



How to interpret an ambulatory blood pressure report

by Assoc Prof Harry Mond | OAM | MBBS | PHD | MD | FRACP | FCSANZ | FACC | FHRS

About Cardiac Monitoring Service

Cardiac Monitoring Service's team of cardiac technicians meet the highest compliance and analytical standards, while delivering the latest heart monitoring software and devices.

Over 30 years of reputable and trusted cardiac monitoring

500k hearts analyzed and reported on each year

Trusted by medical experts in 8 countries worldwide

About Assoc Prof Harry Mond

Cardiac Monitoring Service Medical Director Assoc Prof Harry Mond is a founding member of Cardiac Monitoring Service and remains among the world's top experts in the interpretation of ECG and Holter studies.

As an international educator and author of 260+ peer-reviewed manuscripts and books, he provides regular training and professional development to our team of certified cardiac technicians to ensure the highest clinical standards.

Notable achievements

- Pioneer in Cardiac Pacing and Electrophysiology of the US Heart Rhythm Society
- Lifetime Achievement Award, Royal Melbourne Hospital
- Medal of the Order of Australia
- Founding member & Medical Director, CardioScan (Australia, Hong Kong, Singapore, United Kingdom)
- Medical Director, Cardiac Monitoring Service (USA)
- Fellow Royal Australasian College of Physicians
- Associate Professor University of Melbourne & Monash University
- Cardiac fellow Emory University, Atlanta, Georgia
- Honorary Fellowship, Hong Kong College of Cardiology

Ambulatory blood pressure monitoring has in recent years become a recognized and reliable method for confirming hypertension.

The National Heart Foundation of Australia in its summary of recommendations states that “ambulatory blood pressure monitoring be offered to patients with a blood pressure \geq 140/90 in order to confirm the blood pressure level”.

Indeed, United States, British and European guidelines recommend ambulatory blood pressure monitoring as a cost-effective, diagnostic tool for all patients with suspected hypertension. Sophisticated, automated, 24-hour ambulatory blood pressure monitors are now available. However, like all investigations, the results depend on the quality of the recordings and their interpretation in the clinical setting.

Ambulatory blood pressure monitoring should cover close to a 24-hour period with $>70\%$ of recordings being valid. Recordings are usually performed each 30 minutes during the day and at least hourly overnight. It is recommended that at least 14 recordings be performed during the daytime period. However, monitoring is not without its difficulties with the cuff inflation sometimes being painful and unacceptable and the patient removing the monitor overnight because of difficulty sleeping. Invalid recordings may occur if the cuff is not appropriately attached, removed and reattached by the patient or there is a leak or obstruction in the tubing.

Movement during the recording may also result in an invalid measurement. In these situations, measurements are frequently automatically repeated and there may be enough data (> 14 recordings) to establish a diagnosis even if the figure of valid measurements is $< 70\%$. Other issues include faulty batteries, incorrect times recorded and failure to document sleep and wake times.

The interpretation of the results is a clinical assessment, taking in to consideration well established risk factors for cardiac disease. Consequently, the referring doctor can modify the report conclusions to suit the circumstances such as a young diabetic with renal disease who requires optimal control. The referring doctor and not the reporting physician should review the patient diary with the patient.

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Table 1: Accepted normal limits for ambulatory blood pressure recordings.

Ambulatory Blood Pressure	Systolic (mmHg)	Diastolic (mmHg)
Over 24 hours	≤ 130	≤ 80
Awake (daytime)	≤ 135	≤ 85
Asleep (night-time)	≤ 120	≤ 70
% allowed above limit	$< 25\%$	$< 25\%$


Table 2: Guidelines on severity of recorded pressures (Clinical and not 24 hour ambulatory recordings).

Ambulatory Blood Pressure	Systolic (mmHg)	Diastolic (mmHg)
Optimal	< 120	< 80
Normal	120-129	80-84
High normal	130-139	85-89
Isolated systolic	> 140	< 90
Grade 1: Mild	140-159	90-99
Grade 2 : Moderate	160-179	100-109
Grade 3 : Severe	≥ 180	≥ 110
Emergency	> 220	> 140

So how do I interpret the report?

The front page provides patient details, mean blood pressures and conclusions. Remember, the requesting physician must interpret these conclusions in light of the clinical risk factors.

Six mean blood pressure values are reviewed; systolic and diastolic for 24 hour mean/awake/sleep periods. Each mean value should have 75% of the recordings at or below the normal level for it to be regarded as normal (**Table 1**). A single elevated mean value may not be clinically relevant and the report may still be regarded as normal. The severity of the hypertension will depend on an overall impression of the results and may differ from the clinical limits provided in **Table 2**.

Customer Name Ambulatory Blood Pressure Report															
<table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">Patient / Laboratory No:</td> <td>123456</td> </tr> <tr> <td>Surname:</td> <td>Doe</td> </tr> <tr> <td>First Name:</td> <td>Jane</td> </tr> <tr> <td>Date Of Birth:</td> <td>10/10/1950</td> </tr> <tr> <td>Gender:</td> <td>Female</td> </tr> <tr> <td>Referring Practitioner:</td> <td>Dr Smith</td> </tr> <tr> <td>Date of Commencement:</td> <td>29/09/2014</td> </tr> </table>		Patient / Laboratory No:	123456	Surname:	Doe	First Name:	Jane	Date Of Birth:	10/10/1950	Gender:	Female	Referring Practitioner:	Dr Smith	Date of Commencement:	29/09/2014
Patient / Laboratory No:	123456														
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Date of Commencement:	29/09/2014														
<table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">Mean BP:</td> <td>121/73 mmHg</td> </tr> <tr> <td>Awake:</td> <td>123/75 mmHg</td> </tr> <tr> <td>Asleep:</td> <td>113/68 mmHg</td> </tr> </table> <p>Conclusion:</p> <p>Normal 24-hour ambulatory blood pressure recording</p> <p>Reported By Consultant Cardiologist: Doctors Name</p> <div style="text-align: center; margin: 10px 0;">  </div> <p>Reported On: 02/10/2014</p>		Mean BP:	121/73 mmHg	Awake:	123/75 mmHg	Asleep:	113/68 mmHg								
Mean BP:	121/73 mmHg														
Awake:	123/75 mmHg														
Asleep:	113/68 mmHg														
<div style="display: flex; justify-content: space-between; font-size: small;"> v 4.2.000 IEM - Hypertension Management Software </div>															

So how do I interpret the report?

Page 2 summarizes the recorded data.

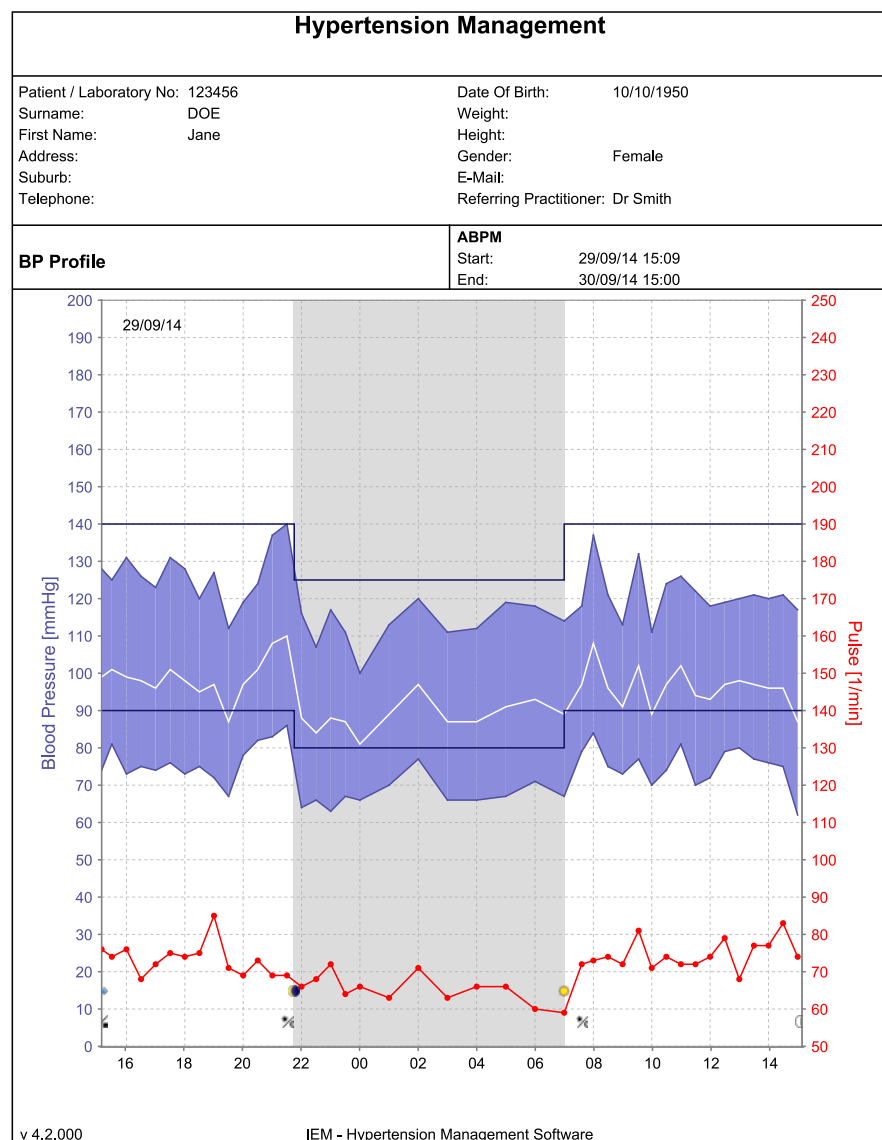
At least 14 valid recordings are required for a satisfactory study. Sometimes because of an incomplete study due to discomfort, a smaller number of recordings may be accepted rather than repeat the study. The mean pressures and percentage above the limit (<25%) are evaluated to determine if hypertension is present

Hypertension Management									
Patient / Laboratory No: 123456					Date Of Birth: 10/10/1950				
Surname: DOE					Weight:				
First Name: Jane					Height:				
Address:					Gender: Female				
Suburb:					E-Mail:				
Telephone:					Referring Practitioner: Dr Smith				
Diagnostic Findings					ABPM				
					Start: 29/09/14 15:09				
					End: 30/09/14 15:00				

So how do I
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report?

Page 3 graphs the measurements above and below the systolic or diastolic limits with night (asleep) values being shaded.

Occasional peaks indicate a temporary rise in pressure although the mean levels and the % above the limit (25%) are still within normal limits. If the monitor exceeds 24 hours, then another day is graphed, even though there may only be few recordings.



So how do I interpret the report?

Page 4 lists the individual recordings including those which were not valid and the reasons for this.

Nocturnal measurements are in the shaded areas. This may extend over two pages. Abnormal values are in red.

The final report may include another four pages which present the data in graph form. For clinical usage, this is unnecessary, but included in the final report as some physicians request information in this format.

Hypertension Management									
Patient / Laboratory No: 123456					Date Of Birth: 10/10/1950				
Surname: DOE					Weight:				
First Name: Jane					Height:				
Address:					Gender: Female				
Suburb:					E-Mail:				
Telephone:					Referring Practitioner: Dr Smith				
Table						ABPM			
						Start: 29/09/14 15:09			
						End: 30/09/14 15:00			
No.	Date	Time	sys	Avera	Dia	Pulse	Code	Comment	
	29/09/14	15:09	128	99	74	76	100	Start of a manual measurement	
	29/09/14	15:30	125	101	81	74			
	29/09/14	16:00	131	99	73	76			
	29/09/14	16:30	126	98	75	68			
	29/09/14	17:00	123	96	74	72			
	29/09/14	17:30	131	101	76	75			
	29/09/14	18:00	128	98	73	74			
	29/09/14	18:30	120	95	75	75			
	29/09/14	19:00	127	97	72	85			
	29/09/14	19:30	112	87	67	71			
	29/09/14	20:00	119	97	78	69			
	29/09/14	20:30	124	101	82	73			
	29/09/14	21:00	137	108	83	69			
	29/09/14	21:30	140	110	86	69			
	29/09/14	21:31					124	The day/night button was not pressed during the set time fra	
	29/09/14	22:00	116	88	64	66			
	29/09/14	22:30	107	84	66	68			
	29/09/14	23:00	117	88	63	72			
	29/09/14	23:30	111	87	67	64			
	30/09/14	00:00	100	81	66	66			
	30/09/14	01:00	113	89	70	63			
	30/09/14	02:00	120	97	77	71			
	30/09/14	03:00	111	87	66	63			
	30/09/14	04:00	112	87	66	66			
	30/09/14	05:00	119	91	67	66			
	30/09/14	06:00	118	93	71	60			
	30/09/14	07:00	114	89	67	59			
	30/09/14	07:36	118	97	79	72	123	The day/night button was pressed during the set time frame,	
	30/09/14	08:00	137	108	84	73			
	30/09/14	08:30	121	96	75	74			
	30/09/14	09:00	113	91	73	72			
	30/09/14	09:33	132	102	77	81			
	30/09/14	10:00	111	89	70	71			
	30/09/14	10:30	124	97	74	74			
	30/09/14	11:00	126	102	81	72			
	30/09/14	11:30	122	94	70	72			
	30/09/14	12:00	118	93	72	74			
	30/09/14	12:30	119	97	79	79			
	30/09/14	13:00	120	98	80	68			
	30/09/14	13:30	121	97	77	77			
	30/09/14	14:00	120	96	76	77			
	30/09/14	14:30	121	96	75	83			
v 4.2.000					IEM - Hypertension Management Software				



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CardioScan, the parent company of Cardiac Monitoring Service, was established 40+ years ago by Medical Director, Assoc Prof Harry Mond, and has grown today to one of the largest services of its kind globally, overseeing more than 500k+ heart studies annually – operating in 10 countries including UK, US, Australia, Hong Kong, Malaysia and Singapore, among others.