life AuSpinal assessments determined by one of the investigators. This was carried out on four participants (eight hands) with bilateral C6 or C7 motor complete lesions and a median (interquartile) time since injury of 7 years (3–12 years). The six therapists had varying levels of experience dealing with SCI, ranging from 6 months to 15 years. Therapists' scores were recorded in paper format and without consultation. Therapists' scores for each task and their total scores were compared to determine interrater reliability using pairwise comparisons. Therapists' scores of each of the seven tasks for the four participants (eight hands) were analyzed using the Cronbach's  $\alpha$ -value. This is a test of internal consistency and was used to determine whether the tasks were assessing similar or different domains.

**Results.** The interrater reliability indicated by the pairwise comparisons for each of the tasks is shown in Table 3. Three of the seven therapists had perfect concordance across total scores for all eight hands. The means (s.d.) of the differences across all pairwise comparisons in total scores were small.

Differences between therapists were dependent on the overall performance of the participant. That is, there was better concordance between therapists in participants with good hand function than in participants with poor hand function. For example, the coefficient of therapists' concordance in participants who scored above 60/86 was less than 1.2%. This equates to a one- to two-point difference in those scoring between 60/86 and 86/86. The coefficient of therapists' concordance in participants who scored less than 60/86 was approximately 15%, with the greatest variance being for the two participants with the poorest hand function. The overall Cronbach's  $\alpha$ -value was 0.93, indicating a very high concordance with tasks assessing a common domain. This result suggests that all seven tasks of the AuSpinal target a common element of unilateral hand function.

*Phase 4: Validity: range of scores (from cross-sectional analysis)*

**Methods.** The aim of the fourth phase was to explore the relative difficulty of the seven AuSpinal tasks by examining the range of scores on a diverse sample of convenience. In total, 26 participants (50 hands) were recruited; some were undergoing initial rehabilitation ( $n=6$ ) and others were living in the community many years after injury ( $n=20$ ). The median (interquartile range) time since injury and age was 8 years (1–17) and 44 years (37–57), respectively. Participants had ASIA impairment scale ASIA A ( $n=7$ ), ASIA B ( $n=6$ ), ASIA C ( $n=6$ ) or ASIA D ( $n=7$ ) lesions.

**Results.** The median score for each task of the AuSpinal ranged from 9 to 13 (see Figures 1 and 2). The corresponding interquartile ranges extended from 6 to 14. The key and can tasks showed the greatest spread of scores. The candy and phone tasks showed the least spread, with clumping around top scores.

*Phase 5: Validity: sensitivity to change over time (from longitudinal analysis)*

**Methods.** The fifth phase of the study involved repeat assessments of a subset of eight participants (16 hands) to examine change over time. The participants were admitted to an in-patient SCI rehabilitation unit after injury. The AuSpinal was administered on admission to, and discharge from the unit, with a median time (interquartile range)

**Table 3** Results from phase 3: Inter-rater reliability

Therapist	1	2	3	4	5	6	7
1	—	-0.3 (1.4)	-0.7 (0.8)	-0.2 (0.4)	-0.7 (0.8)	0.2 (1.5)	-0.7 (0.8)
2		—	-0.3 (0.8)	0.2 (1.3)	-0.3 (0.8)	0.5 (0.8)	0.3 (0.8)
3			—	-0.5 (0.8)	Perfect match	-0.8 (1.3)	Perfect match
4				—	-0.5 (0.8)	-0.3 (1.4)	0.5 (0.8)
5					—	-0.8 (1.3)	Perfect match
6						—	-0.8 (1.3)
7							—

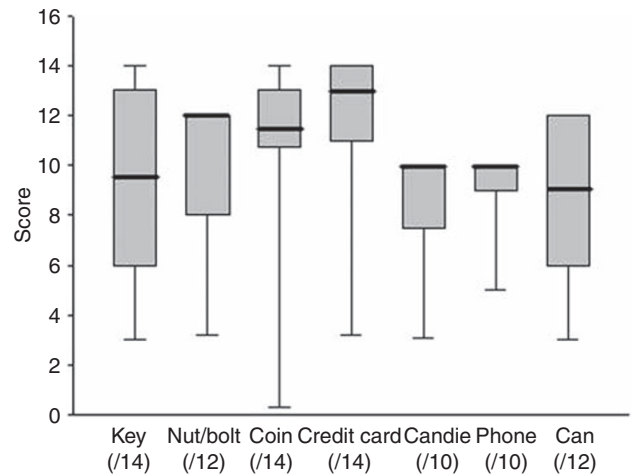
The interrater reliability from the real-life assessments. The mean (s.d.) of the differences between the seven therapists' total score using pair-wise comparisons of the eight performances.



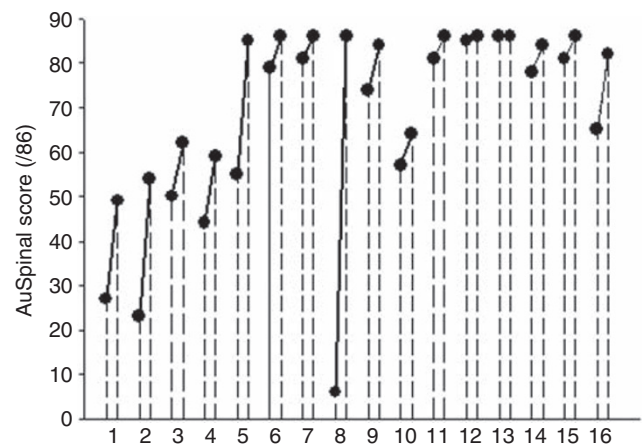
**Figure 1** Items of the AuSpinal, including an Australian 20 cent piece coin (diameter = 28.52 mm; thickness = 2.5 mm; weight = 11.3 g), credit card, key, desk telephone, can of drink (375 ml), chocolate-coated candy (1.3 g) and nut (5/8th inch diameter). The stopwatch is used to limit the time spent attempting a task. It is not used to record the time taken to complete a task.

between assessments of 14 weeks (12–15). The median (interquartile range) time since injury was 54 days (42–83). Participants had ASIA A ( $n = 1$ ) or ASIA D ( $n = 7$ ) lesions.

**Results.** The AuSpinal scores at admission and discharge are shown in Figure 3. There was an obvious and marked change over time in 8 of 16 hands with small change in the remaining 8 hands. There was a ceiling effect, with 7 of 16 hands attaining top scores by discharge.



**Figure 2** Results from phase 4. Median (interquartile range) total scores for each task of the AuSpinal in 50 hands (26 participants). The total possible score for each task is indicated in brackets.



**Figure 3** Results from phase 5. The total AuSpinal score at admission and discharge for the 16 hands (eight participants). The solid line indicates the change in AuSpinal score for each hand.

**Discussion**

Hand function in people with tetraplegia is often asymmetric. The AuSpinal was therefore developed specifically to quantify unilateral hand function in people with tetraplegia. The seven tasks were selected from an array of existing hand

assessments and modified to ensure they were appropriate for this population and were sensitive to change in people with poor hand function. Developing a sensitive unilateral test was considered important for future clinical trials designed to determine the effectiveness of different conservative approaches to hand management, especially for trials using a within-participant design, in which one hand of each participant functions as a control for the other treated hand.

The results of this study indicate that the AuSpinal has good to excellent test-retest, interrater and intrarater reliability. This reliability was reflected by the high degree of concordance between different therapists' ratings of the same task during both video and real-life assessments, and by the high degree of concordance between the same therapists' ratings of digitally mirrored videos. The data indicate that an increase of one or more points on a task is likely to reflect a real change in performance. Good concordance was obtained between therapists across multiple centers, which may reflect the process of a forced dichotomized decision-making protocol (that is, yes or no) for each of the task subcomponents. This removes ambiguities and, unlike a similar hand test,<sup>13</sup> places less emphasis on the type of grasp adopted. The concordance of the total AuSpinal scores between different therapists was better for individuals with good hand function than for individuals with poor hand function. This may reflect some ambiguities in the original testing instructions provided to therapists. For example, not all therapists dealt with the problems of patients dropping or placing items in the same way. In addition, some therapists were stricter than others with respect to scoring tasks, which required participants to hold an item vertically. These issues have been addressed in minor language changes in the revised instructions (see Appendix A). Concordance between therapists may be improved with formal training. However, taken together, our findings suggest that the AuSpinal is robust when repeated across centers and by different therapists.

There was a small systematic increase of 0.5 and 0.4 points for the ratings of the key and coin tasks by the same therapists, respectively, as scored from the videos on the two separate occasions. It is unclear whether differences as small as these are clinically important, although it would seem unlikely. These differences may have been in part due to therapists' unfamiliarity with the computer-rating system. The key and coin tasks were presented to therapists first and it is possible that at the beginning of the first session they rated these two tasks differently, compared with subsequent tasks, and differently than when viewed on the second occasion. Future studies could guard against this order effect by randomizing the order in which tasks are presented and by providing training in the computer-rating system.

The concurrent viewing of eight real-life performances by seven therapists was included to mimic clinical practice. Unlike the video assessments, therapists could view each performance only once in real time. This may have limited the ability of therapists to provide a score in situations in which they had not observed a critical feature during the one-off performance. However, the reliability of real-life

assessments was found to be similar to that of video assessments. That is, there was a high level of agreement between therapists' ratings from both video and real-life observations. This fidelity suggests that the scoring system is robust, a critical feature for longitudinal studies, in which hand assessments are commonly determined by different therapists.

The seven tasks of the AuSpinal measure the same domain of hand function as reflected in the high Cronbach  $\alpha$ -coefficient. This is not unexpected and suggests that some tasks may be redundant. That is, a shorter version incorporating fewer tasks may yield the same information as the current version incorporating seven tasks. This issue is currently being investigated. The psychometric properties of the AuSpinal also require further investigation. The preliminary cross-sectional (phase 4) and longitudinal (phase 5) data suggest that the AuSpinal has a ceiling effect and requires the addition of some more difficult tasks to cater to those with better hand function. For example, 7 of 50 hands received a maximal score in the cross-sectional study. These patients represented a sample of convenience, but probably provide a reasonable estimate of the population at large. The ceiling effect was not totally unexpected because, initially, the emphasis was on designing an assessment tool appropriate for patients with typical motor complete C6 and C7 lesions. The scope was expanded as the project progressed. The obvious solution is to add a few difficult tasks from one of the currently available hand assessments. We are currently exploring this option in a cohort of 68 recently injured patients, with the hope of adding one or two tasks modified from the ARAT<sup>5</sup> to the AuSpinal.

## Conclusion

The AuSpinal is a good, simple and quick measure of hand function. The results of this study indicate that the AuSpinal has face validity and good test-retest, intrarater and interrater reliability. It caters better to patients with limited hand function, but with the addition of harder tasks may prove to be useful for all people with tetraplegia.

## Conflict of interest

The authors declare no conflict of interest.

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## Appendix

### Scoring of the AuSpinal

#### General principles

- Participants can only use one hand. If they need to use two hands, then score '0'.
- Participants cannot use any type of splint or aid.
- Participants must be tested on all subcomponents of each task.
- Participants can continue attempting a subcomponent for 60 s. If an item is dropped, the assessor may place it back at the starting position for another attempt. Timing does not recommence.
- Participants should be asked to attempt to move each object in a way and time that yields the highest score (for example, participants should initially be instructed to pick up the key in less than 60 s without sliding it off the edge of the table).

#### Task 1: KEY

*Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the key without using the side of the table.
2. If unable to pick it up, try again; this time you may use the side of the table.
3. Hold the key between your index finger and thumb above the table for 5 s. Try to keep your palm facing down throughout the 5 s.
4. Place the key into the lock.
5. Turn the key until the bolt completely disappears.
6. Take the key out of the lock and place it back on the table in a controlled way without using the side of the table.

#### Item Position:

Position the kit (comprising the door handle) on the table directly in front of the hand being tested. Ensure the kit is positioned so that turning the key requires pronation.

Set the lock so that the bolt is extended.

Position the key on the table in front of the kit away from the edge of the table.

#### Scoring

##### 1. Pick up the key

- |   | Score |
|---|-------|
| • Able to pick up the key from the table without using the side of the table . . . . .    | 4     |
| • Able to pick up the key from the table but needs to use the side of the table . . . . . | 3     |
| • Unable to pick up the key from the table. . . . .                                       | 0     |
| Subscore . . . . .  | /4    |

<b>2. Hold the key</b>	
● Able to hold the key above the table between the index finger and thumb for 5 s keeping the palm facing down and forearm horizontal . . . . .	4
● Able to hold the key above the table between the index finger and thumb for 5 s but unable to keep the palm facing down and forearm horizontal . . . . .	3
● Unable to hold the key above the table between the index finger and thumb for 5 s . . . . .	0
Subscore . . . . .	/4
<b>3. Insert the key</b>	
● Able to insert the key in the lock. . . . .	2
● Unable to insert the key in the lock. . . . .	0
Subscore . . . . .	/2
<b>4. Turn the key</b>	
● Able to completely turn the key in the lock so bolt disappears. . . . .	2
● Unable to completely turn the key in the lock so bolt disappears. . . . .	0
Subscore . . . . .	/2
<b>5. Remove the key</b>	
● Able to remove the key from the lock and place it onto the table in a controlled way without using the side of the table. . . . .	2
● Unable to remove the key from the lock and place it onto the table in a controlled way without using the side of the table. . . . .	0
Subscore . . . . .	/2
Total score for key task: . . . . .	/14

**Task 2: NUT AND BOLT TASK**

*Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the nut without using the side of the table.
2. If unable to pick it up directly, try again; this time you may use the side of the table.
3. Hold the nut between your index finger and thumb above the table for 5 s. Try to keep your palm facing down throughout the 5 s.
4. Place the nut onto the bolt.
5. Turn the nut until it is completely flush with the bolt.

**Item Position:**

Position the kit (comprising the nut/bolt) on the table directly in front of the hand being tested.  
Position the nut on the table in front of the kit away from the edge of the table.

<b>Scoring</b>	<b>Score</b>
<b>1. Pick up the nut</b>	
● Able to pick up the nut from the table without using the side of the table . . . . .	4
● Able to pick up the nut from the table but needs to use the side of the table . . . . .	3
● Unable to pick up the nut from the table . . . . .	0
Subscore . . . . .	/4
<b>2. Hold the nut</b>	
● Able to hold the nut above the table between the index finger and thumb for 5 s keeping the palm facing down and forearm horizontal . . . . .	4
● Able to hold the nut above the table between the index finger and thumb for 5 s, but unable to keep the palm facing down and forearm horizontal . . . . .	3
● Unable to hold the nut above the table between the index finger and thumb for 5 s . . . . .	0
Subscore . . . . .	/4
<b>3. Position the nut</b>	
● Able to position the nut onto bolt. . . . .	2
● Unable to position the nut onto bolt. . . . .	0
Subscore . . . . .	/2
<b>4. Turn the nut</b>	
● Able to turn the nut so that bolt end is flush with nut. . . . .	2
● Unable to turn the nut so that bolt end is flush with nut. . . . .	0
Subscore . . . . .	/2
Total score for nut and bolt task: . . . . .	/12

**Task 3: COIN (Australian 20 cent piece or similar sized coin)***Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick the coin out of the hip bag.
2. Hold the coin between your index finger and thumb above the table for 5 s. Try to keep your palm facing down throughout the 5 s.
3. Place the coin on the table in a controlled way without using the side of the table.
4. Pick up the coin without using the side of the table.
5. If unable to pick it up directly, try again; this time you may use the side of the table.
6. Place the coin back into the hip bag in a controlled way. You cannot use your other hand to widen the opening of the hip bag.

*Item Position:*

Place the hip bag on the participant and open the top large pocket of the hip bag.

Place the 20 cent coin into the top large pocket of the hip bag.

The assessor may stabilize the hip bag.

**Scoring****Score****1. Retrieve the coin**

- Able to pick out the coin from the pocket of the hip bag. . . . . 2
- Unable to pick out the coin from the pocket of the hip bag. . . . . 0
- Subscore . . . . . /2

**2. Hold the coin**

- Able to hold the coin above the table between the index finger and thumb for 5 s keeping the palm facing down and forearm horizontal . . . . . 4
- Able to hold the coin above the table between the index finger and thumb for 5 s but unable to keep the palm facing down and forearm horizontal . . . . . 3
- Unable to hold the coin above the table between the index finger and thumb for 5 s. . . . . 0
- Subscore . . . . . /4

**3. Place the coin**

- Able to place the coin on the table in a controlled way without using the side of the table . . . . . 2
- Unable to place the coin on the table in a controlled way without using the side of the table . . . . . 0
- Subscore . . . . . /2

**4. Pick up the coin**

- Able to pick up the coin from the table without using the side of the table . . . . . 4
- Able to pick up the coin from the table, but needs to use the side of the table. . . . . 3
- Unable to pick up the coin from the table. . . . . 0
- Subscore . . . . . /4

**5. Replace coin**

- Able to place the coin into the top large pocket of a hip bag in a controlled way. . . . . 2
- Unable to place the coin into the top large pocket of a hip bag in a controlled way. . . . . 0
- Subscore . . . . . /2

Total score for coin task: . . . . . /14

**Task 4: CREDIT CARD***Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the credit card out of the hip bag.
2. Hold the credit card between your index finger and thumb above the table for 5 s. Try to keep your palm facing down throughout the 5 s.
3. Place the credit card on the table in a controlled way without using the side of the table.
4. Pick up the credit card without using the side of the table.
5. If unable to pick it up directly, try again; this time you may use the side of the table.
6. Place the credit card back into the hip bag in a controlled way. You cannot use your other hand to widen the opening of the hip bag.

*Item Position:*

Place the hip bag on the participant and open the top large pocket of the hip bag.

Place the credit card into the top large pocket of the hip bag.

The assessor may stabilize the hip bag.



<b>Scoring</b>	<b>Score</b>
<b>1. Retrieve the credit card</b>	
● Able to pick the credit card out from the pocket of the hip bag . . . . .	2
● Unable to pick the credit card out from the pocket of the hip bag . . . . .	0
Subscore . . . . .	/2
<b>2. Hold the credit card</b>	
● Able to hold the credit card above the table between the index finger and thumb for 5 s keeping the palm facing down and forearm horizontal . . . . .	4
● Able to hold the credit card above the table between the index finger and thumb for 5 s, but unable to keep the palm facing down and forearm horizontal . . . . .	3
● Unable to hold the credit card above the table between the index finger and thumb for 5 s . . . . .	0
Subscore . . . . .	/4
<b>3. Place the credit card</b>	
● Able to place the credit card on the table in a controlled way without using the side of the table. . . . .	2
● Unable to place the credit card on the table in a controlled way without using the side of the table. . . . .	0
Subscore . . . . .	/2
<b>4. Pick up the credit card</b>	
● Able to pick up the credit card from the table without using the side of the table . . . . .	4
● Able to pick up the credit card from the table, but needs to use the side of the table . . . . .	3
● Unable to pick up the credit card from the table . . . . .	0
Subscore . . . . .	/4
<b>5. Replace credit card</b>	
● Able to place the credit card into the top large pocket of the hip bag in a controlled way . . . . .	2
● Unable to place the credit card into the top large pocket of the hip bag in a controlled way . . . . .	0
Subscore . . . . .	/2
Total score for credit card task: . . . . .	/14

**Task 5: CHOCOLATE CANDY (similar in size to a pill)**

*Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the candy without using the side of the table or licking your fingers. If unable to pick it up directly, try again; this time you may use the side of the table.
2. Hold the candy between your index finger and thumb above the table for 5 s. Try to keep your palm facing down throughout the 5 s.
3. Place the candy into your mouth by holding the candy between your index finger and thumb.

*Item Position:*

Place a small candy on the table in front of the hand being tested, away from the edge of the table.

<b>Scoring</b>	<b>Score</b>
<b>1. Pick up candy</b>	
● Able to pick up the candy from the table without using the side of the table . . . . .	4
● Able to pick up the candy from the table, but needs to use the side of the table. . . . .	3
● Unable to pick up the candy from table. . . . .	0
Subscore . . . . .	/4
<b>2. Hold candy</b>	
● Able to hold the candy above the table between the index finger and thumb for 5 s keeping the palm facing down and forearm horizontal . . . . .	4
● Able to hold the candy above the table between the index finger and thumb for 5 s, but unable to keep the palm facing down and forearm horizontal . . . . .	3
● Unable to hold the candy above the table between the index finger and thumb for 5 s. . . . .	0
Subscore . . . . .	/4
<b>3. Place candy in the mouth</b>	
● Able to put the candy into mouth with the candy held between index finger and thumb . . . . .	2
● Unable to put the candy into mouth with the candy held between index finger and thumb . . . . .	0
Subscore . . . . .	/2
Total score for candy task: . . . . .	/10

**Task 6: TELEPHONE**

*Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the telephone receiver.
2. Hold the telephone receiver upright above the table for 5 s. Try to keep the telephone receiver vertical throughout the 5 s.
3. Place the telephone receiver to the ear closest to the hand being used for 5 s (that is, right ear for right hand and left ear for left hand).
4. Place the telephone receiver back on the phone in a controlled way.

*Item Position:*

Position the telephone on the table directly in front of the hand being tested away from the edge of the table.

**Scoring**

	<b>Score</b>
<b>1. Pick up telephone receiver</b>	
● Able to pick up the telephone receiver in a controlled way . . . . .	2
● Unable to pick up the telephone receiver in a controlled way . . . . .	0
Subscore . . . . .	/2
<b>2. Hold telephone receiver</b>	
● Able to hold the telephone receiver above the table keeping the telephone receiver vertical for 5 s . . . . .	4
● Able to hold the telephone receiver above the table but not vertical for 5 s . . . . .	3
● Unable to hold the telephone receiver above the table for 5 s . . . . .	0
Subscore . . . . .	/4
<b>3. Phone to ear</b>	
● Able to hold the telephone receiver to the ipsilateral ear (as though to speak) for 5 s . . . . .	2
● Unable to hold the telephone receiver to the ipsilateral ear (as though to speak) for 5 s . . . . .	0
Subscore . . . . .	/2
<b>4. Replace telephone receiver</b>	
● Able to place the telephone receiver back onto the phone in a controlled way . . . . .	2
● Unable to place the telephone receiver back onto the phone in a controlled way . . . . .	0
Subscore . . . . .	/2
<b>Total score for telephone task:</b> . . . . .	<b>/10</b>

**TASK 7: SOFT DRINK CAN (full, unopened and not chilled)**

*Instructions (provide before attempt at each subcomponent):*

1. Using only one hand, pick up the soft drink can without using the side of the table.
2. If unable to pick it up directly, try again; this time you may use the side of the table.
3. Hold the soft drink can above the table for 5 s. Try to keep the soft drink can vertical throughout the 5 s.
4. Take the soft drink can to your mouth and tilt it as though you are going to drink for 5 s.
5. Put it back on the table in a controlled way without using the side of the table.

*Item Position:*

Place a can of soft drink on the table in front of the hand being tested, away from the edge of the table.

**Scoring**

	<b>Score</b>
<b>1. Pick up soft drink can</b>	
● Able to pick up the soft drink can from the table without using the side of the table . . . . .	4
● Able to pick up the soft drink can from the table, but needs to use the side of the table . . . . .	3
● Unable to pick up the soft drink can . . . . .	0
Subscore . . . . .	/4
<b>2. Hold soft drink can</b>	
● Able to hold the soft drink can above the table keeping it vertical for 5 s . . . . .	4
● Able to hold the soft drink can above the table, but not vertical for 5 s . . . . .	3
● Unable to hold the soft drink can above the table for 5 s . . . . .	0
Subscore . . . . .	/4
<b>3. Tilt to drink</b>	
● Able to lift the soft drink can to mouth and tilt as though drinking (soft drink can opening does not need to be aligned with mouth) for 5 s . . . . .	2

• Unable to lift the soft drink can to mouth and tilt as though drinking for 5 s. . . . .	0
Subscore . . . . .	/2
<b>4. Place soft drink can</b>	
• Able to place the soft drink can on the table in a controlled way without using the side of the table . . . . .	2
• Unable to place the soft drink can on the table in a controlled way without using the side of the table . . . . .	0
Subscore . . . . .	/2
Total score for soft drink can task: . . . . .	/12
<b>TOTAL SCORE FOR AUSPINAL: . . . . .</b>	<b>/86</b>