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Non-Completion of Nighttime Ambulatory Blood Pressure Monitoring: Potential for Selection Bias in Analyses of Non-Dipping

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Non-dipping of blood pressure refers to the absence of at least a 10% reduction in average nighttime (asleep) ambulatory blood pressure (ABP) when compared to average daytime (awake) ABP (1–4). Non-dipping may predict increased cardiovascular risk (1), and identifying correlates of non-dipping has been the topic of a number of studies (2,5–7). Indeed, in the recent article by Rodriguez et al. (2), non-dipping was more common in black non-Hispanic participants who reported low perceived racism in a sample of 180 community-dwelling Hispanic participants. This paper used an ABP monitoring (ABPM) device for measuring non-dipping, and we were intrigued by the statement that “Only one participant had to repeat the ABP assessment due to initial poor-quality recordings. Otherwise, there were no protocol violations, technical failures, or insufficient number of ABP readings (p. 842)” (2).

To assess non-dipping, the ABPM device must be worn during the night, with readings typically taken every 30 minutes. In most studies, there are some participants who remove the device before going to sleep or sometime in the middle of the night because of discomfort or anticipated/actual sleep disruption. Indeed, an analysis of pooled data from several studies stated that 19% of participants (1,909/9,828) were excluded due to nighttime ABPM non-compliance (3). Furthermore, ABPM device-related sleep disruption has been previously reported (4).

In light of these findings, we hypothesized that this disruption of sleep could be a reason for ABPM non-compliance in studies of non-dipping. Furthermore, we were interested in examining whether certain participant characteristics and important correlates of non-dipping differ between those who do and do not comply with nighttime ABPM. We examined these questions using data from the Masked Hypertension Study (8).

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Our analytic sample comprised 878 adults (age 44.3 ± 10.4 years; 59.0% female; 12.1% Hispanic; 7.3% Black) who completed 24-hr ABPM and a self-reported sleep quality questionnaire as part of the Masked Hypertension Study, a prospective cohort study of masked hypertension and target organ damage (8). Participants with <5 nighttime readings—usually due to removing the device during sleep—were classified as nighttime ABPM non-completers. Sleep quality was reported on a 0 (much worse than usual) to 4 (much better than usual) scale the next day; poor sleep was defined as a rating <2 . Using non-parametric testing methods, we assessed if completion status was related to race, ethnicity, age, sex, body mass index (BMI), depression, sleep quality the night of ABPM measurement, Pittsburgh Sleep Quality Index score, discrimination, and daytime average systolic blood pressure BP and diastolic BP.

Approximately 13.2% ($n=116$) of participants were nighttime ABPM non-completers based on the accepted definition of completion; of these non-completers, 71.6% ($n=83$) had no nighttime readings. Of the 33 nighttime ABPM non-completers with partial data (i.e., 1–4 nighttime readings), 24.2% ($n=8$) were non-dippers, with a mean SBP decrease of 13.3 mmHg and a mean DBP decrease of 14.7 mmHg. These participants completed, on average, 3 nightly readings. In contrast, the 762 nighttime ABPM completers provided 14 nightly readings on average. Twenty-five percent ($n=190$) of nighttime ABPM completers exhibited non-dipping, with a mean SBP decrease of 16.7 mmHg and a mean DBP decrease of 15.4 mmHg. Approximately 39.0% ($n=343$) of the analytic sample reported poor sleep. Nighttime ABPM non-completers were less likely to report poor sleep on the night of the assessment than completers ($p=0.002$, Fisher's Exact Test). The common correlates of non-dipping (sex, age, race, ethnicity, depression, BMI, usual sleep quality, and reported discrimination) were not significantly related to non-completion (all $ps>0.09$). There was also no difference in average daytime systolic or diastolic BP between the two groups ($ps>0.45$).

A sizable percentage of participants in our study removed the ABPM device at night (13%), consistent with other studies, and these non-completers reported better sleep than completers. These results provide some insight into what may be driving the non-compliance rates in studies of non-dipping. However, even though the two groups differed on self-reported sleep quality, they did not differ on key correlates of non-dipping and daytime systolic or diastolic BP. Nevertheless, in order to identify potential selection bias in non-dipping analyses, we recommend that studies of ABPM non-dipping report the criteria used to define an “adequate” recording, the proportion of participants with inadequate recordings, and whether missing/incomplete nighttime ABPM is associated with correlates of non-dipping.

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