Does ECT cause cumulative cognitive deficits?

George Kirov, Cardiff University

2004, Patient A: requiring weekly ECT

Case Reports > J ECT. 2009 Sep;25(3):219-20. doi: 10.1097/YCT.0b013e3181937f3d.

Four years of successful maintenance electroconvulsive therapy

George Kirov, Mary Creaby, Najeeb Khalid, Maria Atkins

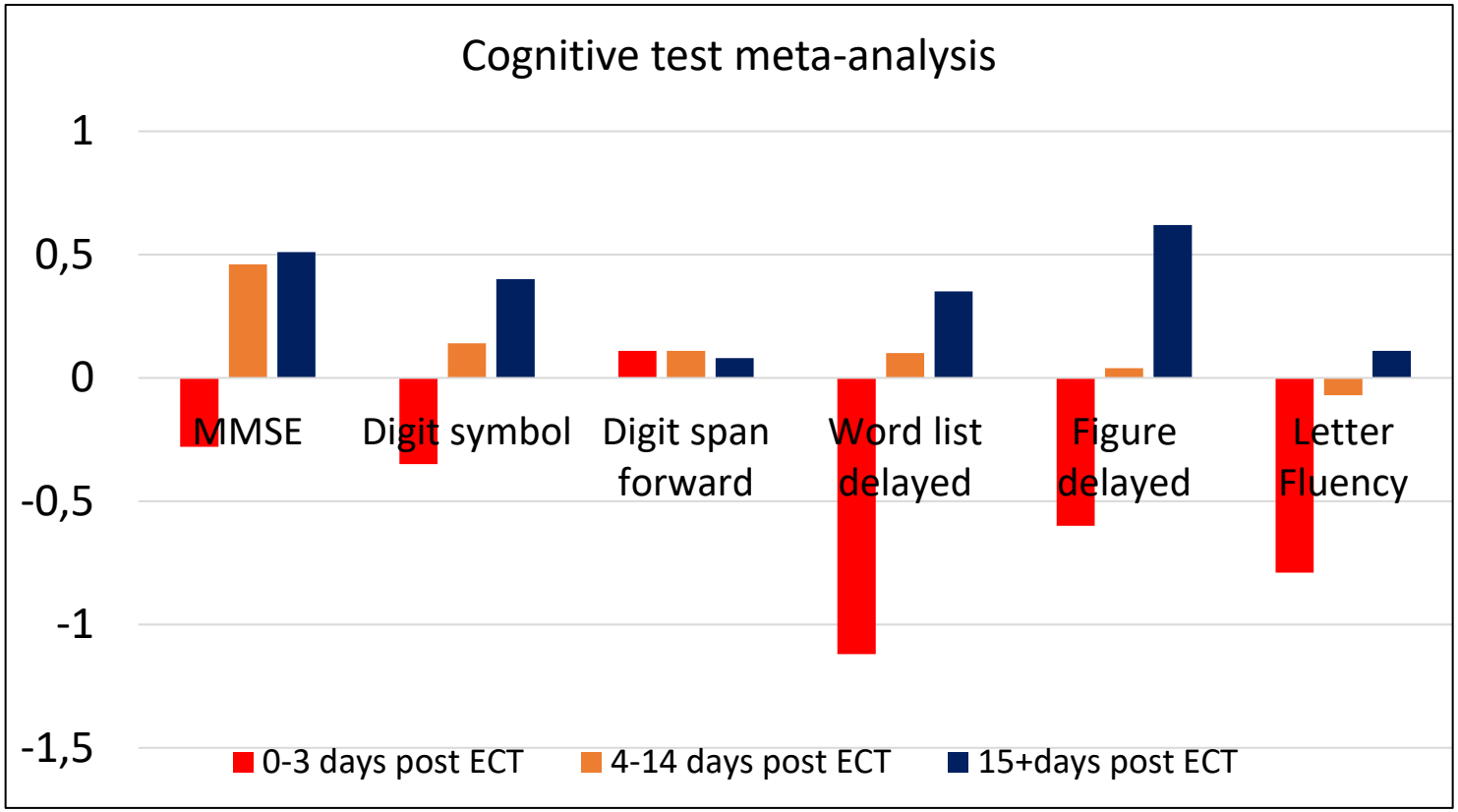
209 ECTs during her lifetime.

2022: "Eighteen years of successful maintenance ECT"
479 ECTs. MMSE = 23-28

Objective Cognitive Performance Associated with Electroconvulsive Therapy for Depression: A Systematic Review and Meta-Analysis

Maria Semkovska and Declan M. McLoughlin

BIOL PSYCHIATRY 2010;**68**:568 –577



- **Conclusions:** Cognitive abnormalities associated with ECT are limited to the first 3 days posttreatment
- But: what happens after repeated courses?

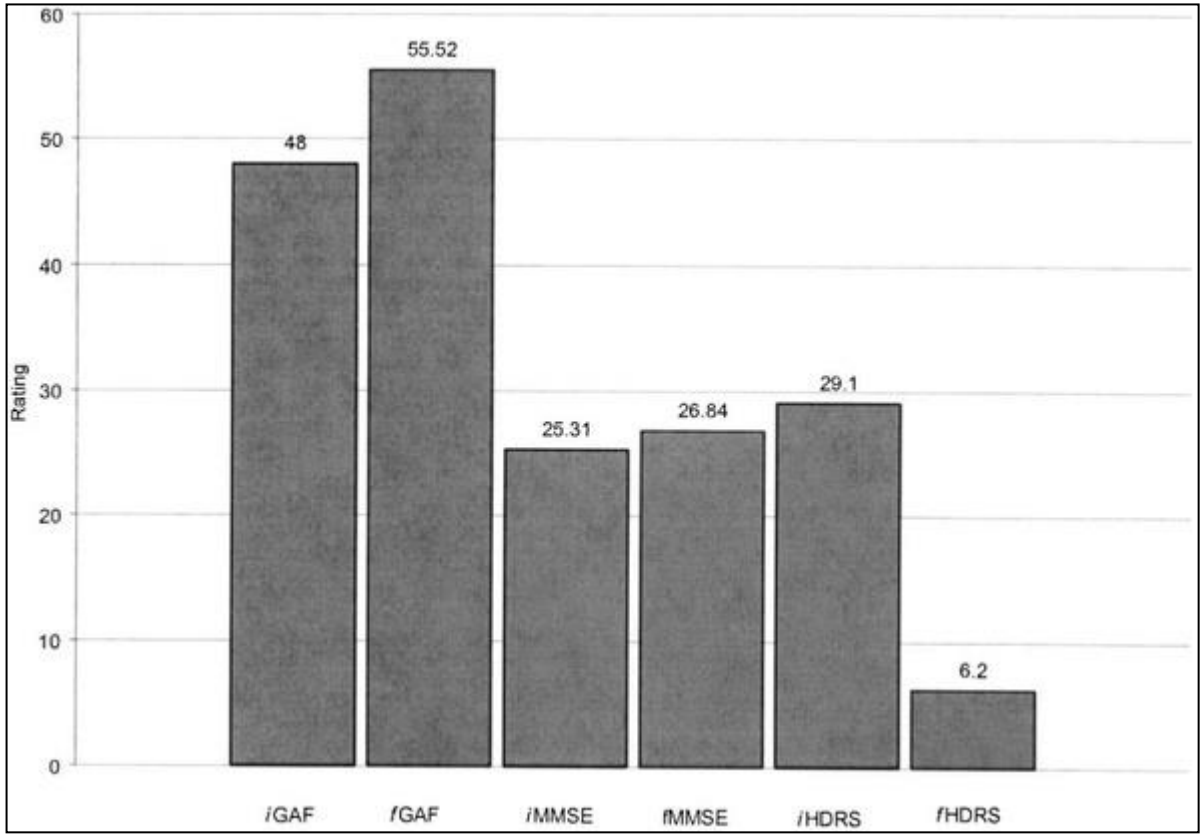
Prospective studies do not report deterioration in cognitive functioning in m-ECT

Continuation and Maintenance Electroconvulsive Therapy for Mood Disorders: Review of the Literature

Georgios Petrides[a] Kristen G. Tobias[b] Charles H. Kellner[b]
Matthew V. Rudorfer[c] Neuropsychobiology 2011;64:129–140

Study	case/ con	duration	effect
Swoboda et al, 2001	13 /13	9.6 months (range 2-24)	Post-ECT MMSE = 28.5 (2 stopped due to “cognitive-related issues”) Controls MMSE=27.7
Rami-Gonzalez et al, 2003	11 /11	27 months, mean ECT N=36	Encoding of new information and frontal function tests significantly lower in the M-ECT patients. MMSE no changes
Vothknecht et al, 2003	9 /13	6 months	Stable cognitive function on a battery of tests
Rami et al, 2004	14 /10	12 months, monthly ECT	No change on a battery of cognitive tests
Kellner et al, 2006	89 /95	6 months, 10 ECTs	No difference in MMSE scores
Navarro 2008	16 /17	2 years, monthly ECT	No difference in MMSE scores
Nordenskjold 2013	15 /8	12 months	No difference in MMSE scores

FIG. 2.



Long-Term Maintenance ECT: A Retrospective Review of Efficacy and Cognitive Outcome.
Russell, J; Rasmussen, Keith; OConnor, M; Copeman, Carol; Ryan, Debra; Rummans, Teresa

Journal of ECT. 19(1):4-9, 2003.

FIG. 2. Average ratings before and after at Least 1 year of maintenance ECT (M-ECT).

At least 1 year of m-ECT. Based on 20 sets of MMSE before starting and at the end of the course

Wolters Kluwer Health | OvidSP

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Cognitive tests in Cardiff

- Since 2004 as part of a study comparing ECT and MST
- Testing adopted as standard
- Cognitive testing made mandatory for ECT in the UK by ECT Accreditation Service

Cognitive tests in Cardiff

Mini Mental State Examination (MMSE)

Verbal Fluency (N words in 1 min, beginning with F, A, T or S)

Digit Span backwards (0-8)

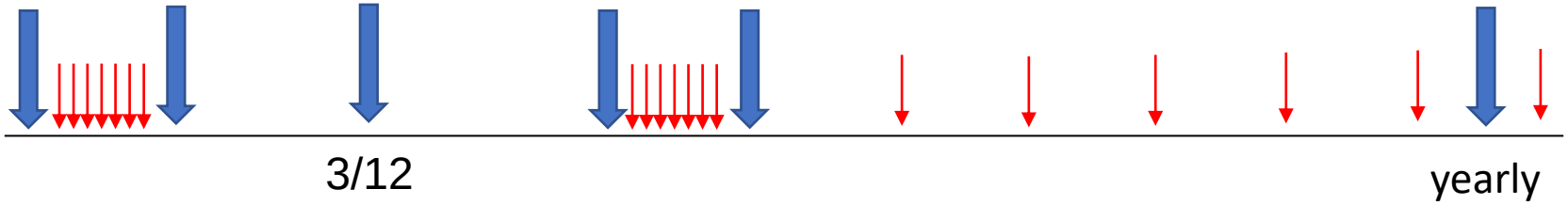
Recognition of words, shapes and faces, on computer (memory)

Reaction time simple / with distraction, on computer

Trail making A & B

Complex figure drawing

Cognitive Failures Questionnaire



In 2016 published data on 498 tests in 199 patients

Statistical analysis

- Linear mixed-effect regression model in R to test the effect size of variables on 9 cognitive tests
- Covariates:
  - age
  - sex
  - depression rating score on the day (HAMD-24)
  - number of days since last ECT (log)
  - number of previous tests (to control for practice)
  - number of previous ECTs

Does ECT cause cumulative cognitive deficits?

Kirov *et al*, March 2016, *BJPsych*

Evaluation of cumulative cognitive deficits from electroconvulsive therapy

George G. Kirov, Laura Owen, Hazel Ballard, Adele Leighton, Kara Hannigan, Danielle Llewellyn, Valentina Escott-Price and Maria Atkins

Background
Electroconvulsive therapy (ECT) is the most effective acute treatment for severe depression, but widely held concerns about memory problems may limit its use.

Aims
To find out whether repeated or maintenance courses of ECT cause cumulative cognitive deterioration.

Method
Analysis of the results of 10 years of cognitive performance data collection from patients who have received ECT. The 199 patients had a total of 498 assessments, undertaken after a mean of 15.3 ECT sessions (range 0–186). A linear mixed-effect regression model was used, testing whether an increasing number of ECT sessions leads to deterioration in performance.

Results
The total number of previous ECT sessions had no effect on cognitive performance. The major factors affecting performance were age, followed by the severity of depression at the time of testing and the number of days since the last ECT session.

Conclusions
Repeated courses of ECT do not lead to cumulative cognitive deficits. This message is reassuring for patients, carers and prescribers who are concerned about memory problems and confusion during ECT.

Declaration of interest
None.

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2016 results: 498 tests in 199 people:

Table 1 Statistical significance and effect size of the number of electroconvulsive therapy (ECT) sessions and the four covariates on the cognitive tests[a]

	Digit Span	Recognition (memory)	Verbal fluency	MMSE	Complex figure	CFQ	Reaction time	Trail making A	Trail making B
Assessment, *n*	460	455	479	493	384	360	418	340	332
ECT sessions, *n*									
Effect size	0.005	−0.008	−0.004	0.005	−0.004	−0.02	−1.0	0.02	−0.5
P	ns	ns	ns	ns	ns	ns	ns	ns	ns
HRSD									
Effect size	−0.01	−0.05	−0.02	−0.03	−0.03	−0.5	−2.9	−0.4	−1.8
P	0.03	0.0006	ns	0.002	ns	9×10^{-10}	0.0007	0.002	0.003
Age									
Effect size	−0.01	−0.08	−0.05	−0.07	−0.3	0.3	−4.9	−1.2	−4.7
P	0.005	6×10^{-10}	0.005	10^{-12}	8×10^{-14}	8×10^{-6}	4×10^{-11}	4×10^{-17}	3×10^{-15}
Days since ECT									
Effect size	−0.002	0.5	0.3	0.1	0.4	−0.6	6.8	3.1	6.7
P	ns	0.0003	ns	ns	ns	ns	ns	0.006	ns
Practice (repetition of test)									
Effect size	0.05	0.1	0.1	−0.02	0.7	0.2	20.2	4.6	13.1
P	ns	ns	ns	ns	ns	ns	0.04	0.006	ns

MMSE, Mini-Mental State Examination, CFQ, Cognitive Failures Questionnaire; HRSD, Hamilton Rating Scale for Depression.
a. Results with $P > 0.05$ are shown as non-significant (ns). No correction for multiple testing is applied. Effect size indicates the degree of change on the cognitive test score by each unit of the variable. For example for the variable age, each year reduces the performance on the MMSE by 0.07 points, i.e. a patient who is 50 years older than another one, scores on average 3.5 points lower. All effect sizes have been converted so that a minus (−) sign always denotes a deterioration.

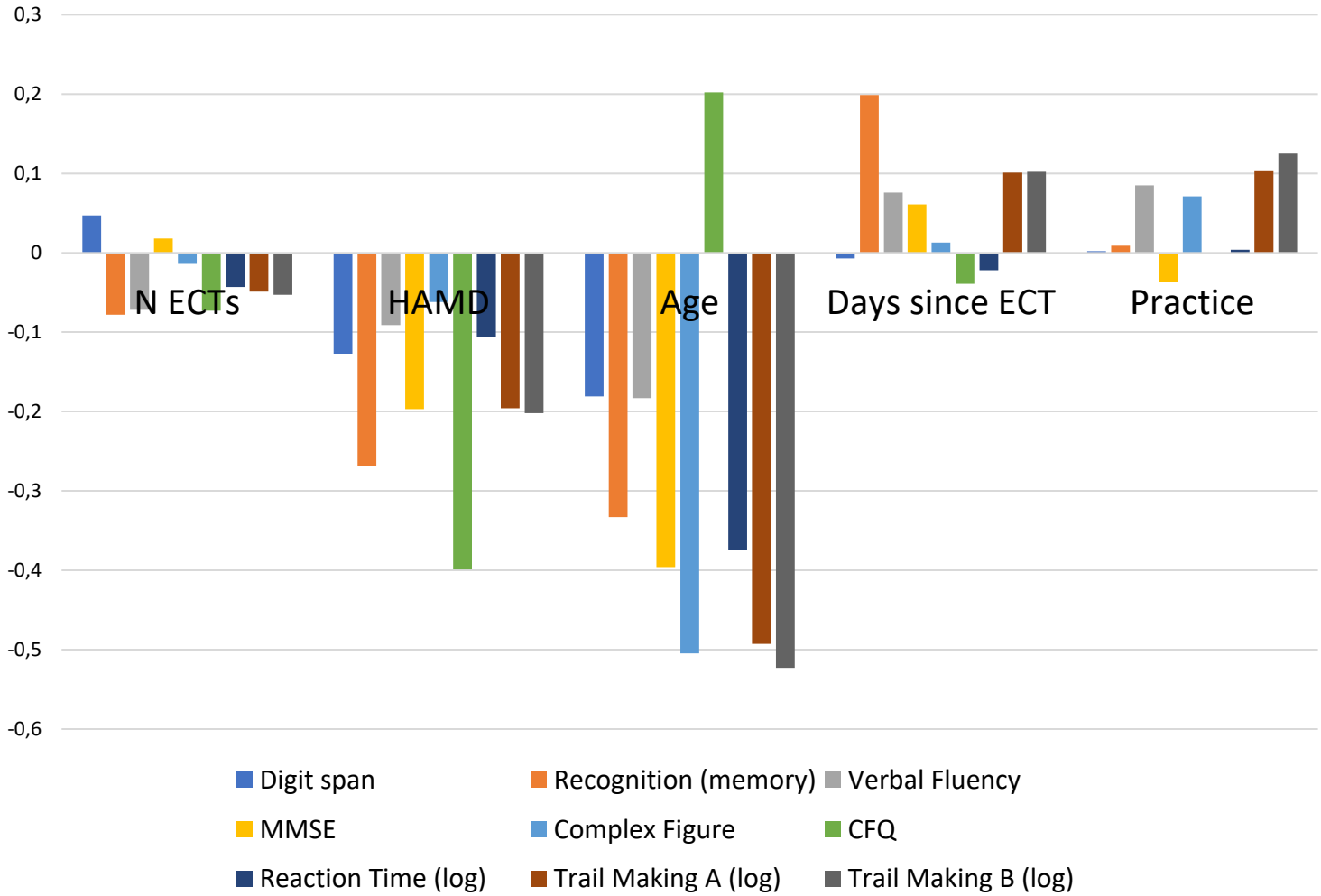
2022 results

788 tests on 308 depressed patients (excluding SCZ)

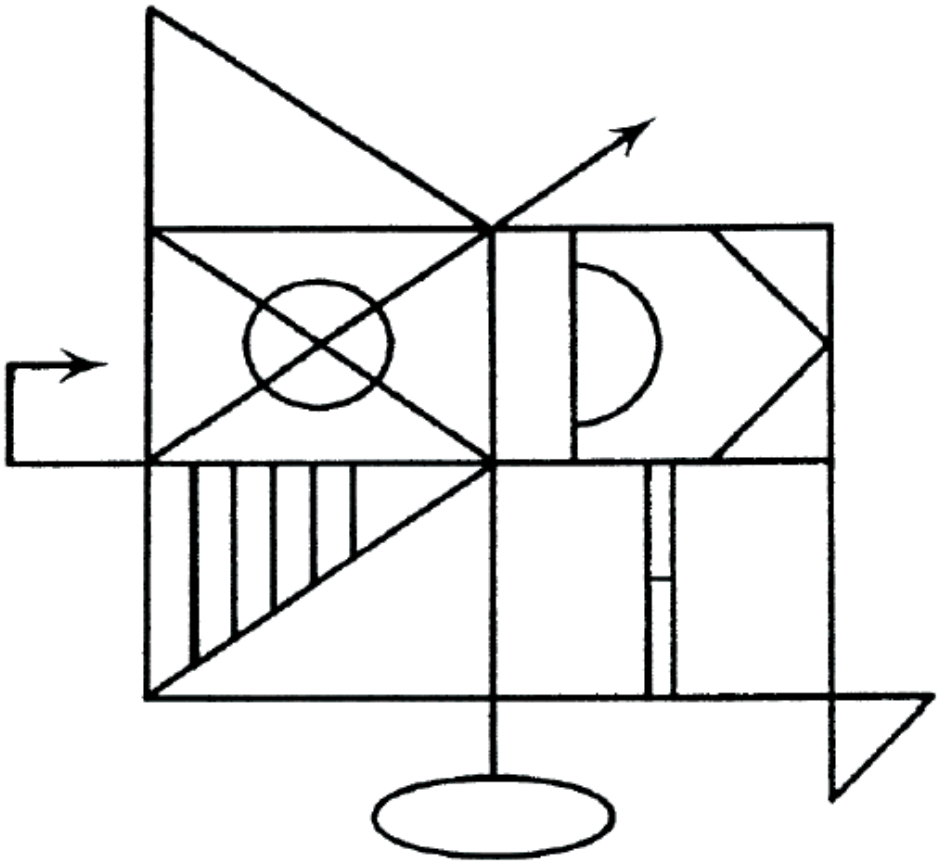
		Digit Span	Recognition (memory)	Verbal Fluency	MMSE	Complex Figure	CFQ	Reaction Time (log)	Trail Making A (log)	Trail Making B (log)
N assessments		739	720	759	773	650	624	677	611	593
N ECTs	Effect size	0.003	-0.01	-0.02	0.002	-0.006	-0.06	0.0	0.0	0.0
	p-value	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
HAMD	Effect size	-0.01	-0.08	-0.04	-0.04	-0.05	-0.6	-0.002	-0.004	-0.05
	p-value	0.007	10^{-8}	0.049	10^{-5}	n.s.	10^{-9}	0.012	10^{-6}	10^{-6}
Age	Effect size	-0.01	-0.08	-0.06	-0.07	-0.3	0.3	-0.06	-0.09	-0.01
	p-value	10^{-10}	10^{-19}	10^{-7}	10^{-29}	10^{-40}	10^{-17}	10^{-28}	10^{-60}	10^{-69}
Days since ECT	Effect size	-0.007	0.5	0.3	0.1	0.1	-0.5	0.003	0.026	0.025
	p-value	n.s.	10^{-8}	n.s.	n.s.	n.s.	n.s.	n.s.	0.001	0.009
Practice	Effect size	0.002	0.03	0.3	-0.08	0.6	n/a	-0.001	0.028	0.03
	p-value	n.s.	n.s.	n.s.	n.s.	n.s.		0.04	0.002	0.002

A negative sign (-) always indicates a worse performance on the test

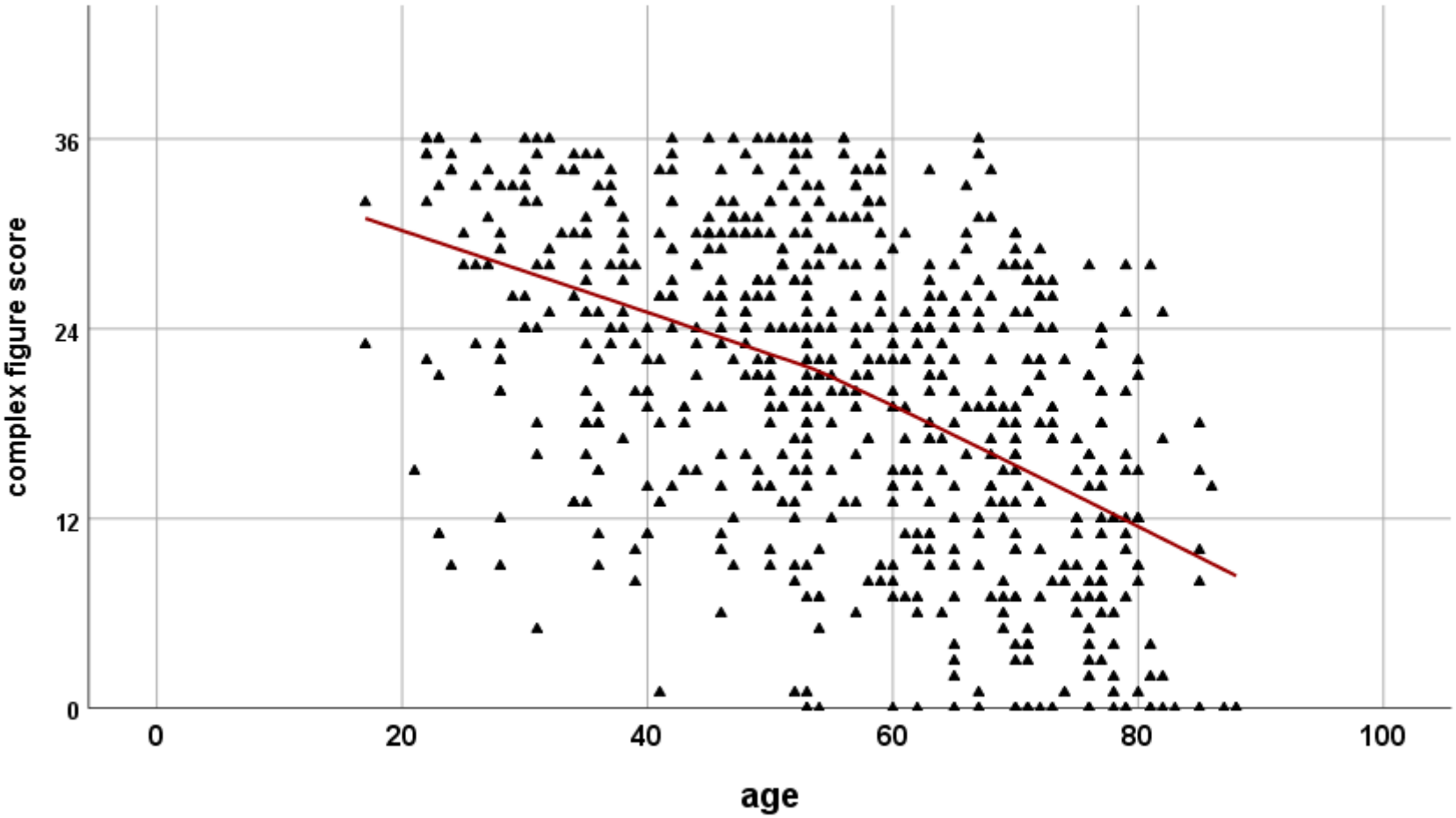
Effect size of co-variates on cognitive tests



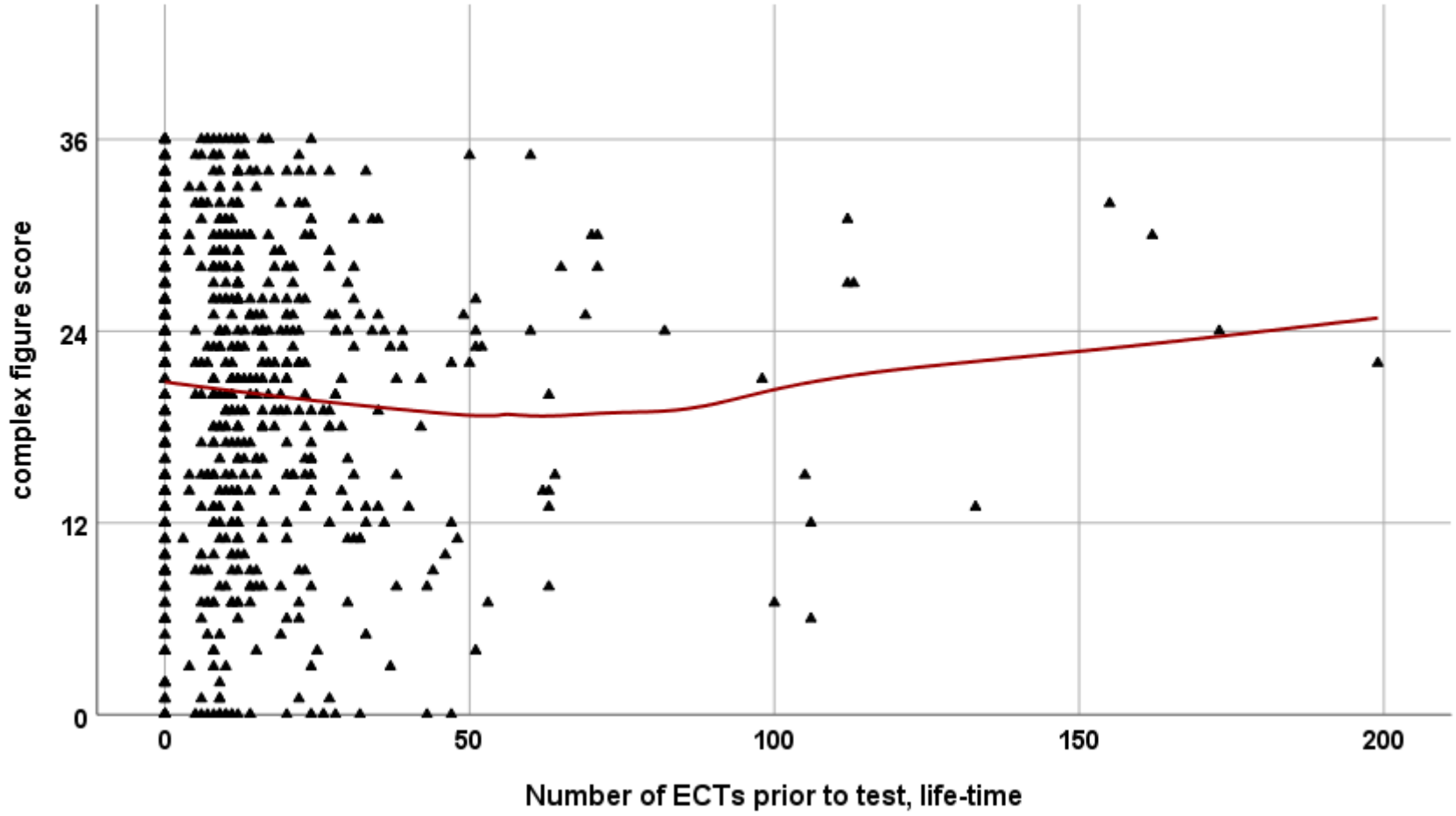
Complex Figure version 1



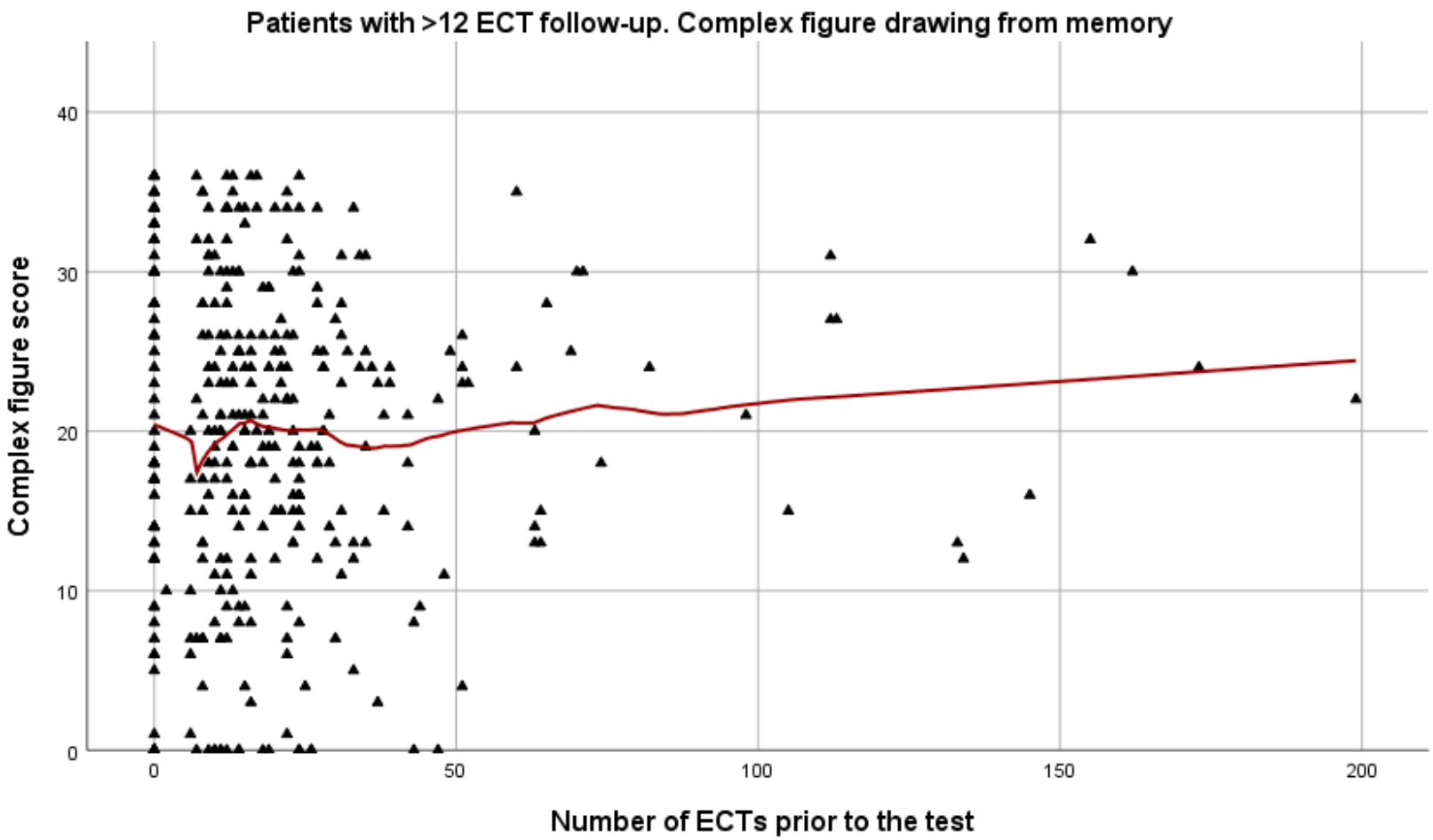
Complex Figure results: the effect from age



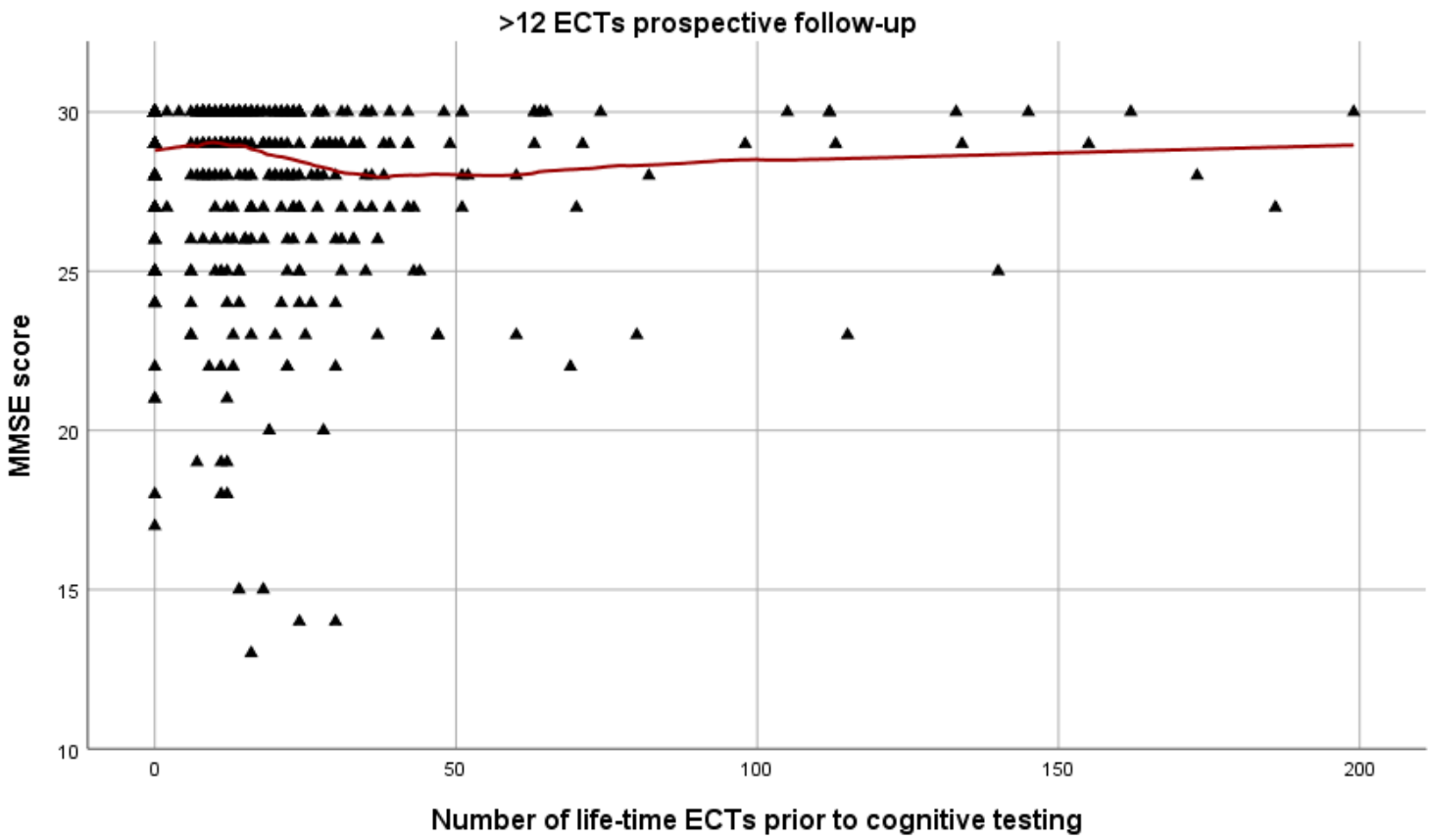
Complex Figure results:
No effect from the number of ECTs



Complex Figure: patients with >12 ECT between 1st and last cognitive test



Patients with >12 ECT between 1st and last cognitive tests

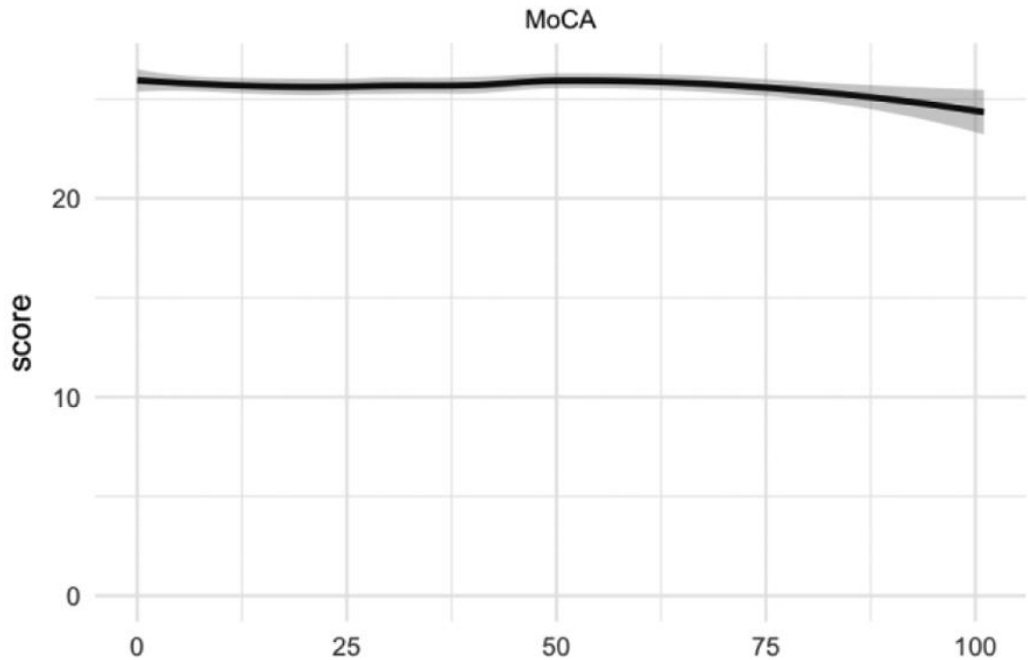


P=0.4

J Affect Disord. 2020 June 15; 271: 109–114. doi:10.1016/j.jad.2020.03.152.

Maintenance ECT is associated with sustained improvement in depression symptoms without adverse cognitive effects in a retrospective cohort of 100 patients each receiving 50 or more ECT treatments

James Luccarelli, MD*, Thomas H. McCoy Jr, MD, Stephen J. Seiner, MD, Michael E. Henry, MD Massachusetts General Hospital



Median 60 ECTs over 22 months, various pulse widths and laterality.

Massachusetts General Hospital

Conclusions

- There is very little evidence that repeated ECT courses or maintenance ECT lead to accumulation of cognitive deficits.
- Autobiographical memory not investigated
- Showing patients their cognitive tests has reassuring effect on them.

Llandough Hospital, Cardiff

Summer School

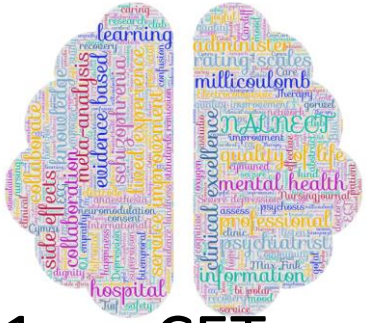
4-7th July in person in Cardiff or on zoom, free

Delegates and speakers of the MRC Summer School 2018

Our annual Summer School in Brain Disorders Research is held at one of the world's leading centres on neuropsychiatric genetics and genomics.

https://www.cardiff.ac.uk/mrc-centre-neuropsychiatric-genetics-genomics/study/summer-school

ECT Journal Club!



- Join us for the ECT Journal Club 1st June 2022, 1pm CET
- Aim: to review key papers on ECT research while having lunch (or breakfast in the Americas)
- Frequency: monthly
- Volunteers needed to present papers

Lancet Psychiatry. 2022 Jun;9(6):435-446. doi: 10.1016/S2215-0366(22)00077-3. Epub 2022 Apr 26.

Risk of suicide death following electroconvulsive therapy treatment for depression: a propensity score-weighted, retrospective cohort study in Canada

Tyler S Kaster [1], Daniel M Blumberger [2], Tara Gomes [3], Rinku Sutradhar [4], Duminda N Wijeysundera [5], Simone N Vigod [6]