TEST

Therapeutic drug levels

A therapeutic drug level measures how much of a prescribed medicine is in your blood.

WHAT IT MEASURES
Amount of a prescribed medicine in your blood

SAMPLE
Blood, usually serum, plasma, or whole blood

FASTING NEEDED?
Sometimes, if the medicine or laboratory requires it

HOW LONG IT TAKES
Usually under 10 minutes for a blood draw

RESULTS IN
Same day to several days, varying by laboratory

USED FOR
Monitoring treatment effectiveness, adherence, and toxicity risk

MAIN LIMITATION
Sampling at the wrong time can mislead interpretation

Overview

A therapeutic drug level measures the concentration of a medicine in your blood. It is also called therapeutic drug monitoring.

The test is mainly used for medicines that need careful dosing. Too little medicine may not work well, while too much may increase side effects or toxicity. Examples include lithium, digoxin, some anti-seizure medicines, certain antibiotics like amoxicillin or doxycycline , and medicines used after an organ transplant.

Most medicines do not need blood-level monitoring. For many drugs, symptoms, side effects, and other tests provide enough information.

A drug level is interpreted alongside your dose, when you took it, kidney and liver function, other medicines, and how you feel. A number within the laboratory's target range does not guarantee that a medicine is effective or safe for every person.

Why the test is ordered

Your healthcare team may order a therapeutic drug level to:

Some levels are checked routinely. Others are ordered only when there is a concern, such as new symptoms, a dose change, or an unexpected response to treatment.

The purpose also affects when the blood is collected. A trough level is taken shortly before the next dose, when the concentration is expected to be lowest. A peak level is taken at a defined time after a dose. Some tests use a sample taken at another carefully recorded time.

- Check whether your current dose is producing the expected exposure
- Investigate side effects or possible toxicity
- See whether a medicine may be too low to work effectively
- Guide dosing when kidney or liver function changes
- Check levels after starting, stopping, or changing an interacting medicine
- Monitor treatment during pregnancy, serious illness, or major weight changes
- Help assess whether doses have been taken as planned

Who should have the test

You may need this test if you take a medicine for which blood concentration helps guide treatment. Monitoring is particularly useful when the difference between an effective amount and a harmful amount is small. This is sometimes called a narrow therapeutic range .

Testing may also be appropriate if your body could begin handling a medicine differently. This can happen with changing kidney or liver function, pregnancy, ageing, serious illness, or interactions with another medicine.

Drug levels are not general screening tests. They are usually ordered for a specific medicine and clinical reason.

How to prepare

Follow the timing instructions carefully. For many therapeutic drug levels, when the sample is collected matters more than whether you have eaten.

Write down or bring:

Do not skip, delay, or take an extra dose unless your healthcare team has specifically instructed you to do so. Ask whether you should take the scheduled dose before or after the blood draw.

Most drug-level tests do not require fasting. However, the medicine itself or other blood tests ordered at the same time may have food restrictions. Follow the instructions from the laboratory or healthcare team.

- The exact time of your last dose
- The amount you took
- Whether any doses were late, missed, or taken twice
- All prescription medicines, over-the-counter products, and supplements
- Any recent change in brand, formulation, or dosing schedule

What happens during the test

Most therapeutic drug levels use a blood sample from a vein in your arm. An elastic band is placed around your upper arm, the skin is cleaned, and a small needle is inserted into the vein. The collection usually takes only a few minutes.

The sample may be tested as serum, plasma, or whole blood. These are different parts or preparations of blood, and the correct sample depends on the medicine.

Tell the person collecting the sample when you last took your dose. If the medicine is being given through an intravenous line, blood should generally be drawn from a different site or according to a specific protocol. Medicine left in the line could produce a falsely high result.

Understanding your results

Results usually show the medicine's concentration, the unit of measurement, and a laboratory reference or target range. This is not a universal "normal range." Targets vary by medicine, laboratory method, sample timing, age, sex, pregnancy status, other medicines, and clinical context.

A result below the target may reflect:

A result above the target may reflect:

The result must also be compared with your symptoms and treatment response. Some people develop side effects within a usual target range, while others may benefit from a concentration outside it under specialist supervision.

Do not change or stop a prescribed medicine based only on the number.

- A dose that provides too little exposure
- A missed or delayed dose
- Collection at the wrong time
- Reduced absorption
- Faster removal of the medicine from the body
- A dose that provides greater exposure than intended
- Reduced kidney or liver clearance
- A medicine interaction
- Collection too soon after a dose
- Contamination from an intravenous line

What affects the results

Sampling time is the most common reason a therapeutic drug level is difficult to interpret. A result taken shortly after a dose may be much higher than one taken just before the next dose.

Other important influences include:

Tell your healthcare team about recent dose changes, vomiting or diarrhoea, major illness, changes in kidney function, pregnancy, and all medicines or supplements.

- Time on treatment: Levels may not yet be stable after starting a medicine or changing the dose.
- Missed or extra doses: Even one dosing error can change the result.
- Kidney function: The kidneys remove many medicines. Reduced function can raise their concentration.
- Liver function: Liver disease can slow the breakdown of some medicines.
- Other medicines: Some drugs increase or decrease how quickly another medicine is absorbed, broken down, or removed.
- Pregnancy and age: Changes in body water, blood proteins, metabolism, and kidney function can alter drug handling.
- Blood protein levels: Some medicines attach to proteins such as albumin. A total drug level may be misleading when protein levels are low.

- Recent illness or fluid changes: Dehydration, major intravenous fluid treatment, or a large recent transfusion may change measured concentrations.
- Sample contamination: Drawing blood from a line used to give the medicine can falsely raise the result.
- Laboratory method: Some tests may also detect related medicines or drug breakdown products.

Accuracy and limitations

A therapeutic drug level directly measures drug concentration, but it cannot show by itself whether treatment is working or causing a symptom.

There is no single rate for how often this test misses a problem or incorrectly suggests one. Accuracy differs by medicine, laboratory method, sample type, and collection timing. Because the result is a continuous number rather than a yes-or-no test, incorrect interpretation is often caused by timing or context rather than a laboratory error.

An in-range result can miss toxicity if you are unusually sensitive to the medicine or if the harmful effect is not closely related to blood concentration. An out-of-range result can incorrectly suggest a dosing problem if the sample was collected at the wrong time.

Some laboratory methods can mistake related compounds or drug breakdown products for the medicine being measured. More specific methods, such as liquid chromatography with mass spectrometry, may be useful when interference is suspected.

A free drug level , which measures medicine not attached to blood proteins, may be more informative for certain highly protein-bound medicines when albumin is low, during pregnancy, or with kidney failure. For some medicines, estimated exposure over several hours is more useful than a single peak or trough result. Vancomycin monitoring is one example.

Risks and complications

A blood draw may cause brief discomfort, a small bruise, or minor bleeding. Some people feel light-headed or faint.

Serious complications from routine blood collection are uncommon.

What happens next

Your healthcare team will review the result with the dose, sample timing, symptoms, and other tests. Routine follow-up may involve continuing the same dose, repeating the level at the correct time, or adjusting treatment.

Contact your healthcare team promptly if you develop new or worsening side effects, cannot keep your medicine down, repeatedly miss doses, or learn that the sample was collected at the wrong time.

Do not wait for a routine drug-level result if you may have taken an overdose or have severe confusion, collapse, a seizure, difficulty breathing, extreme drowsiness, or an abnormal heartbeat. Seek emergency help or contact your local poison service.

Common questions

Can I drink coffee before the test?

Usually, yes. Coffee does not directly affect most therapeutic drug levels. Follow any fasting instructions given for the medicine or for other tests being collected at the same appointment.

Does the time of day matter?

The time relative to your dose matters greatly. Some samples must be collected just before the next dose, while others are taken a set number of hours after it.

Can I exercise beforehand?

Ordinary activity usually does not meaningfully affect most drug levels. Strenuous exercise can change fluid balance, kidney function, or blood flow temporarily, so mention intense recent exercise if your result is unexpected.

Should I take my medicine before the blood test?

Only as instructed. Taking a dose immediately before a planned trough sample could make the result misleadingly high. Do not skip a dose unless your healthcare team has told you to.

Do I need to fast?

Usually not. You may need to fast because of the medicine, another test ordered at the same time, or specific laboratory instructions.

Why does my result differ between laboratories?

Laboratories may use different sample types, measurement methods, units, and target ranges. Results are most useful when interpreted using the range and method reported by the laboratory that performed the test.

Sources

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