Race and Diurnal Blood Pressure Patterns
A Review and Meta-Analysis

Judi Profant, Joel E. Dimsdale

Abstract—Investigators have reported variable findings regarding the role of race in diurnal blood pressure patterns. We performed a review and meta-analysis of this literature to identify the overall effect of race on circadian blood pressure patterns. Eighteen studies involving 2852 participants were reviewed. Meta-analyses were conducted using effect sizes calculated from the data provided directly in the study reports. Separate meta-analyses were conducted on effect sizes for differences between blacks and whites in daytime and nighttime systolic and diastolic blood pressure and nocturnal dip in systolic and diastolic blood pressure. To evaluate discrepancies in findings from studies involving American versus non-American blacks, overall meta-analyses as well as within-subset meta-analyses of black/white differences were conducted for comparisons involving American and non-American blacks. Results of overall meta-analyses indicate that blacks experience higher levels of systolic and diastolic blood pressure, both at night and during the day. These differences were significantly greater at night than during the day (P<0.05). Results of within-subset analyses involving American blacks mirrored those for all black/white comparisons, except that the effect of race on nocturnal dip, ie, that American blacks experienced less of a dip in both systolic and diastolic blood pressure at night, was significant (P<0.05). In contrast, the effect of race on nocturnal dip was not significant for comparisons involving non-American blacks. These results suggest a consistent difference in the chronobiology of blood pressure, particularly in American blacks. (Hypertension. 1999;33:1099-1104.)

Key Words: blood pressure monitoring, ambulatory ■ race ■ ethnic groups ■ chronobiology

B lack populations in the United States, Caribbean, and United Kingdom have been found to have higher blood pressures, higher rates of hypertension, and higher mortality rates from cardiovascular and cerebrovascular disease than populations of European descent.1 Ambulatory blood pressure monitoring (ABPM) has made it possible to monitor daytime and nighttime blood pressure across settings and to study the circadian variation in blood pressure. It has been suggested that circadian patterns and nighttime blood pressure values may be more highly correlated with indices of end-organ damage than resting or clinical blood pressure values. There is evidence that a blunted day/night blood pressure difference, “nocturnal fall,” or “dip” has an adverse prognostic impact in several disease populations. Mortality risk was found to be highest in those with no nocturnal decline in blood pressure, followed by nondippers (those with a decline >0% but <10% of the daytime value).2 Nondipping has been suggested to be a negative prognostic factor in patients with severe congestive heart failure,3 renal insufficiency,4 obstructive sleep apnea,5 and stroke.6 For cardiovascular disease, Verdecella et al7 reported an inverse correlation between left ventricular mass index (LVMI) and the percentage fall in blood pressure at night. Belsha et al8 investigated relationships between diurnal blood pressure variation and target organ abnormalities in adolescents. Findings in this study indicated that nocturnal systolic blood pressure (SBP) was correlated most closely with LVMI.

The literature also suggests that ethnic groups with a blunted nocturnal decline in blood pressure also have greater cardiovascular target-organ damage. Murphy et al9 studied diurnal blood pressure patterns and LVMI in blacks and whites matched for daytime blood pressure. Blacks had higher nocturnal blood pressure than whites as well as higher LVMI. Despite matching on the basis of 24-hour mean blood pressure, Mayet et al10 found a smaller nocturnal dip in mean blood pressure as well as greater LVMI in black versus white hypertensive subjects. In addition, SBP dip correlated inversely with LVMI only in blacks, and LVMI was related to both mean daytime blood pressure and nocturnal dip in mean blood pressure in blacks but only to mean daytime blood pressure in whites. LVMI, therefore, may be more dependent on nocturnal blood pressure dip in black than in white hypertensives.

Several possible determinants of the amplitude of ambulatory blood pressure variations have been suggested, including level of activity, socioeconomic factors, level of stress, and type of work. Other physiological factors that act in circadian patterns have also been implicated, such as hormones, growth factors, immunomodulators, activity of the renin-angiotensin system, baroreflex sensitivity, and sympathoadrenergic activity. However, the consistency of these data linking circadian factors and blood pressure has been questioned. Regarding
<table>
<thead>
<tr>
<th>Reference</th>
<th>Participants</th>
<th>Age, y</th>
<th>Location of Study</th>
<th>Participant Hypertension Status</th>
<th>Day and Night Definitions</th>
<th>Relevant Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acharya et al, 1996</td>
<td>56 Afro-Caribbeans</td>
<td>46±9</td>
<td>Middlesex, UK</td>
<td>Essential hypertensives</td>
<td>Day: 1200–1800 Night: 2400–0600</td>
<td>24-h SBP, DBP higher in Afro-Caribbeans; daytime mean SBP, DBP higher in Afro-Caribbeans; nighttime mean SBP, DBP higher in Afro-Caribbeans; no difference in IABP, SBP, or DBP nocturnal fall</td>
</tr>
<tr>
<td></td>
<td>562 Whites</td>
<td>51±11</td>
<td></td>
<td></td>
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<tr>
<td>Belsha et al, 1997</td>
<td>32 Blacks</td>
<td>6–18</td>
<td>Little Rock, Ark</td>
<td>Normotensives, hypertensives</td>
<td>Participant diary</td>
<td>Less nocturnal SBP fall in blacks; greater night/day SBP ratio in blacks</td>
</tr>
<tr>
<td></td>
<td>67 Whites</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Chase et al, 1997</td>
<td>36 Blacks</td>
<td>20.6±0.67</td>
<td>Denver, Colo</td>
<td>Healthy</td>
<td>Day: 0600–2200 Night: 2200–0600</td>
<td>24-h mean BP higher in African-Americans; daytime SBP higher in African-Americans; mean 24-h DBP higher in African-Americans</td>
</tr>
<tr>
<td></td>
<td>50 Whites</td>
<td>22.4±0.52</td>
<td></td>
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<tr>
<td>Chaturvedi et al, 1994</td>
<td>167 Afro-Caribbeans</td>
<td>40–64</td>
<td>London, UK</td>
<td>Normotensives, hypertensives, untreated hypertensives</td>
<td>Day: 0900–1100 Night: 0300–0500</td>
<td>No difference in daytime age-adjusted mean SBP; higher mean nighttime SBP in Afro-Caribbeans; lower SBP nocturnal fall (%) in Afro-Caribbeans</td>
</tr>
<tr>
<td></td>
<td>152 Europeans</td>
<td></td>
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<td></td>
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<tr>
<td>Fumo et al, 1992</td>
<td>22 American blacks</td>
<td>36±12</td>
<td>Chicago, Ill; Johannesburg, South Africa</td>
<td>Self-defined normal or healthy</td>
<td>Day: 0600–2259 Night: 2300–0559</td>
<td>Similar daytime BP in all groups; higher nighttime BP in American blacks; lower reduction (%) in mean BP at night in American blacks</td>
</tr>
<tr>
<td></td>
<td>22 American whites</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>22 South African blacks</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gretter et al, 1994</td>
<td>275 Blacks</td>
<td>20–79</td>
<td>Chicago, Ill</td>
<td>326 previously untreated patients presenting to Hypertension Clinic plus 195 volunteers, none taking BP medications</td>
<td>Participant diary; if incomplete, average of completed diaries</td>
<td>Higher average ABPM values in blacks; greater difference in SBP while asleep than awake; smaller diurnal change in SBP in blacks; lower daytime increment/nocturnal fall in blacks</td>
</tr>
<tr>
<td></td>
<td>246 Whites</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>149 Whites</td>
<td>13±2</td>
<td></td>
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</tr>
<tr>
<td>Hebert et al, 1996</td>
<td>62 Blacks</td>
<td>51.4±1.72</td>
<td>Columbus, Ohio</td>
<td>Essential hypertensives (≥140/90 mm Hg)</td>
<td>Day: 0600–2200 Night: 0100–0500</td>
<td>Middle night DBP, MAP higher in blacks</td>
</tr>
<tr>
<td></td>
<td>72 Whites</td>
<td>51.9±1.67</td>
<td>Cincinnati, Ohio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>James, 1991</td>
<td>27 Blacks</td>
<td>31.0±8.5</td>
<td>New York, NY</td>
<td>Normotensives women</td>
<td>Work: 1100–1500 Home: 1800–2200 Sleep: 2200–0600</td>
<td>No daytime differences across races; higher BP in blacks during sleep</td>
</tr>
<tr>
<td></td>
<td>83 Whites</td>
<td>29.4±6.7</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>46 Whites</td>
<td>44±2.0</td>
<td></td>
<td></td>
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<tr>
<td>Murphy et al, 1991</td>
<td>44 Blacks</td>
<td>45±15</td>
<td>Chicago, Ill</td>
<td>Possibly hypertensive</td>
<td>Day: 0800–1200 Night: 2400–0600</td>
<td>Similar average daytime BP; fall in nighttime BP lower in blacks</td>
</tr>
<tr>
<td></td>
<td>37 Whites</td>
<td>46±16</td>
<td></td>
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<tr>
<td>Oluade et al, 1998</td>
<td>34 Blacks</td>
<td>54±11</td>
<td>Atlanta, Ga</td>
<td>Mild to moderate essential hypertensives</td>
<td></td>
<td>Less nocturnal dip in blacks; 64% of whites, 41% of blacks were dippers</td>
</tr>
<tr>
<td></td>
<td>39 Whites</td>
<td>52±12</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Osei and Schuster, 1996</td>
<td>31 African-Americans</td>
<td>37.2±1.6</td>
<td>Franklin County, Ohio</td>
<td>Normotensives, nondiabetic</td>
<td>Day: 0800–2200 Night: 2200–0800</td>
<td>SBP, DBP nadir lower in whites than African-Americans and African immigrants</td>
</tr>
<tr>
<td>Prisant et al, 1991</td>
<td>25 Blacks</td>
<td>51.1±13.8</td>
<td>Augusta, Ga</td>
<td>Essential hypertensives</td>
<td>Day: 0800–1200 Night: 2400–0400</td>
<td>No significant racial differences in day, night, or 24-h SBP or DBP</td>
</tr>
<tr>
<td></td>
<td>46 Whites</td>
<td>46.2±10.8</td>
<td></td>
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</table>
baroreflex sensitivity. Vaile et al\(^{10}\) found no significant difference between dippers and nondippers in baroreflex sensitivity while awake or during sleep. Both groups had a significant increase in baroreflex sensitivity during sleep. Baroreflex sensitivity increased during sleep, whereas arterial blood pressure fell. No differences were found in sodium excretion between American blacks, American whites, and South African blacks despite significant differences in diurnal blood pressure patterns.\(^{11}\)

Environmental, personality, and lifestyle factors may be implicated. Relationships have been shown between diurnal blood pressure patterns and such factors as hypertension status, age, gender, level of activity, fitness, hostility, and work stress.\(^{12-18}\)

Several investigators report black/white differences in diurnal blood pressure patterns, eg, that blacks experience a blunted nocturnal decline. Ethnic differences in blood pressure profiles of blacks from Africa as well as American blacks, compared with whites, have also been examined to determine whether the differences reported are true racial differences or consequences of different environmental factors. In a study conducted in Cameroon, investigators found a nocturnal pressure decline in black African hypertensives. Using the criteria of O’Brien et al,\(^{19}\) Muna et al\(^{20}\) determined that 31.7% of the study population were nondippers. Fumo et al\(^{11}\) compared blood pressure variation, sodium and potassium excretion, and LVMI in American whites, American blacks, and South African blacks matched for daytime blood pressure. American whites and South African blacks experienced a similar fall in nighttime blood pressure, whereas nighttime blood pressure was higher in American blacks. Although others suggest that the chronobiological alterations in blood pressure and heart rate in blacks are genetically determined,\(^{21}\) findings in this study suggest that differences in blood pressure patterns between American blacks and American whites may be environmental in origin, are not explained by differences in dietary sodium or potassium intake, and may lead to differences in target-organ damage.

Thus, the findings regarding the association of race and diurnal blood pressure patterns are inconsistent. We conducted a review and meta-analysis of this literature to identify the overall degree to which race is a significant factor in differences in circadian blood pressure patterns.

### Methods

The following keywords were used in a search of the MEDLINE and Current Contents databases for articles about ethnic differences in diurnal blood pressure profiles: race, ethnicity, ethnic differences, dipping, diurnal blood pressure, circadian blood pressure, ambulatory blood pressure, ambulatory blood pressure monitoring, and nocturnal blood pressure. Citations were also obtained from the authors’ reprint files and through correspondence with other investigators. Citations published between 1966 and 1998 were included.

### Inclusion Criteria

Studies satisfying the following criteria were included in the review: a population including normotensives or otherwise healthy hypertensives or both; measurement of 24-hour blood pressure; and SBP, DBP, or nocturnal dip reported separately by race or analyses of racial differences in SBP, DBP, or nocturnal dip. Table 1 summarizes characteristics of studies evaluating ethnic differences in circadian blood pressure patterns.

### Calculation of Effect Size

A common meta-analytic method for effect size estimation is to compute \(d\), a standardized mean difference statistic for comparing differences between means. It is calculated as the mean of the first group minus the mean of the second group, all divided by their pooled standard deviation. These statistics were computed using the data provided in the study reports. The statistical methods used here are mostly those of Hunter and Schmidt.\(^{\text{33}}\)

In our attempt to synthesize these reports, and to include as many relevant data as possible in these analyses, separate meta-analyses were conducted on effect sizes for black/white differences in nighttime SBP and DBP, daytime SBP and DBP, and nocturnal fall in SBP and DBP.

To evaluate discrepancies in findings from studies involving American versus non-American blacks, an overall meta-analysis as well as within-subset meta-analyses were conducted for each measure. Separate analyses of black/white differences have been conducted on effect sizes obtained in comparisons involving American blacks and those comparisons involving non-American blacks. Because only 2 studies involving non-American blacks made comparisons to American whites,\(^{\text{11,23}}\) the country of origin of the white comparison has not been taken into account.
Although differences in diurnal patterns of blood pressure have been reported between normotensives and hypertensives, across gender, and among other ethnic groups,\textsuperscript{23,34,24} for the purposes of this meta-analysis, an effect size was calculated for overall differences between ethnic groups for each black/white comparison, because information about gender and hypertension status is not provided for participants in all studies.

### Results

Eighteen studies involving 2852 participants satisfied the criteria for inclusion. Eight reported a direct measure of ethnic differences on nocturnal fall. Results of the overall and within-subset meta-analyses are summarized in Table 2.

#### Overall Meta-Analyses

Results of overall meta-analyses indicate that there is an effect of race, ie, that blacks have higher levels of both SBP and DBP, both at night and during the day (Table 2). These differences are significantly greater at night than during the day for both SBP and DBP ($P<0.05$). The effect of race on nocturnal fall did not reach significance.

#### Meta-Analyses of Black/White Comparisons Involving American Blacks

As in the overall analyses, results of within-subset meta-analyses indicate that for black/white comparisons involving American blacks, there is an effect of race, ie, that blacks have higher SBP and DBP, both at night and during the day ($P<0.05$). These differences are significantly greater at night than during the day for both SBP and DBP ($P<0.01$) (Table 2). Among black/white comparisons involving American blacks, there is another significant effect of race, ie, that blacks experience less of a fall in both SBP and DBP at night ($P<0.05$).

#### Meta-Analyses of Black/White Comparisons Involving Non-American Blacks

For black/white comparisons involving non-American blacks, there are also effects of race, ie, that blacks have higher SBP and DBP at night and higher DBP during the day ($P<0.05$). The effect of race on SBP is significantly greater at night ($P<0.01$). For comparisons involving non-American blacks, the difference in SBP during the day was not significant, nor was the difference in nocturnal fall (Table 2).

These findings suggest that there may be differences in the effect of race on blood pressure patterns for American versus non-American blacks.

### Discussion

Blood pressure levels, and thus levels of blood pressure dipping, might well be affected by the variety of factors known to influence blood pressure, ie, age, gender, body mass index, dietary salt consumption, etc. Unfortunately, the data are not provided in enough of our reviewed samples to allow quantitative control for these factors or to evaluate whether ethnic differences in dipping might be accounted for by such factors.

Antihypertensive treatment also influences blood pressure patterns and may influence nocturnal blood pressure differently in blacks than whites. Of the 18 studies included in these analyses, all but 2 involved characterization of ambulatory blood pressure and dipping after a washout period or in untreated participants. In the 2 studies that involved treated hypertensives, investigators also observed higher nocturnal blood pressure in blacks. Thus, we do not believe that medication status is confounding these analyses. Future studies on race and dipping should consider these important variables.

In our review, several methodological issues in study design demand consideration. It is difficult to ascertain whether these methodological differences have resulted in differences in reported findings. Investigators must strive toward a consensus regarding the various measurement issues in this area, particularly given the limited reliability of nighttime blood pressure dipping based on 24-hour ABPM.\textsuperscript{35}

Although some authors report a direct measure of dipping, either as a calculation of the absolute or percentage of nocturnal fall or dip or some other value, such as morning rise or nadir during sleep, surprisingly, many of the studies reporting black/white differences in diurnal blood pressure patterns do not report dipping directly. Rather, many of these investigators infer differences in diurnal patterns on the basis of a difference between groups in nighttime blood pressure in the absence of a significant difference between groups in daytime blood pressure.

As evidenced by the various findings listed in Table 1, there is also inconsistency in the reported measures of blood pressure and its variation. Although some authors report mean arterial pressure (MAP), SBP, and DBP, many authors do not report MAP, whereas still others report SBP findings alone. Differences also exist in the time periods for which these measures are reported.

There also exists variation in the thresholds used to determine dipping status. For example, O’Brien et al\textsuperscript{19} categorized dippers as those with a 10-mm Hg nocturnal fall in SBP and a 5-mm Hg fall in DBP, whereas Verdecchia et al\textsuperscript{7} suggest the use of night/day SBP ratios to determine dipping status.

There has also been no consensus about how day and night blood pressures should be defined. Although recommendations have been made in the past to use fixed time intervals,\textsuperscript{36} more recent studies suggest the use of individually determined daytime and nighttime intervals.\textsuperscript{37} There is evidence indicating that the rhythm of blood pressure is determined both by the cycle of activity and internal circadian rhythms.\textsuperscript{16}

### Table 2. Results of Meta-Analyses: Average Effect Sizes

<table>
<thead>
<tr>
<th>Comparison (Black/White Difference)</th>
<th>Average Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
</tr>
<tr>
<td>Daytime SBP</td>
<td>0.17*</td>
</tr>
<tr>
<td>Daytime DBP</td>
<td>0.30*</td>
</tr>
<tr>
<td>Nighttime SBP</td>
<td>0.35†</td>
</tr>
<tr>
<td>Nighttime DBP</td>
<td>0.49†</td>
</tr>
<tr>
<td>SBP nocturnal fall</td>
<td>−0.29</td>
</tr>
<tr>
<td>DBP nocturnal fall</td>
<td>−0.30</td>
</tr>
</tbody>
</table>

*P<0.05.
†P<0.05 for comparisons between daytime and nighttime values.
‡P<0.05 for comparisons between daytime and nighttime values.
§P<0.05 for comparisons between American and non-American blacks.
The definitions of daytime and nighttime periods vary widely across studies. In a few studies, daytime and nighttime blood pressure values are determined by participant diary records of periods of waking and sleep, whereas other investigators use fixed clock times. Daytime and nighttime periods add up to the entire 24-hour period of monitoring in some studies, whereas others do not include readings obtained during transition periods in their analyses of daytime and nighttime blood pressures.

Studies also differ in the methods and devices used in ambulatory monitoring as well as the setting in which monitoring occurred. Although most studies obtained blood pressure measures using automated, noninvasive devices, manufacturers vary between studies. Differences in results obtained using ABPM devices made by different manufacturers have been reported. Two reports included here report data obtained through intraarterial monitoring during inpatient hospitalization, which may result in fewer artificially induced increases in nocturnal blood pressure due to cuff inflation.

Of investigators who report a direct measure of the nocturnal fall in blood pressure, most investigators examining racial differences between blacks and whites in the United States report a racial difference, ie, that blacks experience less nocturnal fall in blood pressure in at least 1 blood pressure measure. However, Rockstroh et al failed to find a significant racial difference in nocturnal fall in a recent study conducted in New Orleans, La. All other studies conducted in the United States reporting a direct measure of nocturnal fall found some evidence of a blunted nocturnal decline in blood pressure among blacks. A study conducted in Chicago, Ill, found less of a decline in SBP, DBP, and mean nighttime blood pressure in blacks versus whites. Similarly, a recent study in Atlanta, Ga, found less nocturnal fall in SBP and DBP in blacks. These authors also found that fewer blacks than whites were classified as dippers, using the criteria proposed by O'Brien et al. In another study conducted in Chicago, blacks were found to have smaller diurnal change in SBP. Although blacks had higher average ABPM values, the difference between blacks and whites was greater during sleep than while awake. Belsha et al found less nocturnal fall in SBP in blacks among children from hypertensive families in Little Rock, Ark.

Some studies compared American whites to groups of American blacks and non-American blacks. For instance, Fumo et al compared American blacks, South African blacks, and American whites and found a smaller percentage reduction in mean blood pressure at night in American blacks compared with the other groups. Osei and Schuster report lower-nadir SBP and DBP values in whites versus both African-Americans and African immigrants in Franklin County, Ohio.

However, findings for comparisons involving non-American blacks are not consistent. In a study conducted in London, Mayet et al found a smaller nocturnal dip in mean blood pressure in blacks compared with whites. Another London study examined racial differences in SBP between Afro-Caribbeans and whites; the racial difference in absolute nocturnal fall was only significant when adjusted for resting SBP, whereas significant differences were found in the percentage of nocturnal fall regardless of adjustments for resting blood pressure levels. However, in a study conducted in Middlesex, UK, comparing 56 Afro-Caribbeans to 562 whites, Acharya et al found no racial differences in SBP or DBP nocturnal dip measured by intraarterial monitoring.

Rowlands et al did not find differences in blood pressure profile between blacks of West Indian origin and whites in the United Kingdom. Notably, blood pressure measurements in this study were obtained using intraarterial monitoring during hospitalization. As noted by Vaughan and Murphy, their 1994 review, this design created an identical environment for all participants. Differences in activity level have a profound effect on blood pressure variability. For instance, van den Meiracker et al found that day/night differences in blood pressure are smaller for those who stay in bed all day than for those who are ambulatory. The other study included here that used intraarterial blood pressure monitoring (IABP) also found no significant differences in mean IABP nocturnal fall; however, Afro-Caribbeans had significantly higher 24-hour, daytime, and nighttime mean IABP.

Prisant et al also failed to find racial differences in ambulatory blood pressure profiles in Augusta, Ga. Notably, daytime and nighttime periods were defined as 8 AM to noon and midnight to 4 AM, respectively, and no direct measure of nocturnal fall was reported. Rockstroh et al found no significant differences in 24-hour blood pressure levels or nocturnal fall between American blacks and whites in New Orleans, La. However, the definitions of daytime and nighttime used in this study were 8 AM to 10 PM and 10 PM to 8 AM, respectively.

Some authors have questioned the reproducibility of circadian variation in blood pressure. James et al found limited reproducibility of dipping status based on nocturnal SBP changes in a sample of 42 elderly participants in the United Kingdom. Dipping status changed in 36% to 43% of participants between visits, depending on the criteria used. These authors evaluated the use of different fixed time periods (2400 to 0600 versus 2200 to 0700) and thresholds (10 mm Hg versus 10%) as well as the use of cusums-based measures in determination of dipping status. The use of cusums-based measures of circadian blood pressure variation was suggested as being more reproducible. Mochizuki et al found that when they monitored ambulatory blood pressure for 48 hours instead of 24, patients who were categorized as dippers on day 1 remained dippers on day 2 in 41% of cases and changed to nondippers in 16% of cases, whereas patients who were categorized as nondippers on day 1 remained nondippers on day 2 in 30% of cases and changed to dippers in 13% of cases. The criterion used to determine dipper status in this study was a reduction during the night of both SBP and DBP of >10% of the daytime blood pressure. Dimsdale and Heeren found that the test-retest reliability in blood pressure dipping across 2 occasions in individuals studied with ABPM as outpatients and inpatients. Overall, these findings suggest that caution should be used in the diagnosis of dipping or nondipping on the basis of one 24-hour ambulatory blood pressure recording. These findings also indicate that dipping may vary across settings. Therefore, accumulation of findings from studies in which monitoring took place in different settings may not be appropriate.

These meta-analyses revealed that, across studies, blacks had higher blood pressure levels, both at night and during the
day, and that these differences were significantly greater at night than during the day (P<0.05). Although the effect of race on nocturnal dip did not reach significance in the overall analysis, there was a significant effect of race in comparisons between whites and American blacks, ie, that blacks experienced less of a dip in both SBP and DBP at night (P<0.05). Our findings also indicate that there may be differences in the effect of race on blood pressure patterns for American versus non-American blacks.

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References

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