

# Night-time blood pressure assessment is important in diagnosing hypertension

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Around 15% of people aged 40–75 may have a form of undiagnosed high blood pressure (hypertension) that occurs only at night-time. Because they do not know about this, and therefore are not being treated for it, they are at a higher risk of cardiovascular disease such as stroke, heart failure, and even death, suggests new research from the University

of Oxford published in the *British Journal of General Practice*.

When blood pressure is monitored over 24 hours, individuals can be divided into three groups according to their blood pressure pattern:

- Dippers, for whom the night-time blood pressure is lower than the day-time blood pressure (which is the case for healthy young people).
- Non-dippers for whom night-time and day-time blood pressure values are not very different.
- Reverse dippers, for whom, contrary to expectations, the night-time blood pressure is higher than the day-time blood pressure, when they are up and active.

When undiagnosed and untreated, [hypertension](#) (also known as [high blood pressure](#)) causes [cardiovascular disease](#), which is one of the main causes of death and disability in the U.K. One in eight people in England have undiagnosed hypertension, putting them at risk of cardiovascular disease.

24-hour blood-pressure monitoring (usually called ambulatory blood pressure monitoring, ABPM) has become less frequent in primary care since the beginning of the COVID-19 pandemic. Home blood-pressure monitoring, using a monitor often purchased by individuals themselves, is the common alternative. However, home blood-pressure monitors cannot be used when the individual is asleep and so cannot measure night-time blood pressure. Therefore, those people whose blood pressure is normal during the day but whose night-time blood pressure, unbeknown to them, rises at night have undiagnosed hypertension, with all the associated risks.

This new study from the University of Oxford looked at 24-hour blood pressure patterns in patients admitted to hospital, and found that nearly

half of these patients have a blood pressure rise at night ("reverse-dipper pattern"). The study researchers then looked at blood pressure patterns from patients in primary care from the same age group (40–75), who had been monitored for 24 hours during their normal daily activities using ABPM.

The proportion of the population in this group who were "reverse-dippers" was around 15%. There are several possible reasons for the difference in the proportion of people found to have a "reverse dipping" blood pressure pattern in the two patient groups. One possible reason is that the community group included a much higher proportion of people who had already been diagnosed with hypertension, and these people are more likely to be "dippers" rather than "reverse dippers." This is because people whose blood pressure is highest in the day and drops at night are more likely to get picked up as having hypertension in GP surgeries and clinics.

- About 15% of individuals in the community between the ages of 40 and 75 have a blood pressure rise at night-time.
- This 24-hour blood pressure pattern is called reverse dipping, because pressure rises ("reverse dip") during the night instead of falling (dipping), the latter being the normal pattern for healthy young people.
- The blood pressure for reverse dippers is lowest during the day-time, when they would have their blood pressure checked by their GP and so these people are at risk of having a missed diagnosis of hypertension.
- Conversely, the blood pressure of dippers decreases during the night and their blood pressure is highest in the day, so they are more likely to be diagnosed with hypertension.
- There is a well-established body of research which shows that reverse dippers are at higher risk of cardiovascular disease such as stroke, [heart failure](#), and even death. The new study found that

across all sexes and in both hospital and community patient groups, at least 1 in 3 reverse dippers had at least one cardiovascular disease.

Co-author, Professor Lionel Tarassenko, professor of electrical engineering and founder director of the Institute of Biomedical Engineering, Department of Engineering Science, University of Oxford, says, "Blood pressure follows a cyclical pattern over 24 hours. Normally, it goes down (or dips) at night during sleep and then rises after waking. For 'reverse dippers' (mostly elderly people, sometimes with diabetes or kidney disease), the pattern is reversed: the blood pressure goes up (or reverse dips) at night, and then decreases after waking. This means that reverse dippers have their lowest blood pressure during the day, and so they will be falsely reassured by day-time monitoring at home or in the GP clinic. Day-time blood pressure measurements are not enough: It is vitally important to identify who is a reverse dipper through 24-hour ambulatory blood pressure monitoring."

Commenting on the importance of the new research findings for policymakers and clinicians, co-author Laura Armitage, doctoral research fellow of the University of Oxford's Nuffield Department of Primary Care Health Sciences and a practicing GP, says, "The UK NICE Guidelines presently recommend GPs diagnose hypertension based on day-time blood pressure measurements only. However, day-time blood pressure measurements are not capable of detecting high blood pressure in these highest-risk patients whose blood pressure rises at night. Our research shows that measuring night-time blood pressure could help identify the 1 in 8 adults in England who have undiagnosed hypertension. Importantly, this would also lead to a reduction in cardiovascular disease and death. This highlights the need for GPs to offer 24-hour blood-pressure assessment to their patients. This is particularly important for those above the age of 60, as the higher night-time blood pressure increases with age and blood pressure checks in the surgery and patient-

self monitoring at home is not capable of picking up high night-time blood pressure."

The authors note several limitations to their study:

- Choice of age group: the researchers did not find any significant differences between the average systolic blood pressure of men and women in the daytime or the night-time, but this may be because of the choice of age group (40–75). In previous work, the researchers had shown that women below the age of 60 had lower systolic blood pressure than men, but the opposite was true above the age of 60. However, we would expect these two phenomena would average out in a combined 40–75 age group.
- This study used systolic blood pressure only to compute the 24-hour blood pressure patterns of the included participants, conforming to common practice in this field. The authors identify that future work could include an analysis of whether 24-hour diastolic blood pressure profiles (the force of blood against the artery walls between heart beats) provide independent information.

Laura Armitage concludes: "Failing to measure night-time blood pressure puts all groups other than dippers at risk of failure to identify hypertension. We recommend that, in addition to taking blood pressure measurements in the surgery GPs should offer 24-hour ambulatory blood pressure monitoring (ABPM) in the home to all patients aged 60 and over as a minimum, when assessing for hypertension.

"While we welcome the additional screening for hypertension recently deployed in pharmacies, it does not address the key issue highlighted in our paper: there is a substantial sub-set of individuals above the age of 60 who have low blood pressure during the day (for example, when screened in the pharmacy) but who have an elevated night-time blood

pressure and hence a high risk of serious cardiovascular disease. Those individuals will not be offered ABPM because of their low day-time [blood pressure](#) and will be falsely reassured."

**More information:** Laura Catherine Armitage et al, Diagnosing hypertension in primary care: the importance of night-time blood pressure assessment, *British Journal of General Practice* (2022). [DOI: 10.3399/BJGP.2022.0160](#)

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