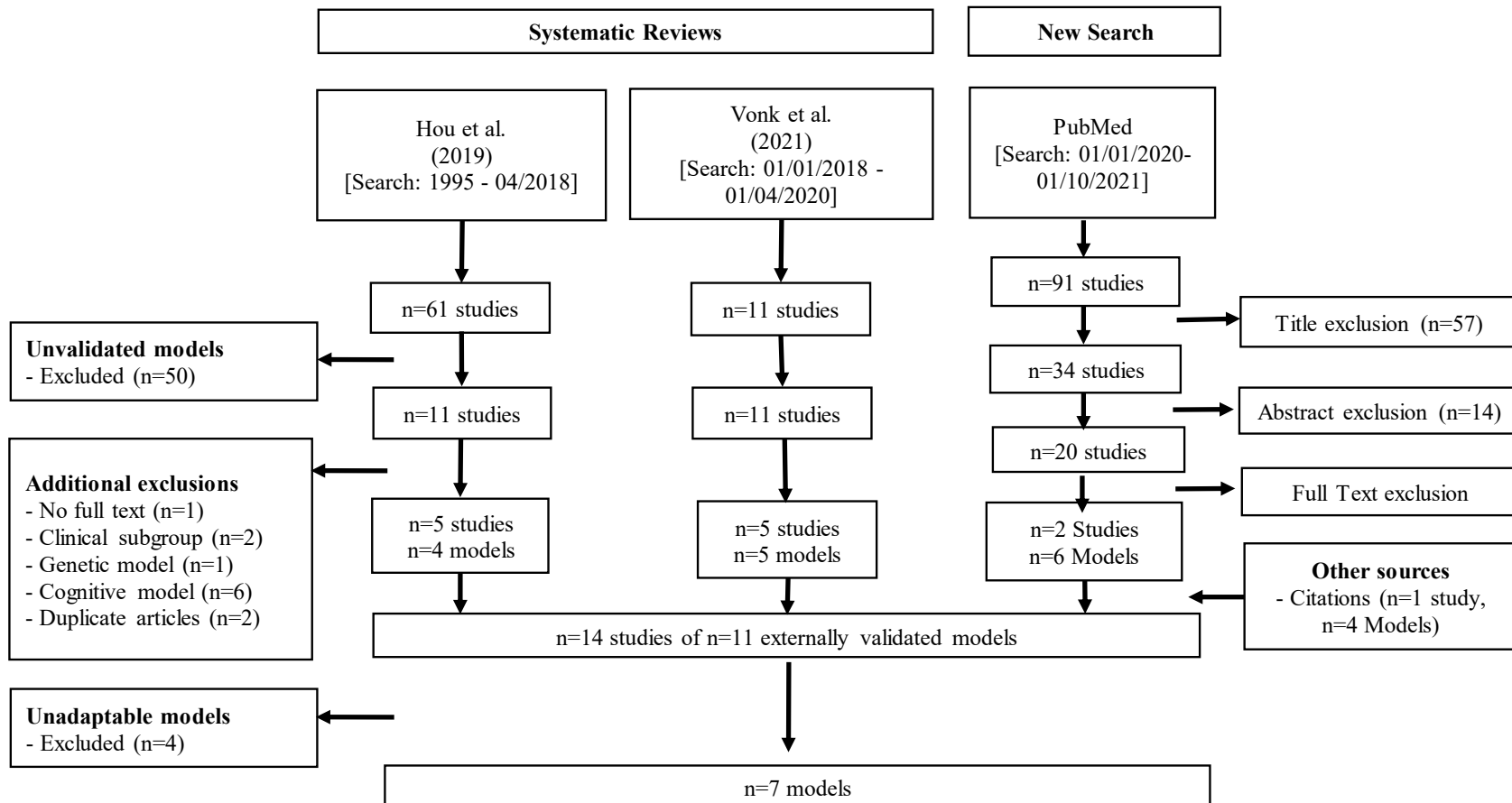


# Supplementary Material

## Dementia Risk Models in an Australian First Nations population: Cross-Sectional Associations and Preparation for Follow-Up

Supplementary Figure 1. Literature review of existing dementia risk prediction models



**Supplementary Table 1.** Overview of seven existing dementia risk models selected for adaption to the data collected in the Torres Strait dementia prevalence survey (2015-2018)

Indicators	Lower age	Follow up	Score Range	Cut-off(s)	Original AUROC
<b>Study on Aging, Cognition and Dementia (AgeCoDe) (Jessen et al., 2011) [1]</b> age, subjective memory impairment, verbal fluency, delayed recall, MMSE, and IADL	>75	6	0-21	≥9, ≥15	0.84 (0.80–0.88)
<b>Australian National University Alzheimer's Disease Risk Index (ANU-ADRI) (Anstey et al., 2013) [2]</b> age group (by sex), education, BMI, diabetes, symptoms of depression, total cholesterol, traumatic brain injury, smoking, alcohol use, social engagement, physical activity, cognitive activity, fish intake, and pesticide exposure	Variable	Variable	0-41	N/A	N/A
<b>Brief Dementia Screening Indicator (BDSI) (Barnes et al., 2014) [3]</b> age group (by sex), education, BMI, diabetes, symptoms of depression, total cholesterol, traumatic brain injury, smoking, alcohol use, social engagement, physical activity, cognitive activity, fish intake, and pesticide exposure	≥65	6	0-56	≥22	0.68 (0.60–0.72)
<b>Canadian Study of Health and Aging (CSHAI) (Hogan et al., 2000) [4]</b> age, MMSE, reported cognitive difficulties	≥65	5	N/A	N/A	0.78
<b>Framingham Heart Study (FHS) (Li et al., 2018) [5]</b> age, marital status, cancer, diabetes, heart attack/arterial fibrillation, stroke/TIA	≥60	5, 10, 20	-1 to +31	15,19,23	0.72
<b>Mexican American Dementia Nomogram (MADeN) (Donwer et al., 2016) [6]</b> age, sex, education, diabetes, pain, walking, IADL score, social leisure	≥65	10	0-32	≥16	0.74 (0.70-0.78)
<b>Washington Heights-Inwood Columbia Aging Project (WHICAP) (Reitz et al., 2010) [7]</b> sex, age, diabetes, hypertension, current smoking, low HDL-C, high waist-hip ratio, education, ethnicity, <i>APOE</i> ε4	≥65	4	0-60	N/A	N/A

- [1] Jessen F, Wiese B, Bickel H, Eißfländer-Gorfer S, Fuchs A, Kaduszkiewicz H, Köhler M, Luck T, Mösch E, Pentzek M, Riedel-Heller SG, Wagner M, Weyerer S, Maier W, van den Bussche H; AgeCoDe Study Group (2011) Prediction of dementia in primary care patients. *PLoS One* **6**, e16852.
- [2] Anstey KJ, Cherbuin N, Herath PM (2013) Development of a new method for assessing global risk of Alzheimer's disease for use in population health approaches to prevention. *Prev Sci* **14**, 411-421.
- [3] Barnes DE, Beiser AS, Lee A, Langa KM, Koyama A, Preis SR, Neuhaus J, McCammon RJ, Yaffe K, Seshadri S, Haan MN, Weir DR (2014) Development and validation of a brief dementia screening indicator for primary care. *Alzheimers Dement* **10**, 656-665.e1.
- [4] Hogan DB, Ebly EM (2000) Predicting who will develop dementia in a cohort of Canadian seniors. *Can J Neurol Sci* **27**, 18-24.
- [5] Li J, Ogrodnik M, Devine S, Auerbach S, Wolf PA, Au R (2018) Practical risk score for 5-, 10-, and 20-year prediction of dementia in elderly persons: Framingham Heart Study. *Alzheimers Dement* **14**, 35-42.
- [6] Downer B, Kumar A, Veeranki SP, Mehta HB, Raji M, Markides KS (2016) Mexican-American dementia nomogram: development of a dementia risk index for Mexican-American older adults. *J Am Geriatr Soc* **64**, e265-e259.
- [7] Reitz C, Tang M-X, Schupf N, Manly JJ, Mayeux R, Luchsinger JA (2010) A summary risk score for the prediction of Alzheimer disease in elderly persons. *Arch Neurol* **67**, 835-841.

**Supplementary Table 2.** Scoring details of seven existing dementia risk models and adapted to data collected in the Torres Strait dementia prevalence survey (2015-2018)

Variables	AgeCoDe (0-21)	ANU-ADRI (-8,+41)	BDSI (0-56)	CSHAI	FHS (-1, +31)	MADeN (0-32)	WHIACP
Age	75-79=0, >=80=3	Male: <65=0, 65-70=1, 70-75=12, 75-80=18, 80-85=26, 85-90=33, >90=38	1 point per year >65	(.25 * age)	60-69=0, 70-79=6, 80+=12	1 point per year after 65	65-70=0, 51-75=6, 76-80=8, 81-5=13, >=86=21
Sex	..	Female: <65=0, 65-70=5, 70-75=14, 75-80=21, 80-85=29, 85-90=35, >90=41	..	..	..	Female=3, Male=0	
Education	..	>11 y=0, 8-10=3, <8=6	<12 y=9	..	..	≥4=0, <4 y=5	>9 y=0, 7-9=8, 0-6=11
BMI/Obesity	..	Normal=0, Overweight=2, Obese=5	BMI≥18.5=0, BMI<18.5=8	..	Underweight=4, Normal=0, Over=-1	..	
Smoking	..	Never=0, Ever=1, Current=4	..	..	..	..	No=0, Current=5
Alcohol	..	None=0, Light-mod=-3	..	..	..	..	
Depression	..	No=0, Yes=2	Antidepressants or 'everything was an effort' ≥3 days p/w, No=0, Yes=6	..	..	Feel the blues No=0, Yes=4	
	..	..	..	..	..	..	No=0, Yes=1
Diabetes	..	No=0, Yes=3	No=0, Yes=3	..	No=0, Yes=2	No=0, Yes=2	No=0, Yes=3
Stroke	..	..	No=0, Yes=6	..	No=0, Yes=5	..	
Subjective Memory Impairment	No=0, Yes, without worry=2, Yes, with worry=4	..	..	Memory problems reported by an informant=10	..	..	
Verbal Fluency	≥18=0, <18=4	..	..	..	..	..	
Delayed recall	7-10=0, 5-6=2, 0-4=4	..	..	..	..	..	
MMSE	≥27=0, <27=4	..	..	(100-(MMSE/30*100))	..	..	
iADLs	Unimpaired=0, Impaired=2	..	Needs help, money or medications. No=0, Yes=10	..	..	Impaired in ≥1 iADL, No=0, Yes=1	
TBI	..	No=0, Yes=4	..	..	..	..	
Marital Status	..	..	..	..	Single=2, Married=0, Formerly=1	..	
Ischemic attack	..	..	..	..	No=0, Yes=4	..	

Pain	..	..	..	..		No=0, Yes=3
Mobility	..	..	..	..	..	Cannot walk 1/2 mile, No=0, Yes=6

ANU-ADRI, Australian National University Alzheimer's Disease Risk Index; AgeCoDe, Study on Aging, Cognition and Dementia; BDSI, Brief Dementia Screening Indicator; CSHAI, Canadian Study of Health and Aging; FHS, Framingham Heart Study; MADeN, Mexican American Dementia Nomogram; WHIACP, Washington Heights-Inwood Columbia Aging Project; BMI, body mass index; MMSE, Mini-Mental Status Exam; iADLs, Instrumental Activities of Daily Living; TBI, traumatic brain injury

**Supplementary Box 1.** Selected description of the adaptation of seven existing dementia risk models to data collected in the Torres Strait dementia prevalence survey (2015-2018)

**Study on Aging, Cognition and Dementia (AgeCoDe)**

Jessen F, Wiese B, Bickel H, Eiffländer-Gorfer S, Fuchs A, Katuszkiewicz H, Köhler M, Luck T, Mösch E, Pentzek M, Riedel-Heller SG, Wagner M, Weyerer S, Maier W, van den Bussche H; AgeCoDe Study Group (2011) Prediction of dementia in primary care patients. *PLoS One* 6, e16852.

**Verbal fluency:** Jessen et al. used a cut-off of <18 words, of which ~30% of participants were in this category. In the Torres Strait Dementia prevalence data, ~30% of participants scored <8 on category fluency of animals. So, a cut-off of <8 was used to adapt the AgeCoDe and participants who scored below this threshold were assigned 4 points.

**Delayed recall:** Jessen et al. categorized the free recall of 0-10 words. Approximately 33% of the participants fell into each of the three categories (i.e., 0-4, 5-6, 7-10). For the Torres Strait Dementia Prevalence Survey (DPS) data, the closest measure of free recall was that of five pictures. The closest equivalent categorisation of participants on this task was 4-5 pictures (56.5%, 0 points), 3 pictures (20.4%, 2 points) and 0-2 pictures (23.1%, 4 points).

**iADL:** Jessen et al. assigned participants as unimpaired or impaired using an Instrumental ADL (IADL) scale described in *Lawton MP, Brody EM (1969) Assessment of older people: self-maintaining and instrumental activities of daily living. Gerontologist 9, 179-186.*

For the DPS data, the closest measure of dependence in iADLs was participants reporting needing help with at least one of cooking, cleaning, medication management and management of finances.

**Other variables:** Age and Mini Mental Status Exam scores were adapted as described in Supplementary Table 2 and subjective memory complaint could not be mapped.

**Australian National University Alzheimer's Disease Risk Index (ANU-ADRI)**

Anstey KJ, Cherbuin N, Herath PM (2013) Development of a new method for assessing global risk of Alzheimer's disease for use in population health approaches to prevention. *Prev Sci* 14, 411-421.

**Education:** Anstey et al. used years of education. This was adapted to the DPS data as the number of years of formal schooling, excluding tertiary qualifications and technical college training.

**BMI/Obesity:** There was no Body Mass Index (BMI) measure in the DPS, so normal weight and overweight could not be calculated. Participants in the DPS were assigned 5 points if obesity was recorded in their clinical records.

**Alcohol:** Anstey et al. used categories corresponding to the Australian National Health and Medical Research Council categories, where Light Drinkers had No more than 10 standard drinks a week and were assigned -3 points. In the DPS data, participants were assigned 0 points if they did not drink (n=197 participants) and -3 points if they drank 1-6 drinks "sometimes" (n=40 participants), or 1-3 drinks 1-3 days per week (n=5 participants).

**Depression:** Depression in the DPS data was scoring  $\geq 8$  points on the Kimberley Indigenous Cognitive Assessment brief depression screening tool (KICA-Dep), which was identified as cut-off for depression in this population [1]. Participants who scored at/above this cut-off were assigned two points.

[1] Russell SG, Quigley R, Thompson F, Sagigi B, Miller G, LoGiudice D, Smith K, Strivens E, Pachana NA (2023) Culturally appropriate assessment of depression and anxiety in older Torres Strait Islanders: limitations and recommendations. *Clin Gerontol* 46, 240-252.

**TBI:** Traumatic Brain Injury (TBI) in the DPS data was participants reporting ever being hit on the head and knocked out. These participants were assigned 4 points.

**Other variables:** Age, gender and diabetes were adapted as described in Supplementary Table 2. It is noted that many other variables described in the ANU-ADRI could not be adapted as they were not captured in the Torres Strait DPS.

**Brief Dementia Screening Indicator (BDSI)**

Barnes DE, Beiser AS, Lee A, Langa KM, Koyama A, Preis SR, Neuhaus J, McCammon RJ, Yaffe K, Seshadri S, Haan MN, Weir DR (2014) Development and validation of a brief dementia screening indicator for primary care. *Alzheimers Dement* **10**, 656-665.e1.

Education: Barnes et al. used years of education. This was adapted to the DPS data as the number of years of formal schooling, excluding tertiary qualifications and technical college training. Participants were assigned 9 points if they had less than 12 years of formal schooling.

Antidepressants or 'everything was an effort'  $\geq 3$  days per week: Participants were assigned 6 points if they answered "A lot" or "All the time" to a question on the KICA-Dep depression screening tool asking in the last week, how often have you "Felt like not doing things that you usually like doing?"

Needs help, money or medications: Participants were assigned 10 points if they had partial or full dependence on someone else for their finances or medications.

Other variables: Age, diabetes, and stroke scores were adapted as described in Supplementary Table 2 and Body Mass Index was not available in the DPS.

**Canadian Study of Health and Aging (CSHAI)**

Hogan DB, Ebly EM (2000) Predicting who will develop dementia in a cohort of Canadian seniors. *Can J Neurol Sci* **27**, 18-24.

Memory problems reported by an informant: Participants were assigned 10 points if a carer answered "Sometimes" or "All the time" to any of the following questions.

Have you noticed that s/he is forgetting a lot of things?

Does s/he forget the names of his/her family? eg. his/her grannies?

Does s/he forget what happened yesterday?

Does s/he forget where s/he is now?

Does s/he say the same thing over and over?

Can s/he remember which week is pension week?

Does s/he keep walking away and getting lost?

Does s/he say things that are wrong in Aboriginal way?

Other variables: Age and MMSE were adapted as described in Supplementary Table 2.

CSHAI final score:  $gen\ CSHAI\_S = (100 - (CSHAI\_MMSE/30 * 100)) + (.25 * CSHAI\_Age) + CSHAI\ Mem$

**Framingham Heart Study (FHS)**

Li J, Ogrodnik M, Devine S, Auerbach S, Wolf PA, Au R (2018) Practical risk score for 5-, 10-, and 20-year prediction of dementia in elderly persons: Framingham Heart Study. *Alzheimers Dement* **14**, 35-42.

BMI/Obesity: There was no Body Mass Index (BMI) measure in the DPS, so underweight, normal weight and overweight could not be calculated. Participants in the DPS were assigned -1 points if obesity was recorded in their clinical records.

Other variables: Age, diabetes, stroke, and marital status were adapted as described in Supplementary Table 2.

**Mexican American Dementia Nomogram (MADeN)**

Downer B, Kumar A, Veeranki SP, Mehta HB, Raji M, Markides KS (2016) Mexican-American Dementia Nomogram: development of a dementia risk index for Mexican-American older adults. *J Am Geriatr Soc* **64**, e265-e269.

Education: Participants were assigned 5 points if they had less than 4 years of formal school education, excluding tertiary qualifications and technical college training.

Feeling the blues: Participants were assigned 4 points if they answered "A lot" or "All the time" to a question on the KICA-Dep depression screening tool asking in the last week, how often have you "felt down, sad, no good?"

Impaired in  $\geq 1$  iADL: Participants were assigned 1 point if they needed help with at least one of cooking, cleaning, medication management and management of finances, compared to report of not needing help with any of these.

Pain: Participants were assigned 3 points if they were in pain all the time, for more than one week and if the pain was greater than 2/5 on targets and/or interfering with daily activities.

Other variables: Age, sex and diabetes were adapted as described in Supplementary Table 2. Social engagement was not available in the DPS.

**Washington Heights-Inwood Columbia Aging Project (WHIACP)**

Reitz C, Tang M-X, Schupf N, Manly JJ, Mayeux R, Luchsinger JA (2010) A summary risk score for the prediction of Alzheimer disease in elderly persons. *Arch Neurol* **67**, 835-841.

Variables: Age, sex, diabetes, hypertension, current smoking and education were as described in Supplementary Table 2.

**Supplementary Table 3.** Distribution of scores for dementia risk models, excluding points for age and MMSE, by study variables, for 274 Torres Strait Islander and Aboriginal residents aged 45 years and over (2015-2018)

<b>Total</b>	<b>AgeCoDe</b>	<b>ANU-ADRI</b>	<b>BDSI</b>	<b>CSHAI</b>	<b>FHS</b>	<b>MADeN</b>	<b>WHACP</b>
n	253	225	234	274	262	234	251
mean (SD)	3.1 (3.3)	8.2 (4.0)	12.0 (5.5)	1.4 (3.4)	1.9 (1.3)	5.1 (3.0)	6.8 (4.9)
median (IQR)	2 (0-6)	8 (6-11)	12 (9-12)	0 (0-0)	2 (1-3)	5 (3-7)	9 (1-10)
range	0, 10	0, 19	0, 28	0, 10	-1, 5	0, 13	0, 18
<b>Age categorized (ref 45-64)</b>							
65-74	2.0**	9.0	12.0	0.0*	2.0*	5.0	10.0**
75-94	6.0**	9.0	12.0	0.0*	2.5*	5.0	10.0**
<b>Sex (Male, ref female)</b>	2.0	7.0	12.0	0.0	2.0	2.0**	8.0*
<b>Highest education - categorized</b>							
Primary school only	4.0**	10.0**	12.0**	0.0	2.0	6.0	10.0**
Grade 8-10	2.0**	7.0**	12.0**	0.0	2.0	5.0	6.0**
Grade 11-12	2.0**	4.0**	6.0**	0.0	2.0	3.5	1.0**
Post school	0.0**	7.0**	12.0**	0.0	2.0	5.0	2.0**
<b>Highest education - dichotomized</b>							
Formal school only	2.0**	9.0	12.0	0.0	2.0	5.0	9.0**
Post school	0.0**	7.0	12.0	0.0	2.0	5.0	2.0**
<b>Marital status</b>							
Single	2.0*	10.0	12.0	0.0	4.0**	5.0*	6.5*
Married/De-facto	2.0*	7.0	12.0	0.0	2.0**	5.0*	8.0*
Previously married	2.0*	9.0	12.0	0.0	3.0**	6.0*	9.0*
<b>Self-reported behaviors</b>							
Current drinks alcohol	0.0**	7.0**	12.0	0.0	1.0**	4.0*	6.0
Previously drank alcohol	2.0*	8.0	12.0	0.0	2.0*	5.0*	8.0
Current smoker	2.0	11.5**	12.0	0.0	2.0	4.0	14.0**
Past smoker	2.0	9.5**	12.0	0.0	2.0	5.0	9.0*
<b>Reported medical history</b>							
Poor mobility/walking	4.0**	9.0*	12.0**	0.0	2.0	6.0*	9.0*
Loss of Consciousness	2.0	11.0**	12.0	0.0	2.0	4.0	9.0
Pain	2.0	8.0	12.0	0.0	2.0	9.0**	9.0



iADLs (Any dependence)	6.0**	9.0	12.0**	0.0*	3.0**	6.0**	9.0*
Memory - Informant	6.0**	9.0	12.0*	10.0**	3.0	5.0	9.0
<b>Medical history from Geriatrician assessment</b>							
Obese	0.0*	12.0**	12.0	0.0	1.0**	5.0	7.0
Hearing impairment	4.0*	7.5	12.0	0.0	2.0	4.0	7.5
Diabetes	2.0*	10.0**	12.0**	0.0	3.0**	5.0**	9.0
Dyslipidemia	2.0	9.0	12.0	0.0	2.0**	5.0	9.0
Chronic kidney disease	4.0**	9.5	12.0	0.0	3.0**	5.0	9.0
Heart disease	4.0*	10.0	12.0	0.0	3.0**	5.0	9.0*
Stroke/CVD	9.0**	7.0	25.0**	0.0	4.0**	6.0	2.0
Hypertension	2.0*	9.0*	12.0*	0.0	2.0*	5.0	9.0**
Depression (KICA-Dep $\geq$ 8)	0.0	10.5*	12.0	0.0	2.0	8.0**	5.5
<b>Cognitive assessment</b>							
Fluency (ref $\geq$ 8 words)							
0-7	8.0**	9.0	12.0**	0.0	2.0**	5.0	9.0*
Recall (pictures)							
0-2	0.0**	8.0	12.0**	0.0*	2.0**	5.0	8.0
3	2.0**	7.0	12.0**	0.0*	2.0**	5.0	9.0
4-5	8.0**	9.0	12.0**	0.0*	3.0**	5.5	9.0
MMSE (<27)	8.0**	10.0*	12.0**	0.0	3.0**	5.0	10.0**
KICA-Cog (<36)	10.0**	9.0	19.0**	0.0*	3.0**	6.0	10.0
<b>Panel diagnosis</b>							
No dementia	2.0**	8.0	12.0**	0.0*	2.0**	5.0	8.0
Dementia	10.0**	9.0	19.0**	0.0*	3.0**	6.5	9.0

iADLs, Instrumental Activities of Daily Living; CVD, cerebrovascular disease; BPI, Brief Pain Inventory; KICA, Kimberley Indigenous Cognitive Assessment tool; KICA-Dep, Brief depression screen in the KICA; Fluency, verbal fluency measured through the number of animals listed in one minute; Recall, free recall of five pictures encoded during administration of the KICA; MMSE, Mini-Mental Status Exam; KICA-Cog, Brief cognitive screen tool in the KICA; IQR, interquartile range.