Comparing participant-reported memory problems with memory performance tests in chronic marijuana users

Porterfield BC[1], Goddard SD[2], Boyd AF[3], Gray KM[4]

[1]UNC-Eshelman School of Pharmacy [2]Texas A&M University [3]CNS Vital Signs, LLC [4]Medical University of South Carolina

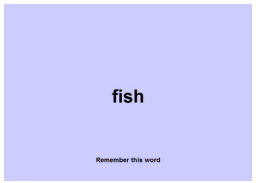
INTRODUCTION:

Marijuana use is one of the most common illicit substances abused in the United States.[i] Many studies on the neurocognitive effects of cannabis use have shown deficits in memory function upon chronic use of cannabis.[ii iii iv] One commonly utilized test to determine memory loss secondary to the use of cannabis is the Marijuana Problem Scale.[v vi vii] It relies upon the subjective self-report of memory loss on an ordinal scale of 0, 1, or 2; these values correspond to "no problem", indicating no impairment in memory, "minor problem," indicating some impairment of memory, and "serious problem," indicating severe impairment of memory. Objective computerized neurocognitive memory tests are commonly performed with both traditional paper batteries and computerized batteries. These assessments report the test taker's ability to recall a bank of 15 words (Fig A) and 15 shapes (Fig B) with both immediate and delay challenges. This study examined baseline reports of these two measures made by participants recruited to participate in a randomized prospective marijuana abuse study. The aim of this study was to compare the Marijuana Problem Scale (MPS), a subjective researcher-administered questionnaire used in this study to survey memory problems, to objective memory performance testing.

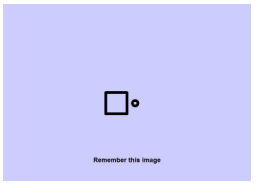
METHODS:

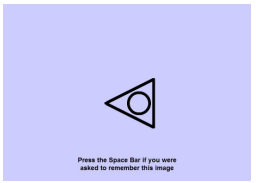
Baseline measurements were conducted before participants were randomized into a marijuana cessation study. Participants were asked to complete the Marijuana Problem Scale per protocol. During the same visit, these participants were tested with the CNS Vital Signs neurocognitive battery[viii] to assess verbal memory, visual memory, working memory, composite memory, reasoning, executive functioning, processing speed, psychomotor speed, reaction time, complex attention, cognitive flexibility, social acuity, and sustained attention. Verbal and visual memory scores from the neurocognitive battery were compared, and participants were grouped by Marijuana Problem Scale response (0, 1, or 2). Participants were included in the study if they met DSM-IV criteria for cannabis dependence, were regular marijuana smokers, were seeking treatment for cessation, and were between the ages of 13 and 21. Participants were excluded from the study if they were allergic to the study medication, taking medications that might interfere with the metabolism of the study medication, currently enrolled in a treatment for cannabis addiction, addicted to another substance besides cannabis or nicotine, physically or mentally ill in such a way as to place them at significant risk due to the treatment protocol, or if they were pregnant or lactating during the study period. To be included in the analysis, participants had to complete both the baseline Marijuana Problem Scale and the CNS Vital Signs neurocognitive memory test being analyzed. One hundred and fourteen participants were analyzed for this study.

A



B





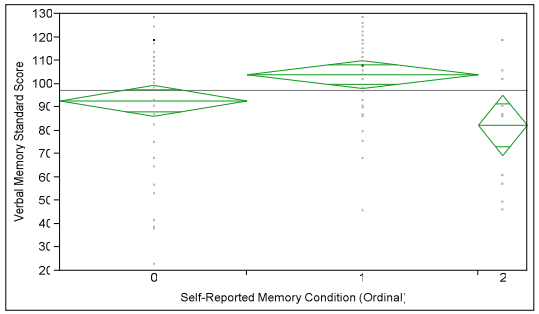
C

Marijuana Problem Scale Ordinal Score	Meaning	Number of Participants	Average Age (SD)	Average Years Smoking Cannabis (SD)	Sex (% male)
0	No problem	47	18.8 (1.6)	3.9 (1.7)	80.9
1	Minor problem	55	19.0 (1.5)	4.3 (1.8)	72.7
2	Serious problem	12	19.0 (1.7)	4.6 (2.6)	41.7

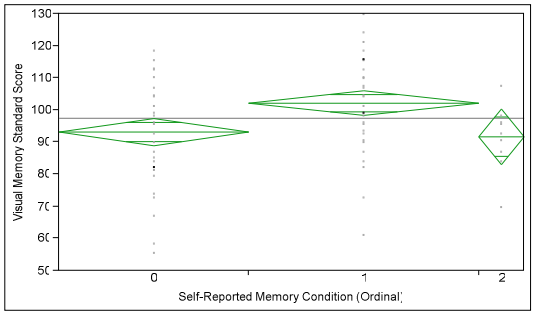
Marijuana Problem Scale Ordinal Score	Mean Verbal Standardized Score	Verbal Confidence Interval	Mean Visual Standardized Score	Visual Confidence Interval
0	92.7	84.7 – 100.7	93.1	88.2 – 98.0
1	103.9	99.2 – 108.6	102.1	98.6 – 105.7
2	82.2	65.4 – 99.0	91.7	84.5 – 98.9

D

Verbal Memory Standard Score ANOVA



Visual Memory Standard Score ANOVA



E

Verbal Memory Significance Between Groups According to Tukey –Kramer Test	
Group Comparison	p value (*significant at <0.05)
0 to 1	0.0372*
0 to 2	0.3286
1 to 2	0.0088*

F

Visual Memory Significance Between Groups According to Tukey-Kramer Test	
Group Comparison	p value (*significant at <0.05)
0 to 1	0.0064*
0 to 2	0.9546
1 to 2	0.0792

RESULTS & DISCUSSION:

There were three possible responses to the MPS: no problem = 0, minor problem = 1, and serious problem = 2 (Fig C). Those reporting "no problem," a 0 on the MPS, had a mean verbal memory score of 92.7 with a CI of 84.7 – 100.7 and mean visual memory score of 93.1 with a CI of 88.2 – 98.0. Those reporting memory losses as a "minor problem," a 1 on the MPS, had a mean verbal score of 103.9 with a CI of 99.2 – 108.6 and a mean visual memory score of 102.1 with a CI of 98.6 – 105.7. Those reporting "serious problem," a 2 on the MPS, had a mean verbal memory score of 82.2 with a CI of 65.4 – 99.0 and a mean visual memory score of 91.7 with a CI of 84.5 – 98.9 (Fig C).

ANOVA analysis revealed that differences between the verbal and visual memory scores among the 3 MPS groups were found to be significant at (p=0.0033 and p=0.0039, respectively) (Fig D). Further analysis by a Tukey-Kramer test showed that certain combinations of groups failed to demonstrate a significant difference in means. Specifically, there was a significant difference between those reporting "no problem" and "minor problem" (p=0.0372) and between those reporting "minor problem" and "serious problem" (p=0.0088) in verbal memory scores (Fig E), but no significant difference between those reporting "no problem" and "serious problem" (p=0.3286). Likewise, there was a significant difference in visual memory scores between those reporting "no problem" and "minor problem" (p=0.0064), but no difference between the other combinations of groups (p=0.0792 and p=0.9546) (Fig F). These insignificant differences suggest that participants have categorized themselves inconsistently on the MPS in regard to the objective evidence. This analysis showed a paradoxical response in which participants reporting a "minor problem" due to memory loss scored highest on the verbal and visual tests overall than did participants reporting "no problem." It should be noted that the distribution contained comparatively few scores of 2 on the MPS (Fig C).

This finding indicates that the participants may have a compromised ability to assess their degree of memory impairment. Objective memory tests provided results that did not correspond to the results obtained through the subjective Marijuana Problem Scale. Self-reporting offers subjective measures of a problem, but may not provide an objective perspective on what is being measured. Therefore, self-assessments may be less likely to provide reliable data when used as the sole measure of memory impairment. It may be more reliable to judge memory with an objective measure.

CONCLUSIONS:

Both verbal and visual memory scores showed significant differences in participants reporting "no problem" and "minor problem." However, the objective memory scores indicated that those with minor problems were less likely to experience the degree of memory impairment that those reporting no impairment experienced. This finding suggests that objective measures of memory may prove more reliable at assessing memory impairment in research studies than the use of subjective questionnaires.

REFERENCES

[i] Johnston LD, O'Malley PM, Bachman JG, et al. Monitoring the Future: National results on adolescent drug use: Overview of key findings, 2010. National Institute on Drug Abuse.
[ii] Pope HG Jr, Yurgelun-Todd D. The residual cognitive effects of heavy marijuana use in college students. *JAMA*. 1996 Feb 21; 275(7): 521-7.
[iii] Bolla KI, Brown K, Eldreth D, et al. Dose-related neurocognitive effects of marijuana use. *Neurology*. 2002 Nov 12; 59(9): 1337-43.
[iv] Grant I, Gonzalez R, Carey CL, et al. Non-acute (residual) neurocognitive effects of cannabis use: a meta-analytic study. *J Int Neuropsychol Soc*. 2003 Jul; 9(5): 679-89.
[v] Stephens RS, Roffman RA, Curtin L. Comparison of extended versus brief treatments for marijuana use. *J Consult Clin Psychol*. 2000; 68(5): 898-908.
[vi] Stephens RS, Roffman RA, Simmons EE, et al. Adult marijuana users seeking treatment. J Consult Clin Psychol. 1993; 61(6): 1100-1104.
[vii] Stephens RS, Roffman RA, Simpson EE, et al. Treating adult marijuana dependence: a test of the relapse prevention model. J Consult Clin Psychol. 62(1): 92-99.
[viii] Gualtieri CG, Johnson LG. Reliability and validity of a computerized neurocognitive test battery, CNS Vital Signs. *Arach Clin Neuropsychol*. 2006 Oct; 21(7): 623-43.

DISCLOSURES

Mr. Boyd is CEO of CNS Vital Signs and a developer of the CNS Vital Signs Battery

This research was supported by NIDA grant R01DA026777 and NCRR grant UL1RR029882.