

Hypothesis

Long-term cognitive function will be affected by an acute episodes of severe sepsis requiring hospitalization in an intensive care unit (ICU).

Introduction

Sepsis/systemic inflammatory response syndrome is associated with impairments that persist for months/years after recovery.¹

Memory impairments on standardized cognitive test batteries following discharge have been revealed in a population of pediatric intensive care unit patients.²

Diffusion tensor imaging has revealed alterations to white matter tracts following an episode of sepsis.^{3†}

The feedback related negativity (FRN) measured via electroencephalography (EEG) indicates how the outcome of a particular choice is encoded, impacts later decisions.⁴

Methods

GROUP	SEX (N)	AGE M (SD)	EDUCATION M (SD)	GAMBLING Hx
CONTROL	10 (5M:4F)	38.7 (3)	14.2 (.79)	Normal
SEPSIS (1 year p.i.*)	10 (6M:4F)	36 (3.2)	15.4 (.77)	Normal

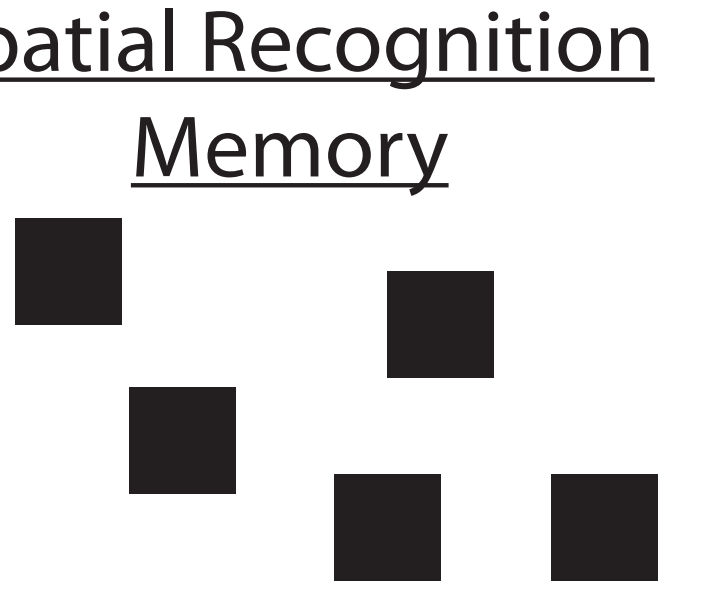
Subject demographic information
*p.i. = post infection

Behavioural Measures

Participants completed a subset of tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB) clustered around visuospatial processing / memory and executive functions. Subjects also completed a computerized version of the Iowa gambling task (IGT). Task completion order was counterbalanced.

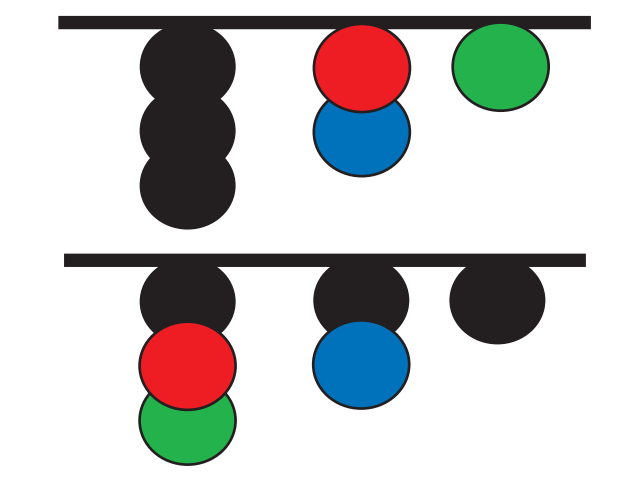
1. CANTAB

Spatial Recognition Memory



Force Two Choice Task:
"Try to remember where you saw the boxes."

Stockings of Cambridge



Sequential Planning Task:
"Make the picture on the bottom look like the picture on the top in x moves."

Delayed Matching to Sample

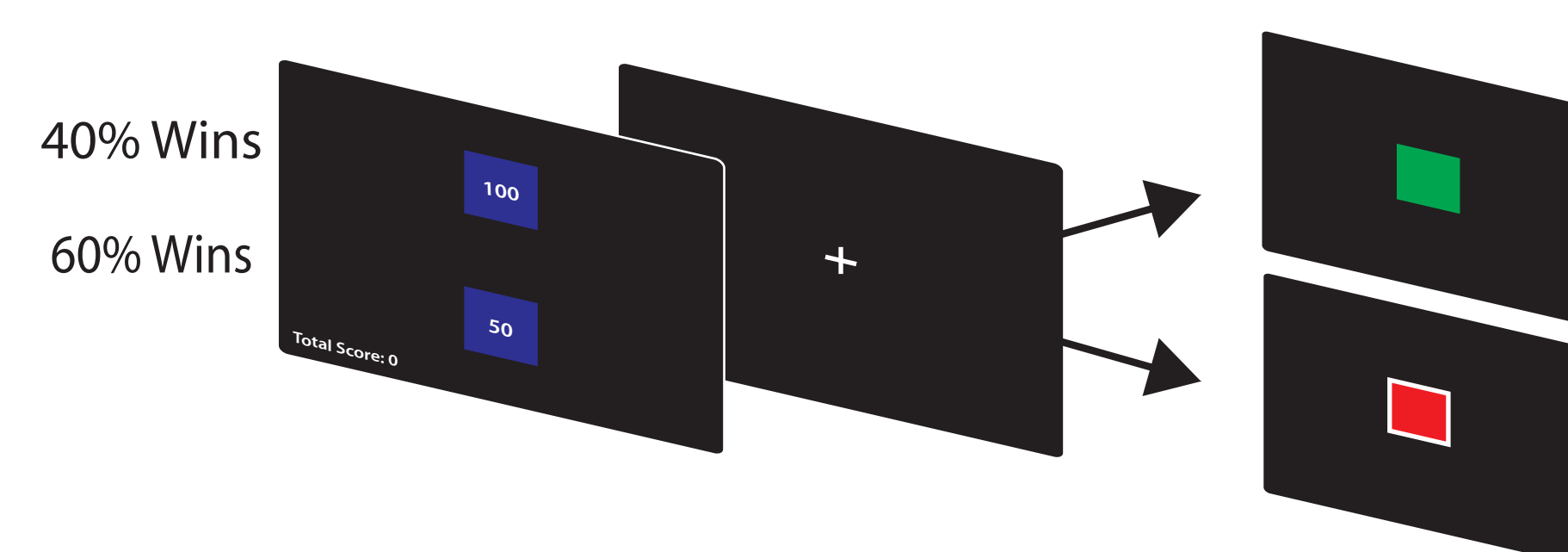


Forced Choice Task:

"Which pattern matches the one you saw before."

2. Iowa Gambling Task

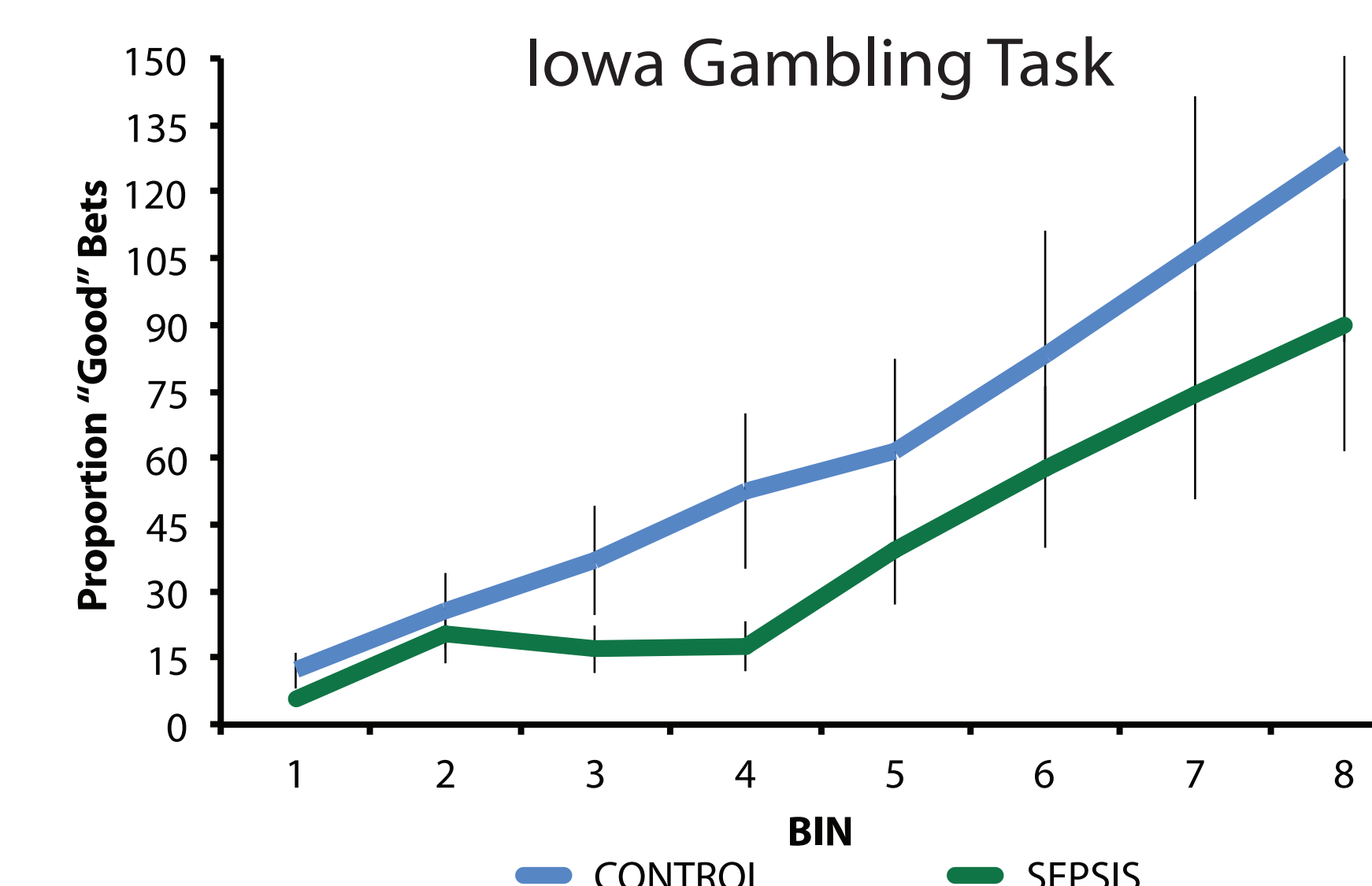
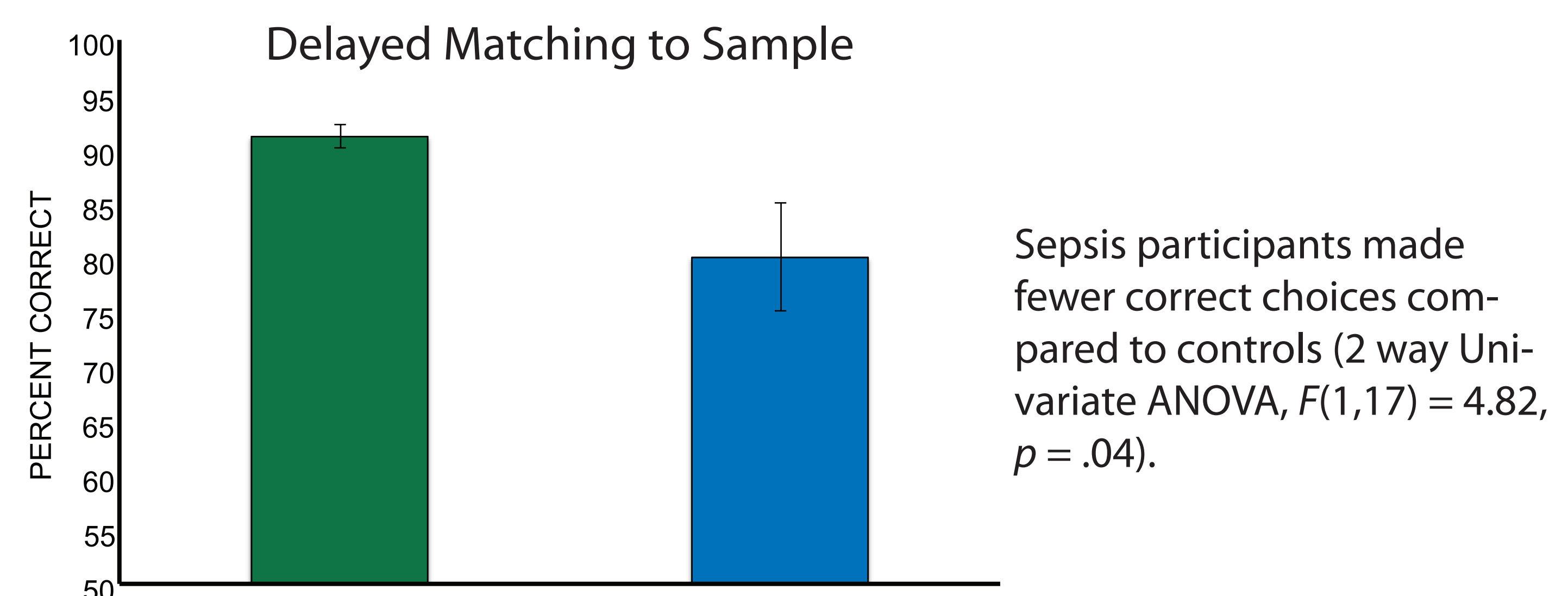
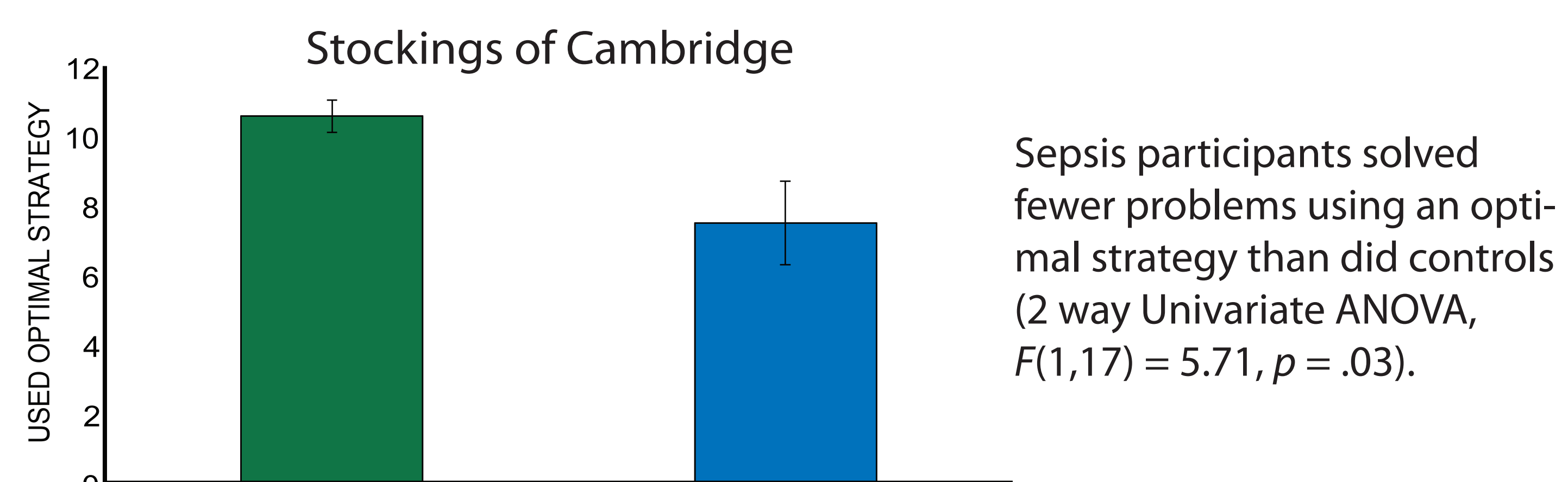
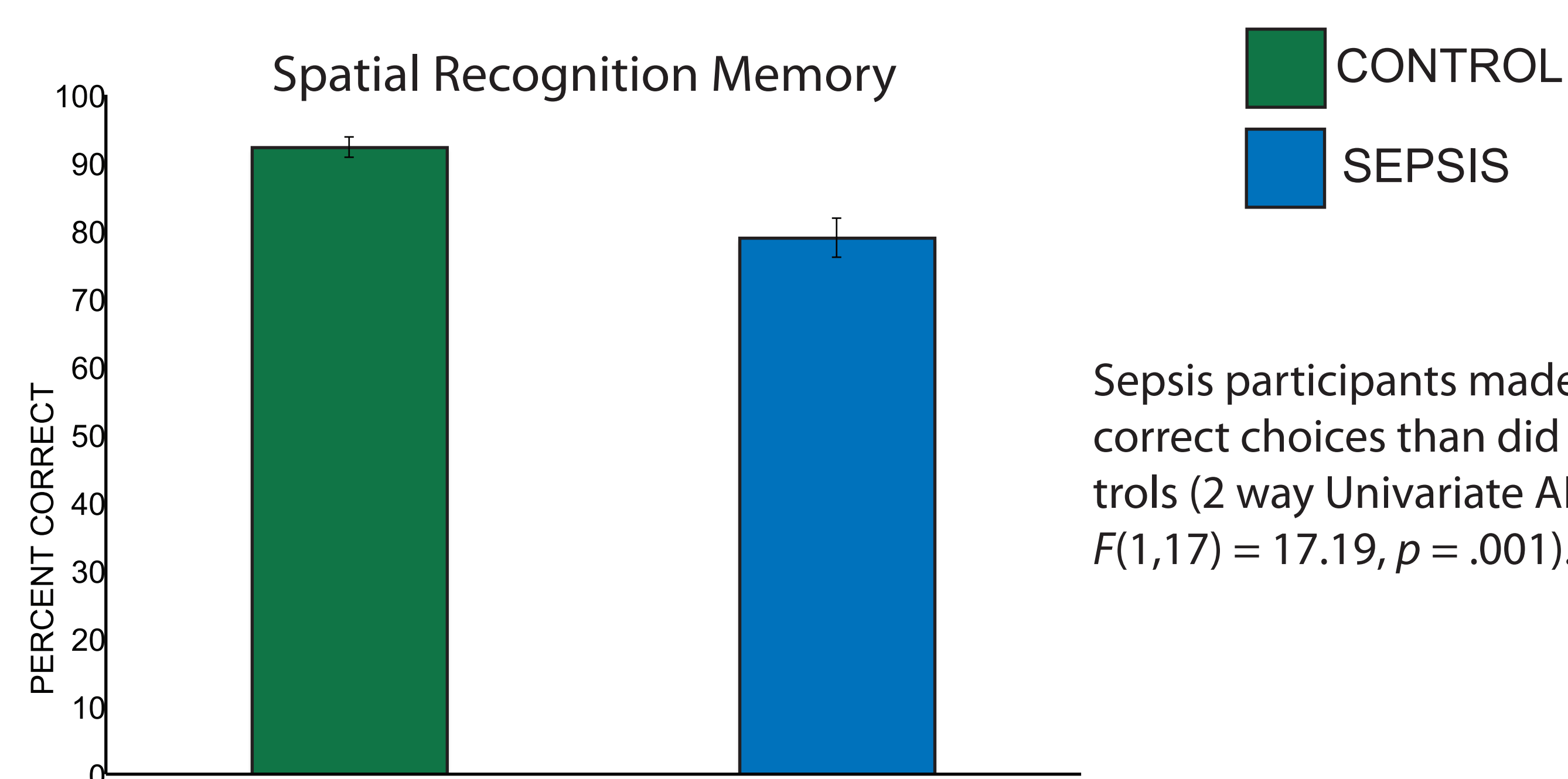
Subjects made 400 bets. Large bets win 40% of the time. without knowing that the win:loss ratio of the \$100 bet is 40:60 whereas the \$50 bet is 60:40. It is most advantageous to choose the \$50 bet.



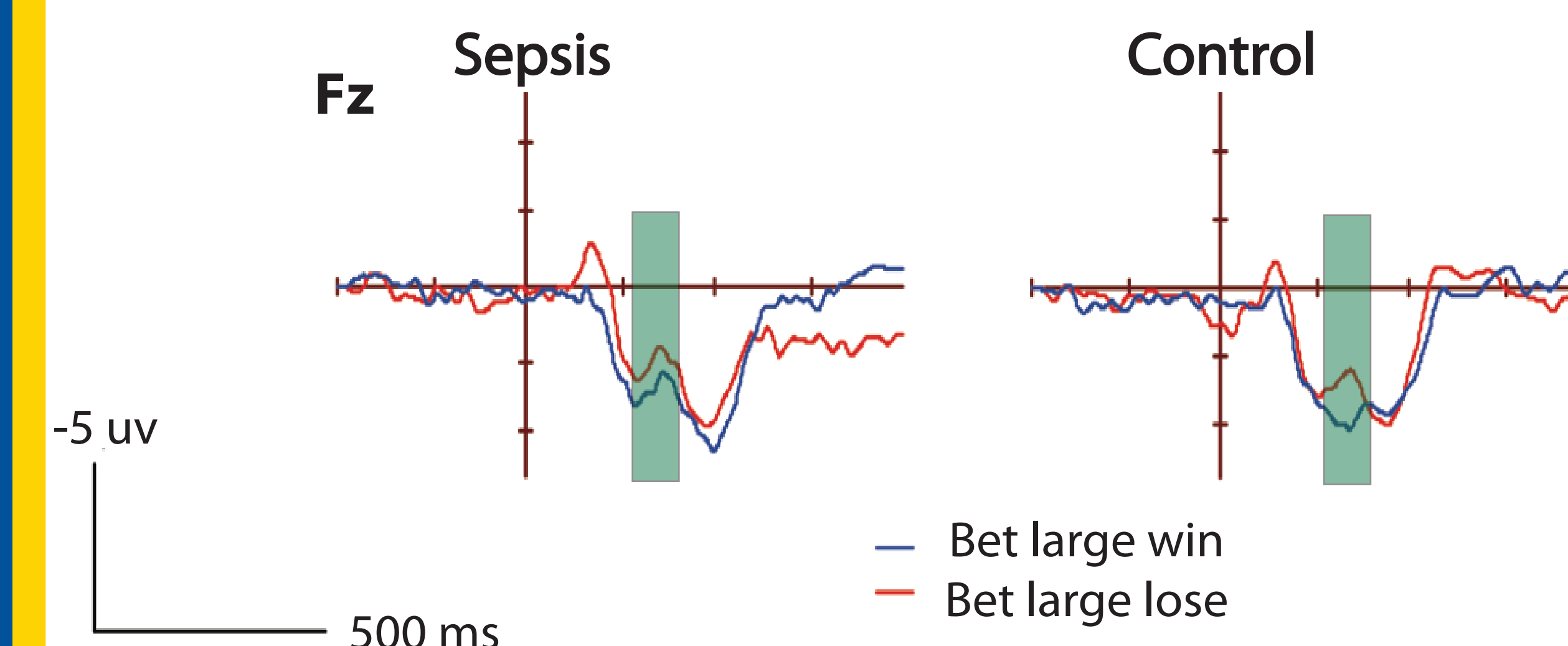
Physiological Measures

EEG was recorded from 128 scalp sites (sampling rate: 500Hz; Electrical Geodesics Inc.) during IGT performance. A small number of electrodes were interpolated and ocular artifacts were corrected. Event related potentials (ERPs) were computed for all outcomes (BESA).

Results



A trend was observed for sepsis participants to learn the IGT more slowly than controls though additional subjects are required to increase statistical power (*n.s.*).



ERPs for large wins and losses. The FRN occurring around 250ms post-stimulus onset at medial-frontal electrode Fz. Fz was interpreted as indicating activity in the anterior cingulate cortex. Additional subjects are required.

Discussion

Cognitive impairments following recovery from sepsis have been confirmed using the CANTAB, a standardized neuropsychological screening tool.

Sepsis participants were impaired relative to controls on all CANTAB tasks in our test battery, though not significantly so for all tasks.

Alterations in the ERPs of sepsis-recovered patients in conjunction with poorer performance on the IGT require further examination.

Future Research

An additional group of individuals who have been admitted to the ICU, but who did not have sepsis, are required before any definitive conclusions can be made.

Conclusion

Quantifiable, long-term cognitive impairments are present 10-12 months after an individual has recovered from Sepsis.

References

- Semmler et al. (2013). J Neurol Neurosurg Psychiatry:84. 62-69.
- Elison et al. (2008). Intensive Care Med:34. 1289-1293.
- Sharshar et al. (2007). Intensive Care Med:33. 798-806.
- Gehring & Willoughby (2002). Science:295. 2279-2282.