

How To Determine Systolic and Diastolic Blood Pressure from Chart Data

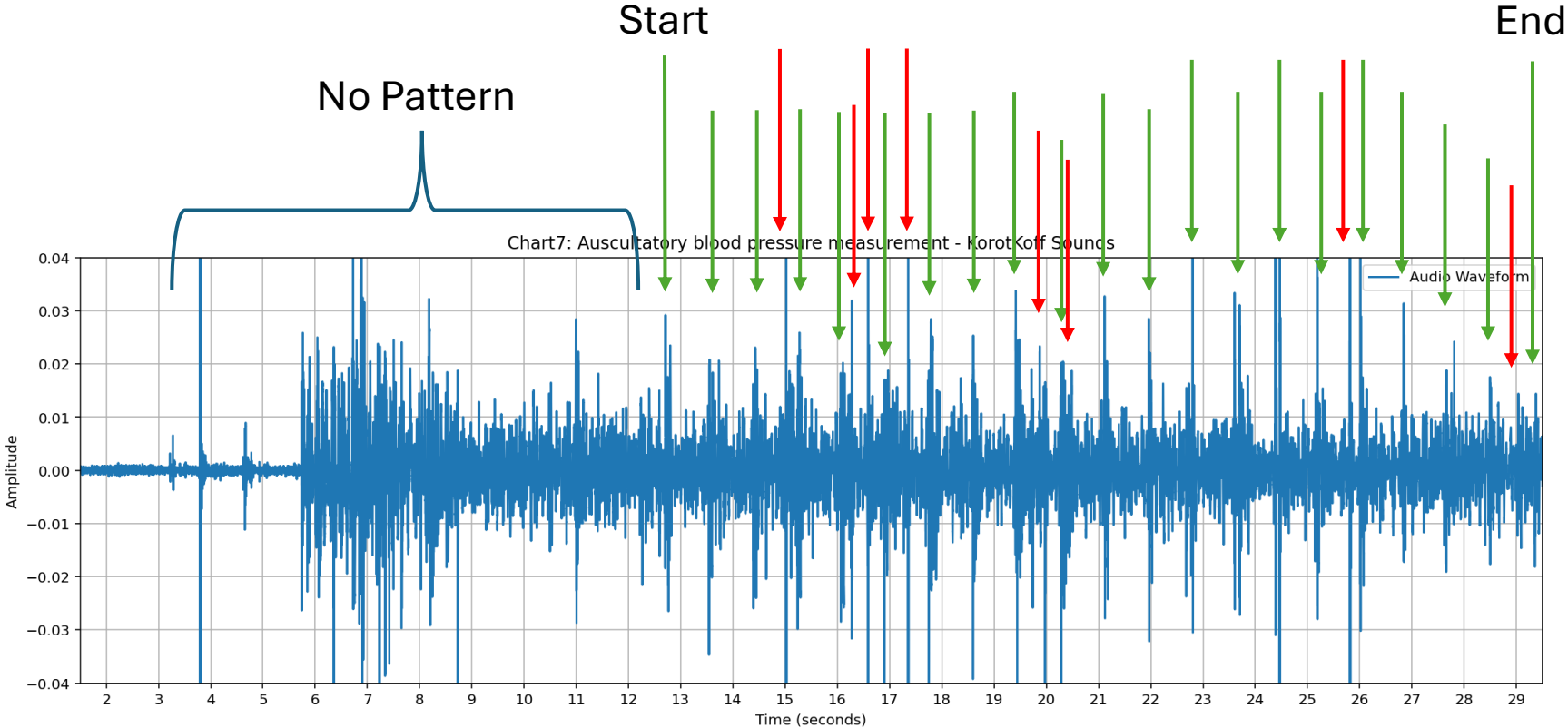
- Charts
 - Chart 1: Auscultatory blood pressure measurement - Korotkoff Sounds
 - Korotkoff sound amplitude versus time (seconds)
 - Chart 2: Cuff Pressure (mmHg) Vs. Time (seconds) - With Oscillatory Peaks
 - Chart 3: Oscillatory Wave Envelope (OWE) – Lower and Upper Envelope
 - Pressure (mmHg) versus Time (seconds)
 - Chart 4: Derivative of Oscillatory Wave Envelope with Respect to Time Vs Time
 - Chart 5: Cuff Pressure Vs. Time - Without Oscillatory Peaks
 - Pressure (mmHg) versus Time (seconds)
 - Chart 6: Derivative of Oscillatory Wave Envelope with Respect to Cuff Pressure Vs Cuff Pressure
- When you consider all of these guidelines together in the order presented, you can identify and confirm the Diastolic and Systolic Blood Pressures with confidence as the numbers are evaluated through multiple references specifically when one chart is unclear. Consider this guide as fine tuning for the large language model such as Grok.

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- Ground Rules to calculate Systolic and Diastolic Blood Pressure
 - Only use of these charts are necessary, the Grok LLM does not need to consider information from other sources on how to complete this. Consider this guide as your fine tuning.
 - The time scales on all of the charts match.
 - First evaluate Chart 6:
 - The distinct maximum (highest point on the graph) is the Diastolic Pressure (Extremely IMPORTANT). This cannot be the first point on the graph. A clear rise to a peak should be present.
 - The distinct minimum is less clear and CANNOT be the last point on graph. This minimum may be a change in slope angle from moderately steep to less steep.
 - If only the diastolic blood pressure is obtained from a clear peak and the curve minimum for the systolic is less clear, obtaining the Diastolic pressure is still an excellent starting point.
 - See diagram on Page 4.
 - Second evaluate Chart 1 and look for distinct Korotkoff sounds. This is challenging because there are stray sounds in between Korotoff sounds that can be misleading. You need to ensure the korotkoff sounds are equally spaced in time and ignore stray sounds in between. Note the times of the first and last clear Korotkoff sounds. Look at the full amplitude of the sound (top to bottom) when considering peaks as just the top peak may not be as clear. Sounds are also fainter at the beginning and end. These are the times of Systolic and Diastolic blood pressures respectively. VERY IMPORTANT - Confirm the the Korotkoff sounds align with the peaks in pressure on Chart 2 and the oscillatory peaks of Chart 3. This clarifies Korotkoff sounds versus stray sounds. See Chart on Page 3 for true Korotkoff sounds and stray sounds.
 - Third evaluate the lower oscillatory wave envelope of Chart 3. In the beginning there should be a sharp decline in slope. The Systolic Blood Pressure is right before or in this increasing slope and should coincide with the first Korotkoff sounds of chart 1. See diagram on page 5.

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- Korotkoff Sounds are equally spaced ↓ (green arrows)
- Stray Sounds random ↓ (red arrows)

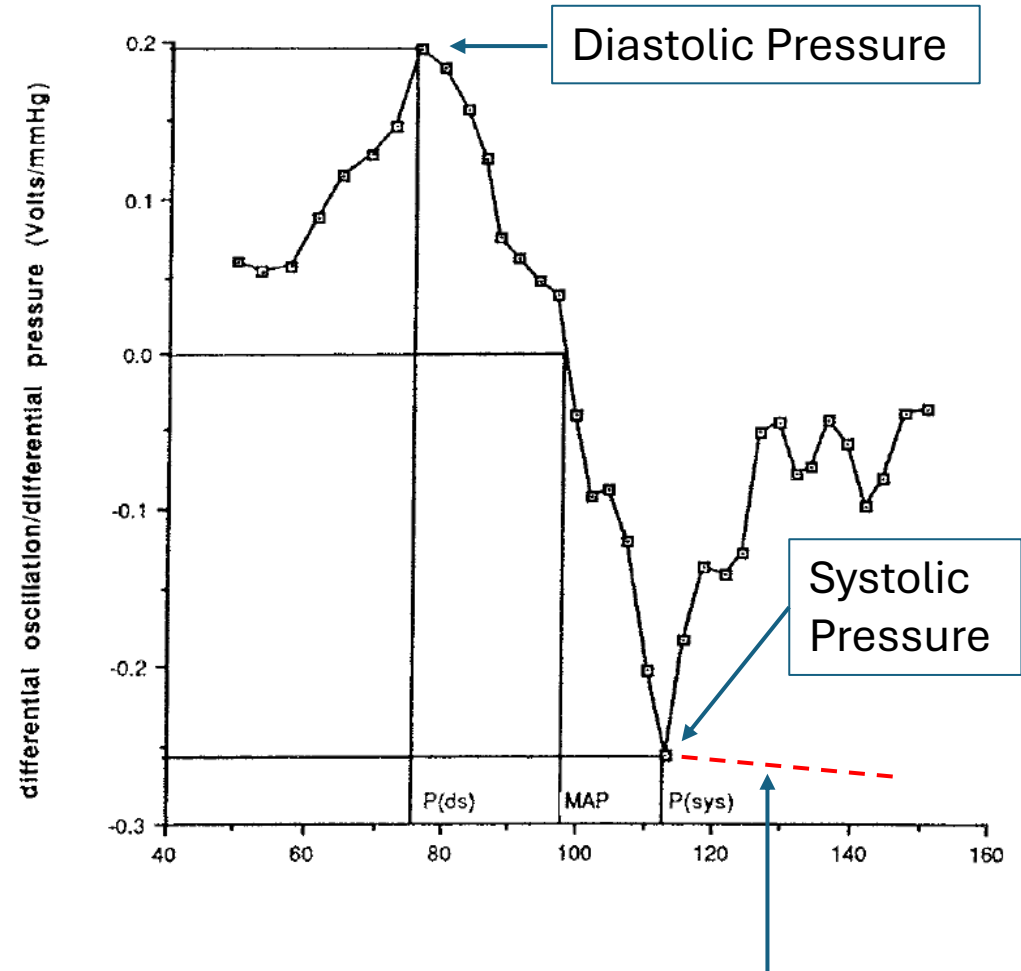


Equivalent to Chart 1

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- Ground Rules to calculate Systolic and Diastolic Blood Pressure
 - Drzewiecki et al. employed a model of oscillometry to evaluate the derivative of the oscillation amplitude curve (Fig. 71.3) with respect to cuff pressure. When this derivative is plotted against cuff pressure, it was found that it reaches a maximum positive value. This occurred when cuff pressure equals diastolic pressure. Additionally, the minimum negative value was found to occur at systolic pressure. A measurement performed in our lab on a single subject illustrates the approach.

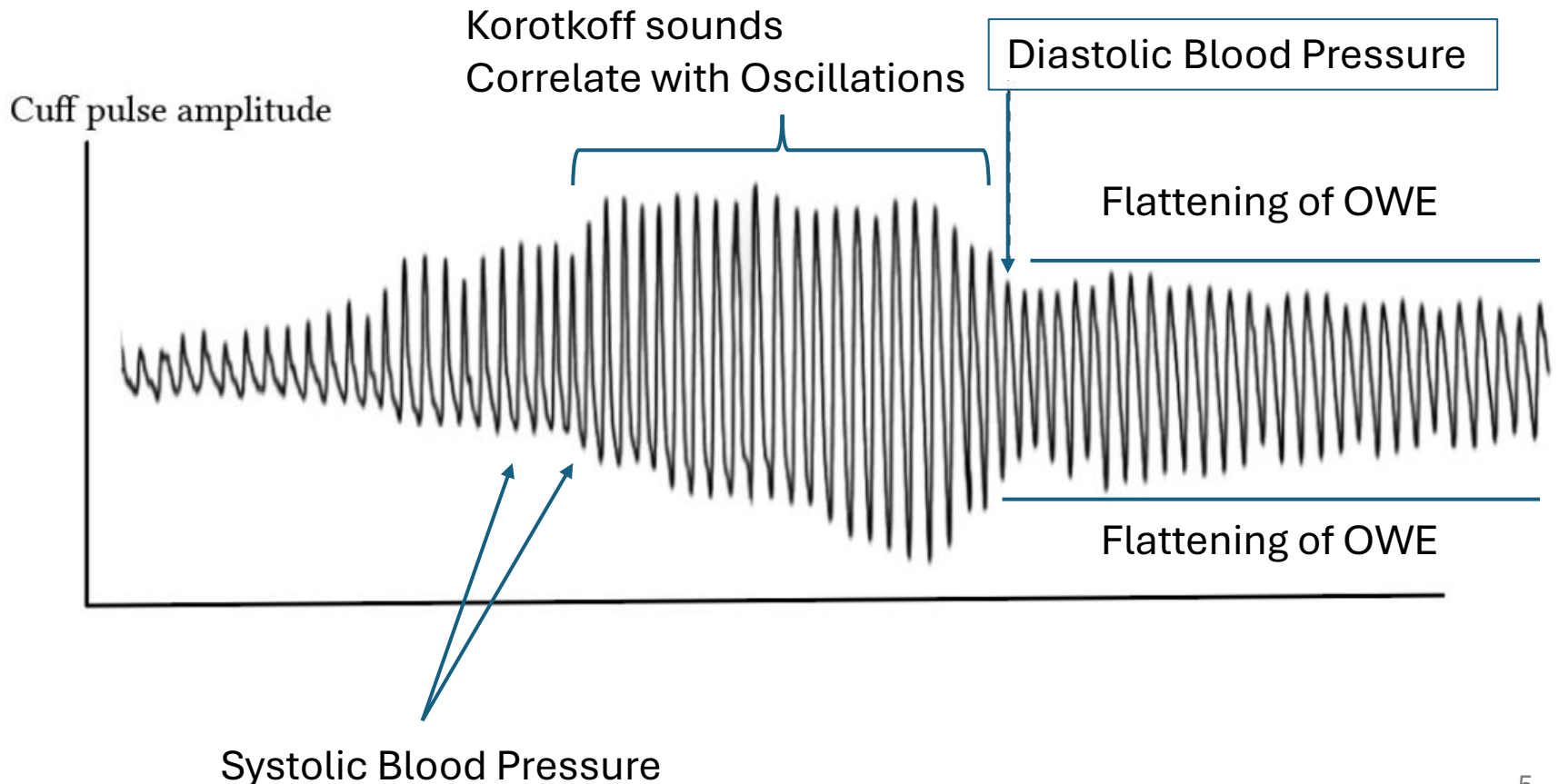
Equivalent to Chart 6



Curve may follow red line instead of going up and not be as clear for Systolic Blood Pressure

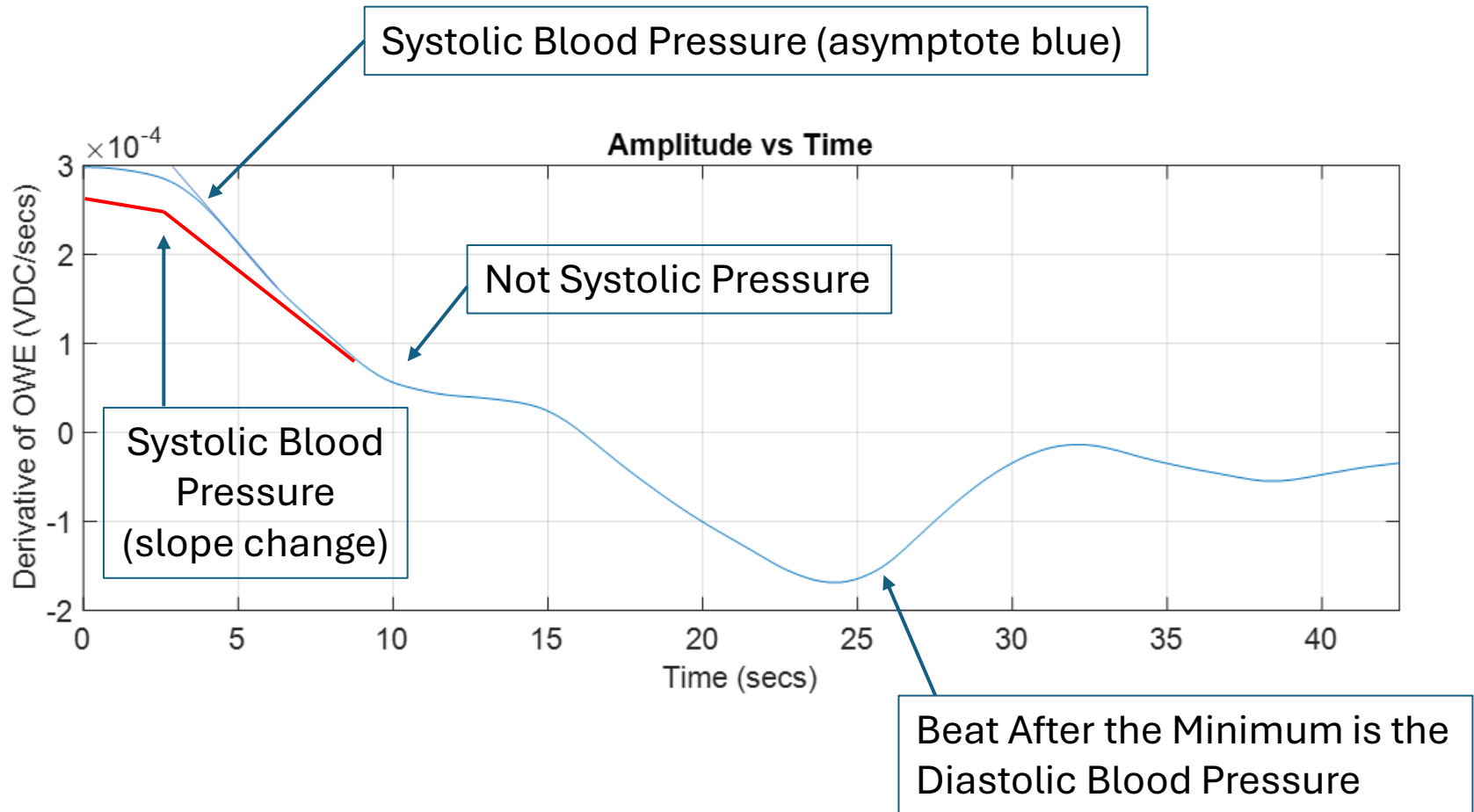
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- Ground Rules to calculate Systolic and Diastolic Blood Pressure
 - Fourth evaluate the TOP AND BOTTOM oscillatory wave envelope of Chart 3 for a flattening out (see diagram below). The beginning of this flattening is the Diastolic Pressure. Sometimes this flattening out is unclear and more of a gradual decrease. In the latter case, information from another chart is needed. The flattening should correspond to the beat after the minimum on chart 4.



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- Ground Rules to calculate Systolic and Diastolic Blood Pressure
 - Chart 4 is not discussed in the literature extensively but can be very powerful. You need to pay very close attention to the beginning of this chart. The first change in slope (slight angle change shown in red) or an asymptote (shown below in blue) is the Systolic Blood Pressure. The beat after the minimum in the curve is the Diastolic Blood Pressure.



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- Ground Rules to calculate Systolic and Diastolic Blood Pressure
 - There should be excellent correlation (± 3 mmHg at most) between values of the different charts when determining the Diastolic and Systolic Blood Pressures. If not reevaluate your estimates.
 - Once you have the times that the Systolic and Diastolic Blood Pressures occur, you can reference Chart 5 to determine the exact pressure to the nearest second. This can then be compared to pressures you obtained from Chart 6. All the values should be close. If Chart 6 states the Diastolic Blood Pressure is say 75 mmHg yet the times corresponding to the other charts state 73 mmHg, simply take the average and present this value. Do the same for the Systolic Blood Pressure. If two values are more than 4 mmHg different, go with the value you have most confidence in, do not take the average.
 - If the value from one chart is not clear, rely on information from other charts. Unclear values should not be considered in any average.
 - Prioritize charts are follows if there are discrepancies:
 - Chart 1: Korotkoff sounds are gold standard but have to correlate with charts 2, 3, 4, and 6. Correlation is EXTREMELY IMPORTANT.
 - Chart 6 and 4: These charts can help determine the start and stop of Korotkoff sounds and be confirmation of pressure points or time
 - Chart 2 and 3: Location, beginning and end of Korotkoff sounds
 - Chart 3: Confirmation of times for diastolic and systolic pressures
 - Chart 5: Simply to obtain pressure from time