

Clinical Insights

# The Basic Metabolic Panel

Providing a broad assessment of patient health at the point of care



**POCT**



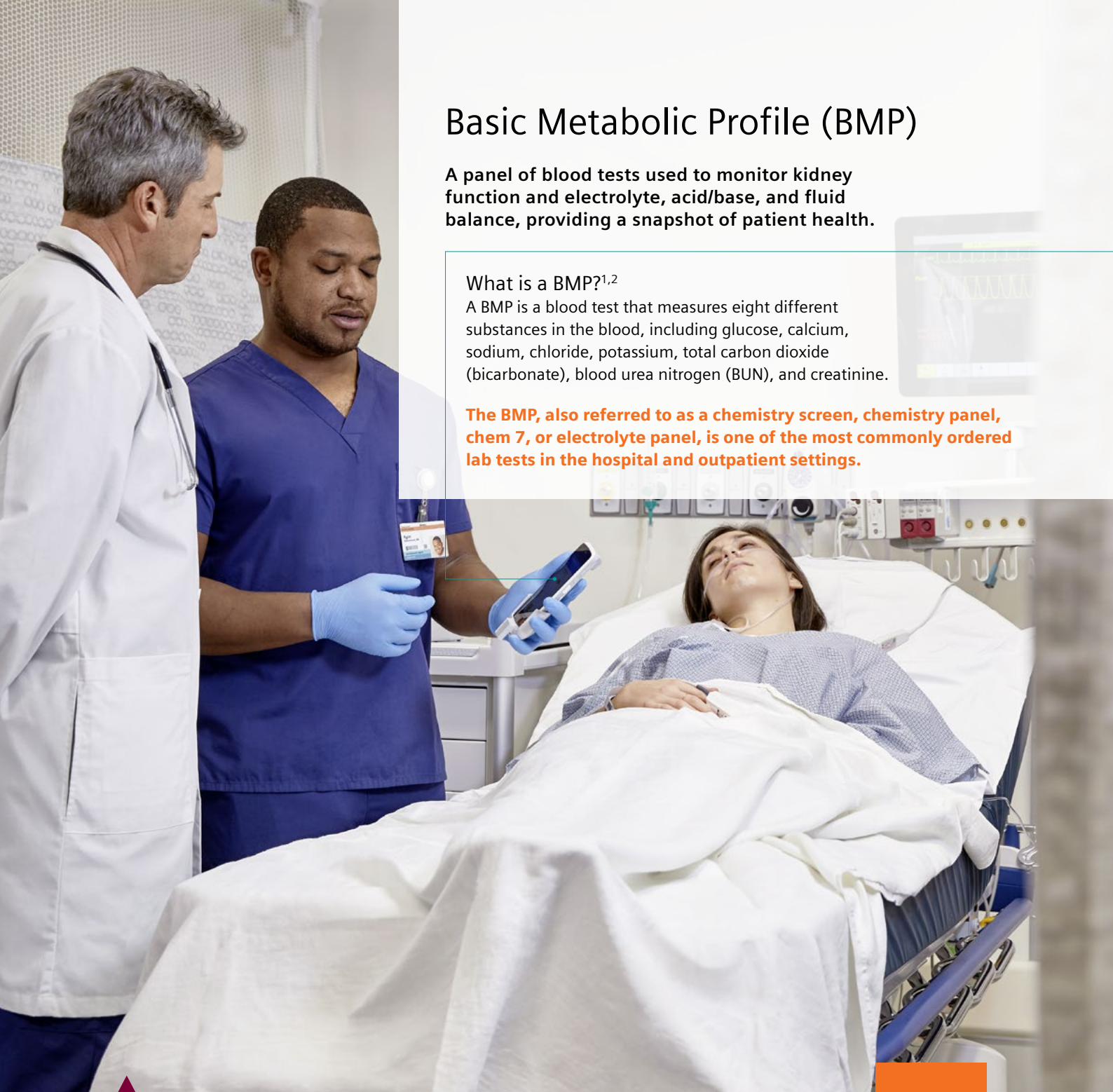
# Basic Metabolic Profile (BMP)

A panel of blood tests used to monitor kidney function and electrolyte, acid/base, and fluid balance, providing a snapshot of patient health.

## What is a BMP?<sup>1,2</sup>

A BMP is a blood test that measures eight different substances in the blood, including glucose, calcium, sodium, chloride, potassium, total carbon dioxide (bicarbonate), blood urea nitrogen (BUN), and creatinine.

**The BMP, also referred to as a chemistry screen, chemistry panel, chem 7, or electrolyte panel, is one of the most commonly ordered lab tests in the hospital and outpatient settings.**



## What is the clinical significance of a BMP?<sup>1,2</sup>

Overall, a BMP provides important information about the body's chemical balance and metabolism, supplying a general overview of a patient's health. It is used to monitor kidney function and electrolyte, acid/base, and fluid balance. **It helps diagnose, screen for, and monitor many health conditions, including kidney failure, sepsis and septic shock, and diabetic ketoacidosis.**

- **Basic health screening** to detect possible underlying health concerns before symptoms have occurred<sup>3</sup>
- **General diagnostic testing** for a wide range of symptoms and medical conditions<sup>3</sup>
- **Follow-up testing to monitor** changes over time or in response to treatment<sup>3</sup>

Screening

Diagnosis

Monitoring

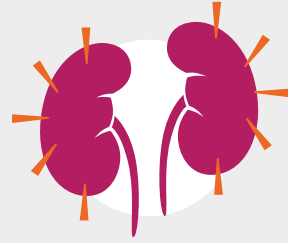
## The Basic Metabolic Panel<sup>3,4,5</sup>

Test Analyte and Reference Range*	Indications for Use
<p><b>Glucose (Glu)</b></p> <p>Reference Range 74–100 mg/dL 4.1–5.5 mmol/L</p>	<p><b>Used in the diagnosis and treatment of carbohydrate metabolism disorders, including diabetes mellitus and idiopathic hypoglycemia, and of pancreatic islet cell tumors.</b></p> <p><b>Hypoglycemia:</b> Causes include too much insulin or diabetes medication.</p> <p><b>Hyperglycemia:</b> Causes include diabetes, medications such as corticosteroids.</p>
<p><b>Calcium (Ca<sup>++</sup>)</b></p> <p>Reference Range 4.6–5.3 mg/dL 1.15–1.33 mmol/L</p>	<p><b>Used in diagnosis and treatment of parathyroid disease, a variety of bone diseases, chronic renal disease, and tetany.</b></p> <p><b>Hypocalcemia:</b> Causes include parathyroid insufficiency, poor intake of calcium-rich foods, low vitamin D levels.</p> <p><b>Hypercalcemia:</b> Causes include increase parathyroid activity, high vitamin D intake.</p>
<p><b>Sodium (Na<sup>+</sup>)</b></p> <p>Reference Range 138–146 mmol/L</p>	<p><b>Used in diagnosis and treatment of diseases involving electrolyte imbalance.</b></p> <p><b>Hyponatremia:</b> Causes include diarrhea, medications (diuretics such as thiazides), renal insufficiency.</p> <p><b>Hypernatremia:</b> Causes include hypercortisolism (Cushing’s syndrome), fluid loss that results in dehydration, renal insufficiency.</p>
<p><b>Chloride (Cl<sup>-</sup>)</b></p> <p>Reference Range 98–107 mmol/L</p>	<p><b>Used in the diagnosis and treatment of electrolyte and metabolic disorders.</b></p> <p><b>Hypochloremia:</b> Causes include lung disease (emphysema), medications (loop diuretics), diarrhea/vomiting.</p> <p><b>Hyperchloremia:</b> Causes include renal failure, medications (corticosteroids, diuretics).</p>
<p><b>Potassium (K<sup>+</sup>)</b></p> <p>Reference Range 3.5–4.5 mmol/L</p>	<p><b>Used in diagnosis and treatment of diseases involving electrolyte imbalance.</b></p> <p><b>Hypokalemia:</b> Causes include medications (loop diuretics and corticosteroids), fluid loss (vomiting, diarrhea), Cushing’s syndrome.</p> <p><b>Hyperkalemia:</b> Causes include renal failure, medications (ACE inhibitors, potassium-sparing diuretics), Addison’s disease.</p>
<p><b>Total Carbon Dioxide (TCO<sub>2</sub>, Bicarbonate)</b></p> <p>Reference Range 22–29 mmol/L arterial 23–30 mmol/L venous</p>	<p><b>Used in the diagnosis and treatment of disorders associated with changes in body acid-base balance.</b></p> <p><b>Low TCO<sub>2</sub>:</b> Causes include increased acid in the blood (metabolic acidosis), diabetic ketoacidosis, aspirin toxicity.</p> <p><b>High TCO<sub>2</sub>:</b> Causes include lung disease (COPD).</p>
<p><b>Blood Urea Nitrogen (BUN)</b></p> <p>Reference Range 8–26 mg/dL</p>	<p><b>Used in the diagnosis and treatment of certain renal and metabolic diseases.</b></p> <p><b>High BUN:</b> Main cause for concern: Causes include kidney failure or any disease process that decreases blood flow to the kidneys (shock, heart failure, etc.).</p>
<p><b>Creatinine (Crea)</b></p> <p>Reference Range 0.51–1.19 mg/dL</p>	<p><b>Used in the diagnosis and treatment of certain renal diseases and in monitoring renal dialysis.</b></p> <p><b>High Crea:</b> Causes include kidney failure or an issue with kidney function due to variety of problems (lack of perfusion, infection, etc.).</p>

\*Note: Different methods can be used for some of the measurements, so there is no universal reference range for the BMP.

## Did you know?

**The availability of BUN and creatinine measurements also enables the calculation of other important assessments of kidney health?**



BUN/CREA<sup>6-8</sup>

**The availability of both a BUN and creatinine result enables the calculation of the BUN/CREA ratio.**

The BUN/creatinine ratio blood test is used to diagnose acute or chronic kidney disease or damage. This ratio can help determine the underlying cause of the altered kidney function. It may also be used to determine gastrointestinal bleeding, urinary tract blockages, or trauma. A higher ratio may indicate dehydration, gastrointestinal bleeding, or decreased blood flow to the kidneys, while a lower ratio can be associated with liver disease, malnutrition, or increased muscle mass.

eGFR<sup>9-10</sup>

**Availability of a creatinine measurement also enables the calculation of estimated glomerular filtration rate (eGFR).**

The creatinine level may be used to calculate eGFR, which assesses kidney filtration function. Estimated glomerular filtration rate (eGFR) is calculated using the creatinine value and other factors, such as age, gender, and body size. The eGFR measurement can help account for certain differences between people that measuring creatinine alone does not.

## Testing locations

The BMP provides a broad assessment of overall health and has utility across care settings and patient populations, young and old. In fact, it is the second most common test performed in the U.S. and one of the most common tests ordered in the hospital and outpatient settings.<sup>11-15</sup>

### Physician's offices

As part of an annual physical or based on patient symptomology

### Emergency settings

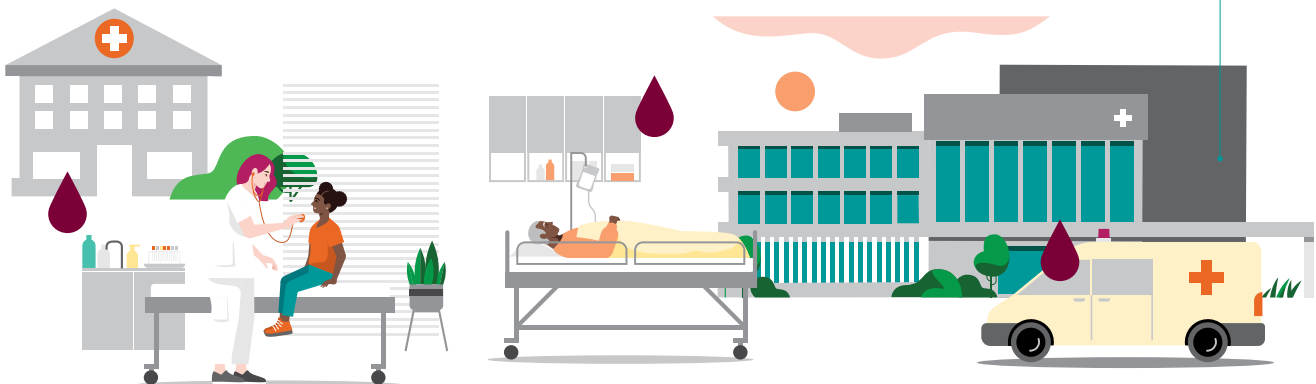
(emergency rooms, urgent care, critical care transport)<sup>14-16</sup>

To speed triage, guide critical decision making, and promote earlier intervention

### General hospital units and intensive care units

(ICU, MICU, NICU, PICU, SICU)<sup>13,17-19</sup>

To monitor patient condition and effectiveness of treatment



BMP testing can be performed in a laboratory or at the point-of-care. Point of care testing (POCT) can aid clinicians in making rapid health assessments and treatment decisions where and when they are necessary.

Point-of-care testing (POCT) can provide accurate, efficient, and timely measurements, with the potential to influence clinical decision making sooner.<sup>20</sup>

## The Basic Metabolic Panel (BMP): 9 Key Points

### A snapshot of patient health

- 1 A blood test that measures eight different analytes, including glucose, calcium, sodium, chloride, potassium, total carbon dioxide (bicarbonate), blood urea nitrogen (BUN), and creatinine.  
Also enables calculation of BUN/creatinine ratio and estimated glomerular filtration rate (eGFR).
- 2 Overall, used to assess kidney function and electrolyte, acid/base, and fluid balance.
- 3 A single BMP result, or combination of results, can indicate kidney disease, diabetes, hypertension, dehydration, hypoglycemia, lung disease, and other conditions.
- 4 Is the second most common test performed in the U.S. and one of the most common tests ordered in the hospital and outpatient settings.
- 5 Has utility as a **basic health screening** to detect possible underlying health concerns before symptoms have occurred.
- 6 Has utility as **follow-up testing** to monitor changes over time or in response to treatment.
- 7 Has utility as **general diagnostic testing** for a wide range of symptoms and medical conditions.
- 8 Is commonly performed in physician's offices, clinics, emergency settings (ER, urgent care, critical care transport), and across hospital units including intensive care units (ICU, MICU, NICU, PICU, SICU).
- ! 9 ***Point-of-care BMP testing can provide accurate, efficient, and timely measurements to aid clinicians in making critical health assessments and treatment decisions where and when they are necessary.***

## References

1. <https://my.clevelandclinic.org/health/diagnostics/22020-basic-metabolic-panel-bmp>. Accessed 5-26-23.
2. <https://www.medicalnewstoday.com/articles/bmp#uses>. Accessed 2-26-23.
3. <https://www.testing.com/tests/basic-metabolic-panel-bmp>. Accessed 5-26-23.
4. epoc System Manual with epoc NXS Host. 51015950 Rev.:03. © 2022. Siemens Healthcare Diagnostics Inc.
5. <https://www.registerednurses.com/metabolic-panel-bmp-cmp-nursing-lab-values/>. Accessed 5-26-23.
6. <https://www.healthlabs.com/bun-creatinine-ratio-testing>. Accessed 5-26-23.
7. <https://www.rupahealth.com/post/understanding-the-important-of-testing-for-bun-and-creatinine-in-functional-medicine>. Accessed 5-26-23.
8. <https://www.testing.com/tests/renal-panel/>. Accessed 5-26-23.
9. <https://www.kidney.org/newsletter/what-difference-between-scr-egfr-acr-and-bun>. Accessed 5-26-23.
10. <https://www.testing.com/tests/creatinine/>. Accessed 5-26-23.
11. Horton S, et al. The top 25 laboratory tests by volume and revenue in five different countries. *Am J Clin Pathol*. 2019;151(5):446-51.
12. <https://www.medcram.com/courses/bmp-chem-7-results-explained-clearly>. Accessed 6-1-23.
13. <https://text2md.com/blog/when-should-you-get-a-basic-metabolic-panel-test/>. Accessed 6-1-23.
14. <https://fullscript.com/blog/common-lab-tests>. Accessed 6-1-23.
15. Siemens Healthineers Internal Carevoyance Survey Data. May 2023.
16. Goyder C, Tan PS, Verbakel J, et al. Impact of point-of-care panel tests in ambulatory care: a systematic review and meta-analysis. *BMJ Open*. 2020;10:e032132.
17. Singer AJ, Taylor M, LeBlanc D, Meyers K, Perez K, Thode HC Jr, Pines JM. Early point-of-care testing at triage reduces care time in stable adult emergency department patients. *J Emerg Med*. 2018 Aug;55(2):172-178. doi: 10.1016/j.jemermed.2018.04.061. Epub 2018 Jun 7. PMID: 29887410.
18. Frassica JJ. Frequency of laboratory test utilization in the intensive care unit and its implications for large-scale data collection efforts. *J Am Med Inform Assoc*. 2005 Mar-Apr;12(2):229-33. doi: 10.1197/jamia.M1604. Epub 2004 Nov 23. PMID: 15561793; PMCID: PMC551555.
19. Almeqdadi M, Nair HK, Hill J, Sanchez-Cruz J, Nader C, Jaber BL. A quality improvement project to reduce overutilization of blood tests in a teaching hospital. *J Community Hosp Intern Med Perspect*. 2019 Jun 19;9(3):189-194. doi: 10.1080/20009666.2019.1601979. PMID: 31258856; PMCID: PMC6586109.
20. Ismail F, Mackay WG, Kerry A, Staines H, Rooney KD. The accuracy and timeliness of a point of care lactate measurement in patients with sepsis. *Scand J Trauma Resusc Emerg Med*. 2015 Sep 17;23:68. doi: 10.1186/s13049-015-0151-x. Erratum in: *Scand J Trauma Resusc Emerg Med*. 2016;24:41. PMID: 26383239; PMCID: PMC4573294.



## POINT OF CARE TESTING UNIVERSITY

Educational support provided by Siemens Healthineers.

All information is for education only and is not intended to be relied upon by the reader for instruction as to the practice of medicine.

Any healthcare practitioner reading this information is reminded that they must use their learning, training, and expertise in dealing with their individual patients.