Abnormal Nocturnal Fluctuations in Ambulatory Blood Pressure Relate to Worse Cognitive Performance in Older Adults: The Vanderbilt Memory & Aging Project

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Background & Objective

- Among older adults, high blood pressure increases risk for Alzheimer's disease and cerebrovascular disease.
- Ambulatory blood pressure (ABP) monitoring measures blood pressure (BP) intermittently offering a more sensitive predictor of cardiovascular outcome than static readings.
- We examined whether ABP variability relates to worse neuropsychological performance in older participants with normal cognition (NC) and mild cognitive impairment (MCI).

Methods

- Participant data were drawn from the Vanderbilt Memory & Aging Project, a case-control longitudinal study investigating vascular health and brain aging.
- At screening, participants were diagnosed with NC or MCI (Albert et al., 2011) via consensus conference following a comprehensive assessment.
- At enrollment 135 NC and 122 MCI participants completed a neuropsychological protocol and 24-hour ABP monitoring capturing BP values every 30 minutes. See **Table** for participant characteristics.
- Systolic blood pressure (SBP) and diastolic blood pressure (DBP) data were coded based on time of day to capture wake and sleep intervals. From this information, nocturnal fluctuations were defined as:
  - Dipper (10-19% nocturnal decrease),
  - Riser (>0% nocturnal increase),
  - Non-dipper (0-9% nocturnal decrease), and
  - Extreme dipper (≥20% nocturnal decrease).

Analyses & Results

- Linear regressions, adjusting for age, sex, race, education, diabetes, and prevalent cardiovascular disease, cross-sectionally related ABP nocturnal fluctuation to neuropsychological performances with dipper as the referent (56 comparisons). See **Figures** for results.
- Secondary analyses testing ABP x cognitive diagnosis interactions yielded null results.

Table. Participant Characteristics

	NC n=135	MCI n=122	Total n=257
Age, years	73±7	72±7	73±7
Sex, % female	36	38	37
Race, % White	87	87	87
Education, years	**16±3**	**15±3***	16±3
Diabetes, %	15	22	18
Prevalent CVD, %	4	3	4
Awake SBP, mmHg	134±12	134±12	134±12
Awake DBP, mmHg	77±8	76±9	77±8
Sleep SBP, mmHg	**119±13**	**122±12***	120±12
Sleep DBP, mmHg	65±9	66±8	66±8
SBP Dipper, mmHg†	15±3	14±3	15±3
SBP Riser, mmHg†	-5±5	-5±5	-5±5
SBP Non-Dipper, mmHg†	6±3	5±3	5±3
SBP Extreme Dipper, mmHg†	26±7	22±1	25±6
DBP Dipper, mmHg†	15±3	15±3	15±3
DBP Riser, mmHg†	-8±10	-5±8	-6±8
DBP Non-Dipper, mmHg†	5±3	6±3	5±3
DBP Extreme Dipper, mmHg†	26±6	25±4	26±5
Montreal Cognitive Assessment	**27±2**	**24±3****	26±3
CVLT-II Trials 1-5 Total Learning	**47±10**	**35±10****	41±11
CVLT-II Delayed Recall	**11±3**	**6±4****	8±4
BFLT Trials 1-5 Total Learning	**134±32**	**91±35****	113±40
BFLT Delayed Recall	**33±8**	**22±10****	27±10
BNT 30-Item	**28±2**	**26±3****	27±3
Animal Naming	**21±5**	**17±5****	19±5
WAIS-IV Digit-Symbol Coding	**57±11**	**48±12****	53±13
DKEFS Number Sequencing	**35±11**	**47±23****	41±19
DKEFS Number-Letter Switching	**84±29**	**146±124****	114±93
DKEFS Tower	**16±4**	**14±5****	15±5
DKEFS Color-Word Inhibition	**60±13**	**78±28****	68±24
Letter Fluency (FAS)	**43±11**	**34±10****	38±12
Hooper Visual Organization Test	**25±3**	**24±3****	25±3

Note: †nocturnal change; *as compared to NC, p<0.05; **as compared to NC, p<0.001; CVLT-II=California Verbal Learning Test-II; BFLT=Biber Figure Learning Test; BNT=Boston Naming Test; WAIS-IV=Wechsler Adult Intelligence Scale-IV; DKEFS=Delis-Kaplan Executive Function System

Figure A. Total Systolic Nocturnal Results

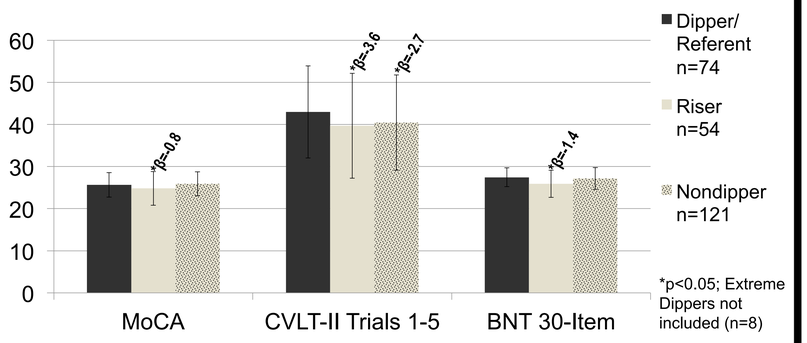
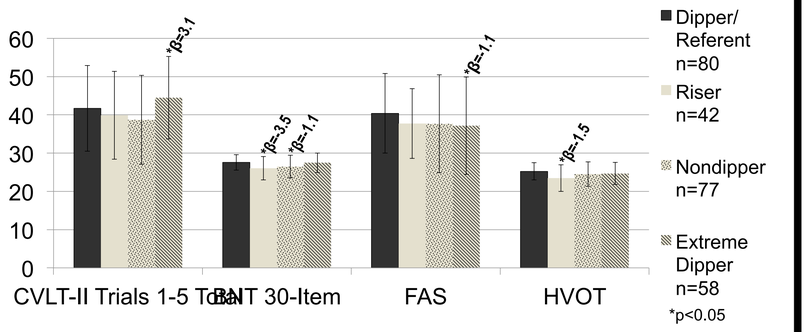


Figure B. Total Diastolic Nocturnal Results



Conclusions

- Abnormal nocturnal SBP and DBP fluctuations relate to poorer global cognition, learning, naming, letter fluency, and object recognition performances among older adults regardless of cognitive status.
- Differing underlying mechanisms of cerebrovascular damage are associated with each nocturnal decline subtype. Risers more commonly have intracranial hemorrhage, while the majority of strokes in extreme dippers are ischemic and occur during sleep or in the early morning (Kario et al., 2003).
- Future work should assess the longitudinal impact of abnormal nocturnal BP fluctuations on brain aging, including cognitive decline, biomarkers of Alzheimer's disease, and cerebrovascular disease.

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