



Nottingham Assessment for Drivers with Dementia

Revised Manual 2016

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Introduction

The Nottingham Assessment for Drivers with Dementia (NADD) was developed as part of a research programme on the effects of cognitive impairment on driving abilities conducted at the University of Nottingham. Patients who had a diagnosis of dementia and were driving were referred to the study by psychiatrists, mental health nurses and general practitioners. Participants were asked to complete a battery of cognitive tests and an on-road assessment. Their results were also compared to a control group of healthy participants. From this information, a battery of cognitive tests was identified which correctly classified 92% of drivers with dementia as safe or unsafe to drive (Lincoln et al., 2006). This was validated in an independent sample of drivers with dementia, where 76% of participants were correctly classified as safe or unsafe by the cognitive tests (Lincoln et al., 2009). The full battery was called the Dementia Drivers Screening Assessment. However, the full battery contained tests from several sources and therefore it was not always practical for therapists to obtain access to the necessary materials. A shortened version of the Dementia Drivers Screening Assessment was developed (Lincoln & Radford 2014) which only required materials for one test, the Stroke Drivers Screening Assessment, to be purchased. This version is the Nottingham Assessment for Drivers with Dementia. It has been shown to have an accuracy of 79% in classifying drivers with dementia as safe or unsafe in relation to an on-road driving test. It is better at identifying those who are safe, than unsafe on the road.

The NADD has been designed as a cognitive screening measure for use with people with dementia who wish to continue driving, either upon initial diagnosis, or when their licence is due for renewal. It may be used to decide who has the cognitive abilities to be safe to continue driving and who should be referred for on-road assessment. Patients who had other medical conditions that precluded them from driving were excluded from the research, thus conclusions drawn from the NADD may only apply to drivers with dementia. The recruitment was carried out in an NHS memory

clinic, so the accuracy of predictions in other settings has not been established.

The purpose of the NADD is to screen patients with dementia to provide clinicians with more information about whether or not a client has the cognitive skills required to be likely to be safe to continue driving. The NADD is a cognitive screening assessment and should be used in conjunction with clinical judgement and assessment of vision and motor abilities. It is not intended to provide a decision on safety to drive but to provide a recommendation in relation to cognitive abilities to inform for further action. In most cases the information is passed on to a general practitioner or psychiatrist to inform their recommendation to the driving authorities. However, it is important to note that the validation of the NADD is more rigorous than most other assessment methods used in clinical practice to determine safety to drive.

Test Administration

The NADD should be administered in a quiet room with the client and examiner seated at a table. They are usually seated at right angles to each other rather than opposite each other.

Tests are usually completed in one session, but if necessary may be administered in two sessions. No feedback about performance is given until the end of the session. People are encouraged to attempt tasks and to persevere when they encounter difficulties by giving non-specific feedback, such as 'that's fine' or 'just do what you think is right'.

Administer the tests in the order presented in the manual. For each test standard instructions are given. These may be repeated once if the client seems not to understand or has difficulty remembering what he/she is required to do. No additional information may be given. If the client asks for further instructions, reply with a phrase such as "*Do what you think is right*". The instructions were intentionally kept short so that minimal language comprehension would be required and there were few demands on memory. In all the validation studies the instructions used have been those provided in the manual. Any deviation from these may affect the scores obtained and therefore the predictive validity of the test. Gestures are used to supplement the verbal instructions. These are intended to help those with communication problems, but should be used for all clients.

The NADD comprises seven tests. Three tests are from the Stroke Drivers Screening Assessment (SDSA) (Nouri & Lincoln, 1994), two from the Salford Objective Recognition Test (SORT) (Burgess, Dean, Lincoln & Pearce, 1996) one from the Adult Memory and Information Processing Battery (AMIPB) (Coughlan & Hollows, 1985) and the Victoria version of the Stroop task (Strauss, Sherman & Spreen, 2006).

The equipment needed is this manual, the Stroke Drivers Screening Assessment, print outs of the AMIPB, Stroop and SORT from this manual, felt pen or soft pencil, and timer.

A video demonstrating the administration of the NADD is available on request from Nadina.lincoln@nottingham.ac.uk

SDSA Dot Cancellation

This tests assesses sustained attention and visual inattention

Equipment

Photocopy of Dot cancellation master, pen and timer. A felt pen or soft pencil is easy for clients to use and easier to score than when using a biro.

Method

Place the photocopied dot cancellation sheet on the table centrally in front of the client. Explain the test as follows:

"You will see that there are groups of dots arranged in rows. Some of the groups have 3 dots, some 4 and some 5 dots (indicate examples on the practice row). I want you to cross out every group of 4 dots."

"I want you to complete the first row as a practice."

If the client is unsure what to do, cross out the first set of 4 dots as an example and then ask the client to continue with the practice row. Check the practice row. If the client makes any errors point them out, by saying for example *"you have missed a set of 4 dots here"* or *"you have crossed out a group of 3 dots but the task is to cross out all the groups of 4 dots"*.

Then say

"The task is timed but it is more important to be accurate than fast. Start when you are ready".

Start the timer as soon as the client starts to attempt the task.

If the client seems to have forgotten the instructions or requests a repetition, the instructions can be repeated once using the same wording as given at the beginning of the task. After that no further explanation should be given.

Once the client has completed the first twelve rows, ask them to stop. Use a phrase such as *'That's fine; that is all you need to do'*.

Time Limit

7 minutes 30 seconds.

If the client has not completed 12 rows at the time limit, indicate that the task is complete by a phrase such as

"That's fine; you have done enough now and can stop".

If the client continues beyond the time limit, despite being asked to stop working, note the point reached at the time limit and mark on the score sheet afterwards.

Score

Record the following on the Summary Score Sheet:

- The time taken to complete first twelve rows of the task (except the practice row) in seconds.
- The number of groups of 4 dots not crossed out (errors). This can be simplified by preparing a marking template, photocopied onto an overhead projector acetate sheet.

An item is scored if a pencil/pen mark goes through some point of the group of dots. So for example, if the client just marks one dot in a group of 4, this would count as having crossed out the group. Similarly if a client scribbles across the pages, all those groups crossed through by chance would count in the score even though the client was not performing the task of crossing out groups of dots.

SDSA Square Matrices Directions

This test assesses executive abilities, attention, visuospatial ability and visual memory.

Equipment

Matrix board, car and lorry cards and timer.

Method

Place the pile of car/lorry cards at the bottom of the grid with the example card on the top of the pile. The cards under the example card are shuffled between assessments so that they are in random order.

Explain the test as follows:

"The large arrows correspond to the lorries and the small arrows to the cars. Each arrow indicates a direction of travel." (Demonstrate right, left, upwards as away and downwards as towards). Arrows facing 'north' indicate the vehicle is travelling away from the client, arrows facing 'south' indicate the vehicle is travelling towards the client.

"I want you to position these cards (indicate the car/lorry cards) so that each car is travelling in the direction indicated by the small arrow and each lorry in the direction indicated by the large arrow. I will do the first one as an example"

Position the card marked example to demonstrate the task. Then indicate to the client to start and begin timing. Score the responses when the client indicates he/she has finished. If the client seems to have forgotten the instructions or requests a repetition the instructions can be repeated once using the same wording as given at the beginning of the task. After that no further explanation should be given.

Time Limit

5 minutes.

If the client has not completed the task after 5 minutes have elapsed, stop the client using a phrase such as *"That's fine, you have done enough now and can stop"*.

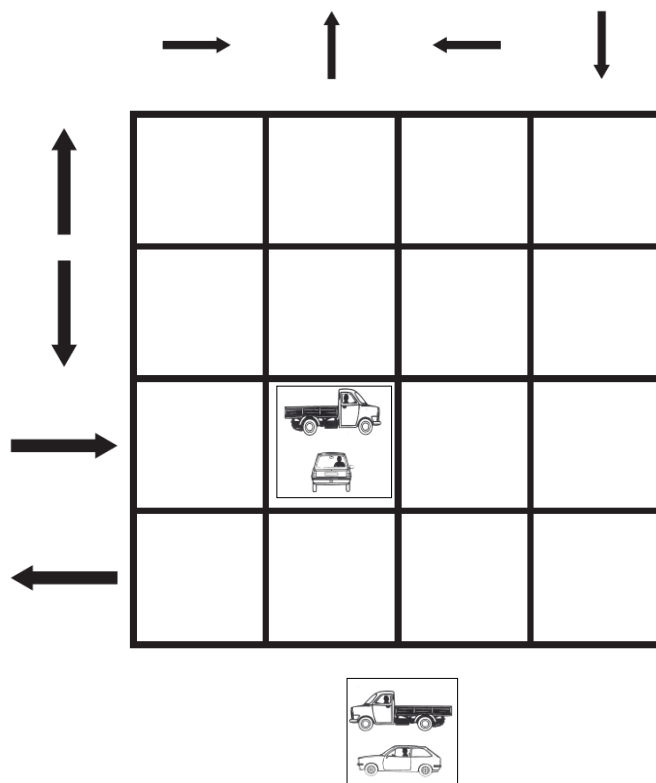
If the client continues beyond the time limit, despite being asked to stop working, note the score obtained at the time limit.

Score

1 point for each correctly positioned car. 1 point for each correctly positioned lorry. The score includes the practice item, so the maximum possible score is 32. The easiest way to score the task is to score all the lorries first then all the cars. If the cards are piled on top of each other all cards in the pile are scored.

Record the total score on the Summary Score Sheet.

Square Matrices Directions Layout



Pile of all remaining cards

SDSA Road Sign Recognition

This test assesses executive abilities, attention, and visuospatial ability.

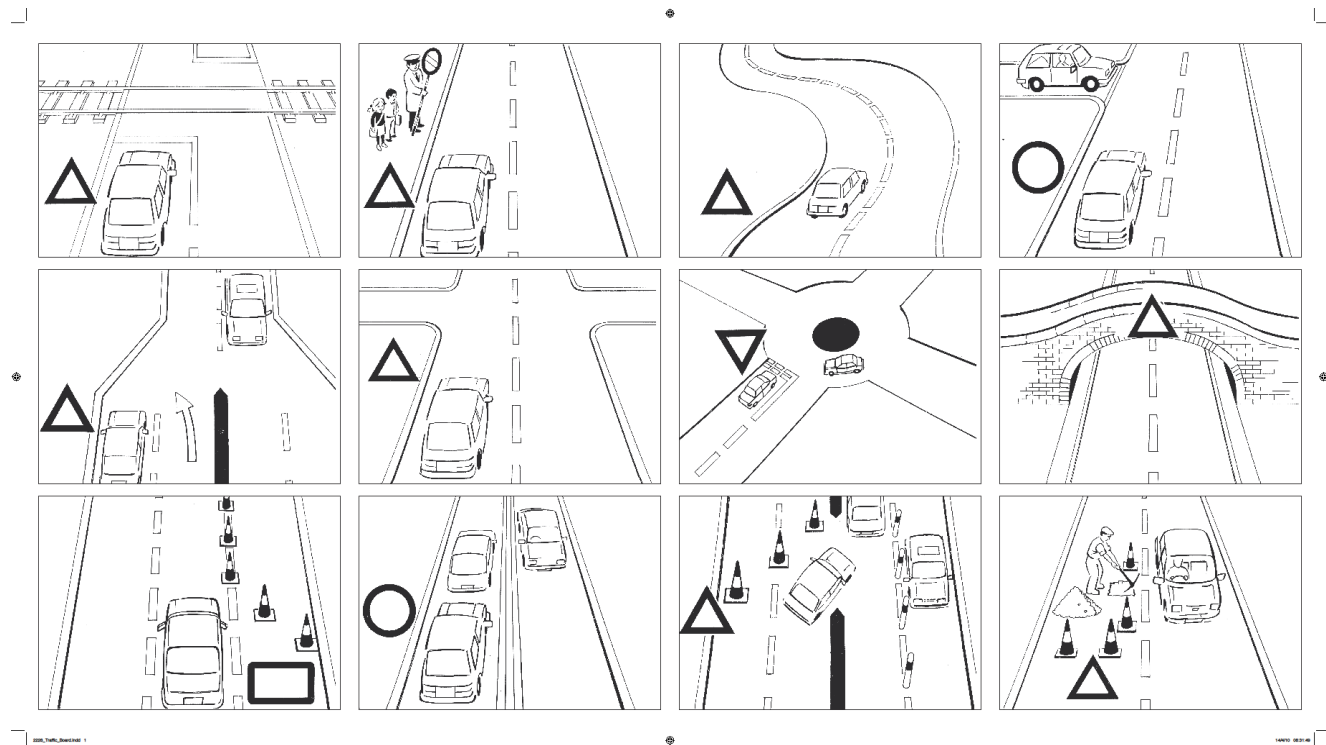
Equipment

Road situation card, example road situation card, road sign cards and timer.

Method

Place the road situation card in front of the client. When new, the road situation card will not lie flat. Bend it backwards and forwards several times before using it so that it does lie flat. Place the example road situation (broken traffic lights) card to one side of the road situation card. Spread the road sign cards below the road situation card.

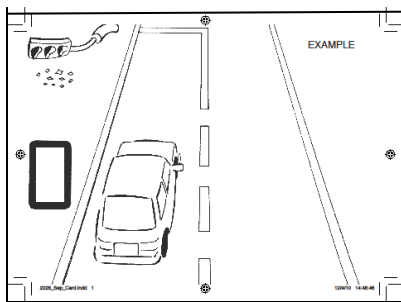
Road Sign Recognition Layout



Road sign cards spread out along here.

Explain the test as follows:

"I would like you to put each road sign on the picture of the road situation which it matches best. This card shows a broken traffic light (point to the example road situation card). The sign which best matches this situation is the one indicating a traffic light out of action (pick out the broken traffic light road sign). So this sign (broken traffic light) goes with this picture. (Place the broken traffic light road sign on top of the example card and move to one side).



Now you do the rest." Put the example card with the example sign on top of it, to one side.

Begin timing. Score the responses when the client indicates he/she has finished.

If the client seems to have forgotten the instructions or requests a repetition, the instructions can be repeated once using the same wording as given at the beginning of the task. After that no further explanation should be given.

Time limit

3 minutes

If the client has not completed the task after 3 minutes have elapsed, stop the client using a phrase such as *"That's fine, you have done enough now and can stop"*.

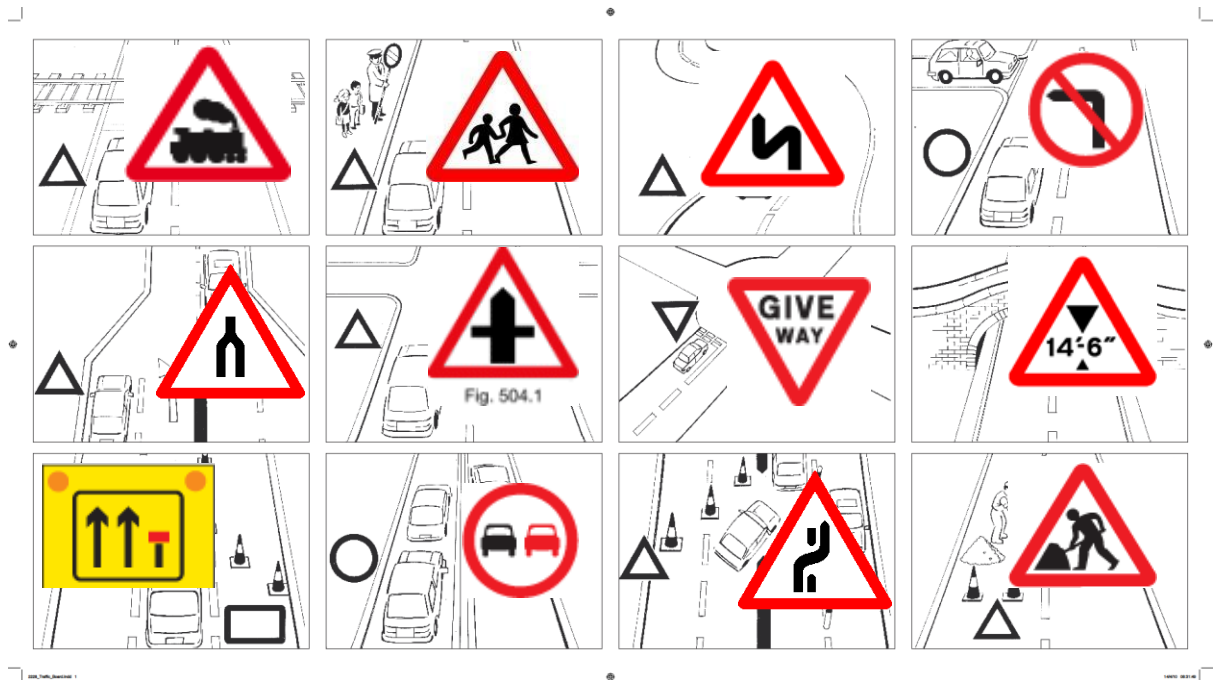
If the client continues beyond the time limit, despite being asked to stop working, note the score obtained at the time limit.

Score

One point for each sign correctly matched. The example is not included in the score. If the client puts several cards in a pile, score only the top card on the pile. Maximum score 12 points.

The correct answers are:

Road Sign Recognition Test Correct Signs



Transfer the number correct to the Summary Score Sheet

SORT Words Immediate and Delayed Recall

This test assesses verbal memory.

Equipment

SORT Words presentation booklet and SORT Words test cards and SORT response sheet. These can be printed out on A4 paper from the appendix to this manual.

Method

Put the presentation booklet in front of the participant:

I am going to show you a number of words. For each word I would like you to tell me whether the item seems pleasant (i.e. "yes") or unpleasant (i.e. "no"). There is no need to think long and hard about your answer, a general first impression will do.

Present the words one at a time for 3 seconds each.

For *immediate recall*, present the recognition book straight after presenting the words to be remembered. Present each recognition card and ask:

Which of these words have you seen in the first set that I gave you?

If the client is unsure encourage him/her to make a guess.

Time limit

There is no time limit

Score

Record the responses on the score sheet. The correct answer is indicated by the shaded box. Record the total number correct for immediate recall (maximum 12).

SORT Words Score Sheet

1.

2

3

4

5

6

7

8

9

10

11

12

Number Correct

AMIPB Information Processing A

This tests assesses speed of information processing.

Equipment

AMIPB stimulus sheet (double sided), pencil and stopwatch

Method

Show the client the demonstration items. Explain and demonstrate using the first 5 items, that the client is required to strike out (with just a single dash or stroke) the second highest number in each line. Allow the client to practice on the second 5 items.

Present the test sheet and say:

Now I'd like you to work through these, striking out the second highest number each time. Work down the page, and go as fast as you can until I tell you to stop. I'll give you a few minutes. Off you go.

Allow four minutes. If the client has not completed the task after 4 minutes have elapsed, stop the client using a phrase such as "*That's fine, you have done enough now and can stop*".

If the client continues beyond the time limit, despite being asked to stop working, note the score obtained at the time limit.

If all 105 items are completed in under 4 minutes then prorate the score for 4 minutes. For example, if 105 items are completed in 3 minutes 30 seconds, then $105/3.5 \times 4 = 120$ would have been completed in 4 minutes.

91, 26, 43, 82, 17
61, 59, 62, 18, 80
27, 48, 92, 36, 28
53, 29, 61, 19, 32
32, 41, 18, 24, 11

28, 62, 19, 12, 54
42, 25, 41, 33, 38
17, 12, 18, 15, 29
86, 42, 93, 28, 71
76, 72, 40, 60, 29

26, 56, 28, 93, 40
54, 90, 26, 81, 15
32, 37, 91, 15, 22
11, 42, 86, 90, 19
19, 53, 18, 92, 64

24, 82, 58, 26, 41
80, 36, 72, 43, 65
74, 19, 41, 28, 50
55, 41, 60, 11, 13
60, 99, 20, 22, 48

63, 20, 82, 18, 99
28, 40, 23, 76, 77
12, 15, 38, 65, 71
17, 57, 41, 91, 28
32, 39, 14, 56, 42

28, 21, 81, 47, 68
57, 52, 10, 69, 92
41, 60, 56, 78, 69
94, 79, 38, 20, 29
26, 94, 37, 50, 29

51, 29, 81, 16, 99
18, 32, 67, 77, 33
42, 83, 17, 56, 40
36, 98, 39, 19, 14
80, 22, 82, 75, 57

52, 91, 17, 86, 68
21, 20, 50, 94, 54
70, 13, 38, 62, 69
43, 21, 16, 50, 56
45, 48, 89, 21, 12

90, 27, 83, 41, 86
87, 15, 10, 85, 90
22, 56, 74, 36, 57
73, 80, 12, 72, 84
95, 41, 81, 70, 18

65, 26, 11, 72, 22
37, 55, 18, 53, 90
92, 49, 27, 19, 83
94, 93, 64, 11, 65
14, 18, 83, 73, 10

82, 37, 21, 97, 79
66, 29, 59, 23, 32
71, 62, 50, 82, 44
64, 97, 91, 63, 95
56, 12, 82, 43, 20

41, 30, 94, 50, 58
24, 95, 75, 81, 72
59, 26, 57, 19, 36
52, 17, 23, 60, 28
52, 68, 62, 30, 74

90, 52, 81, 23, 39
12, 49, 59, 92, 87
55, 27, 36, 84, 66
55, 86, 29, 38, 22
33, 55, 41, 61, 65

93, 78, 50, 12, 15
32, 70, 92, 65, 80
18, 29, 54, 28, 30
25, 56, 41, 39, 20
94, 34, 29, 36, 14

27, 29, 16, 23, 38
83, 81, 75, 77, 89
91, 61, 54, 80, 59
79, 82, 47, 16, 52
80, 83, 29, 90, 10

37, 51, 19, 36, 84
27, 64, 48, 63, 20
18, 16, 71, 23, 62
28, 21, 92, 74, 61
26, 54, 51, 29, 60

72, 26, 34, 61, 79
68, 17, 72, 65, 81
61, 98, 60, 27, 41
12, 83, 70, 65, 32
45, 72, 24, 59, 10

61, 14, 15, 50, 47
44, 19, 65, 24, 13
42, 40, 55, 84, 73
37, 49, 45, 38, 27
55, 25, 86, 20, 46

43, 52, 41, 80, 10
85, 22, 16, 45, 53
57, 17, 68, 98, 80
17, 23, 15, 30, 36
20, 53, 50, 72, 29

14, 45, 89, 53, 21
35, 58, 41, 65, 28
63, 30, 93, 21, 45
94, 92, 16, 82, 24
22, 59, 21, 75, 48

61, 96, 82, 85, 74
27, 86, 50, 16, 11
43, 30, 99, 36, 22
48, 50, 60, 44, 82
68, 27, 63, 37, 45

Show the motor speed test sheet. Say:

This is a test of your speed. I'd like you to strike out each of these figures as quickly as you can. (Demonstrate on the practice items provided).

Work down the page as fast as you can until I tell you to stop. I will only give you a few seconds. Off you go.

Allow 20 seconds.

If the client has not completed the task after 20 seconds have elapsed, stop the client using a phrase such as *"That's fine, you have done enough now and can stop"*.

If the client continues beyond the time limit, despite being asked to stop working, note the score obtained at the time limit.

Time limits

Part A: 4 minutes

Part B: 20 seconds

Score

Photocopy the score sheet below on to an acetate sheet to provide a scoring template.

The Adjusted Score is derived from the following:

- TASK A total (number of items attempted)
- TASK A errors % (number of errors divided by number items attempted*100)
- TASK A speed (number of items cancelled on motor speed task)
- Task A Adjusted Score = $(12 * \text{Task A total} * \text{Task A speed}) / (12 * \text{Task A speed} - \text{Task A total})$

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Stroop test

This test assesses executive abilities and divided attention.

Equipment

Stroop words and colour words cards printed on A4 sheets, Stroop response sheet and timer.

Method

Put the Words card in front of the client and say

I want you to name the colours of the words as quickly as you can. Begin here (point), and go across the rows from left to right. (Clarify if necessary) Name the colours in which the words are printed.

Start the timer immediately after giving the instructions. Direct the client's attention across the rows from left to right. Record the time.

Place the Colour Words card in front of the client and say:

Now again I want you to name the colours of the words as quickly as you can. Begin here (point), and go across the rows from left to right. (Clarify if necessary). Don't read the word, tell me the colour in which the word is printed.

Errors in colour naming are corrected immediately, if they are not spontaneously corrected by the client. Then instruct the client to go on as quickly as possible. Start the timer immediately after giving the instructions. Record the time taken to complete the task.

Time limit

No time limit

Score

Record the time taken for each trial.

Calculate Stroop score as Time 2 (colours words) – Time 1 (words).

**STROOP TEST
WORDS**

and

over

when

when

hard

over

when

hard

and

hard

and

over

when

hard

when

over

hard

over

and

and

hard

and

over

when

STROOP TEST
COLOUR WORDS

red

green

red

blue

blue

brown

blue

green

green

red

blue

brown

brown

red

brown

red

green

brown

green

red

blue

blue

brown

green

STROOP RESPONSE SHEET

WORDS

green	blue	brown	red
brown	red	green	blue
blue	green	brown	red
blue	brown	red	green
red	green	blue	brown
brown	green	blue	red

Time taken _____

COLOUR WORDS

green	blue	brown	red
brown	red	green	blue
blue	green	brown	red
blue	brown	red	green
red	green	blue	brown
brown	green	blue	red

Time taken _____

Stroop Score = Colour words time – Words Time

SORT Delayed Recall

About 30 minutes after the SORT immediate recall administer the Delayed recall (other tests or activities may be administered in the interim). As above, ask the client to point out which word on each page has previously been seen.

Time limit

There is no time limit

Score

Record the total number correct for delayed recall (maximum 12).

Scoring and Interpretation

The scores obtained are inserted in the Score Sheet

NADD Score Sheet

	Score	Pass Equation		Fail Equation	
		Multiply by:	Result	Multiply by:	Result
SDSA Dot Cancellation Time 12 lines		0.058		0.058	
SDSA Dot Cancellation Errors 12 lines		0.092		0.128	
SDSA Square Matrices Directions		0.146		0.138	
SDSA Road Sign Recognition		0.470		0.216	
SORT Words Immediate		1.533		1.209	
AMIPB Information Processing A adjusted		0.156		0.157	
Stroop time		0.012		0.011	
SORT Words delayed		-0.326		-0.025	
Constant		-20.129		-20.304	
		Total Pass		Total Fail	
Overall score (Pass- Fail)					

Add the scores in the 'Result' columns for the pass equation and the fail equation, taking into account plus and minus signs. The Overall Score is the pass equation total – fail equation total.

An excel spreadsheet to calculate scores is available on request from Nadina.lincoln@nottingham.ac.uk.

Interpretation of Results

If the Overall score (Pass equation score – Fail equation score) is more than 0, this suggests that the client has the cognitive abilities to be safe to drive. If the score is below 0, this suggests the client may be unsafe to drive, and should be recommended for an on road driving assessment. This may be arranged through a specialist driving assessment centre, which can be located through the Forum of Mobility Centres (see <http://www.drivingmobility.org.uk>) . It is important to be aware that the predictive ability of the cognitive tests has been found to be about 80% accurate, therefore other aspects of performance including motor abilities, vision and driving history should be considered. The test is also better at predicting who is safe to drive, rather than who is unsafe. Therefore those who pass the test may be considered to have the cognitive abilities to be safe to continue driving, whereas those who fail should be assessed on the road.

Additional information may be obtained from individual test scores. Lincoln and Radford (2014) examined the predictive validity of the individual tests of the NADD. Road Sign Recognition and Square Matrices from the SDSA both produced a significant area under the curve (AUC). 94% of those who scored >6 on Road Sign Recognition were found to be safe on the road. Similarly, 90% of those scored >16 on Square Matrices Directions were found to be safe on the road. These cut-offs can be used to identify drivers who are likely to be safe on the road. Those who score below either cut-off need to be assessed further using the complete NADD or using on-road assessments.

Table 4 gives the mean and standard deviation score for each measure in the predictive equation. These data are based on 118 patients with dementia, whose data was reported in the initial papers (Lincoln et al. (2006, Lincoln et al. 2009). They have been separated into mean and standard deviation for Pass and Fail, thus it can be seen which group a patient is more likely to be in. However, there is substantial overlap between the distribution of scores for Safe and Unsafe groups, thus conclusions should not be made based on individual tests alone. A more reliable indicator is that based on the entire predictive equation.

Comparison between Test Scores according to Driving Grades

Test	Driving Grade			
	Safe		Unsafe	
	Mean	SD	Mean	SD
Dot cancellation time for 12 lines	285.3	91.1	306.3	96.6
Dot cancellation errors for 12 lines	14.8	14.8	23.8	25.0
Square Matrices Directions	13.8	9.3	9.5	9.8
Road Sign Recognition	4.3	2.7	2.4	2.4
SORT Words Immediate	9.1	2.9	8.4	2.5
SORT Words Delayed	7.5	3.2	7.4	3.0
AMIPB Info Processing A adjusted score	38.1	19.2	30.0	21.2
Stroop (time 2 - time 1)	31.7	52.8	43.9	69.3

The NADD tests were administered to 30 healthy elderly people, aged 61-82 (mean 68.7 SD 5.61) years who were all found safe to drive on the road. The distribution of their scores is shown in Table 5.

Scores of Healthy Elderly People

	Mean	SD
Dot cancellation time 12 lines	217.8	64.2
Dot cancellation errors 12 lines	5.4	4.4
Square Matrices Directions	30.9	3.9
Road Sign Recognition	7.4	2.8
SORT Words Immediate	11.8	0.4
SORT Words Delayed	11.7	0.6
AMIPB Info Processing A adjusted score	68.6	16.9
Stroop (time 2 - time 1)	10.6	9.7

The purpose of the NADD is to screen patients with dementia to provide clinicians with more information about whether or not a client has the cognitive skills required to be likely to be safe to continue driving. The NADD is a cognitive screening assessment and should be used in conjunction with clinical judgement and assessment of vision and motor abilities. It is not intended to provide a decision on safety to drive but to provide a recommendation in relation to cognitive abilities to inform for further action. In most cases the information is passed on to a general practitioner or psychiatrist to inform their recommendation to the driving authorities. However, it is important to note that the validation of the NADD is more rigorous than most other assessment methods used in clinical practice to determine safety to drive.

References

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Appendix 1 SORT Test materials

S.O.R.T

Words (II)
Presentation

claw

pole

cash

teacher

wood

flag

limb

dust

inn

chair

rock

ship

S.O.R.T

**Words (II)
Recognition**

farm

limb

arm

hymn

stone

clock

bone

rock

soul

shod

pole

rod

ship

vessel

lip

nestle

master creature

faster teacher

wood trees

hood breeze

skirt

dust

dirt

crust

rash

funny

cash

money

hare

cheat

chair

seat

manner flag

banner stag

claw

more

nail

pale

pub

chin

shrub

inn