

Benzene Sensitivity

Biohacker Report

REPORT CATEGORY —



DETOX

Sample Client

Report date: 15 January 2026

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DISCLAIMER

This report does not diagnose this or any other health conditions. Please talk to a healthcare professional if this condition runs in your family, you think you might have this condition, or you have any concerns about your results.

Personal information

NAME

Sample Client

SEX AT BIRTH

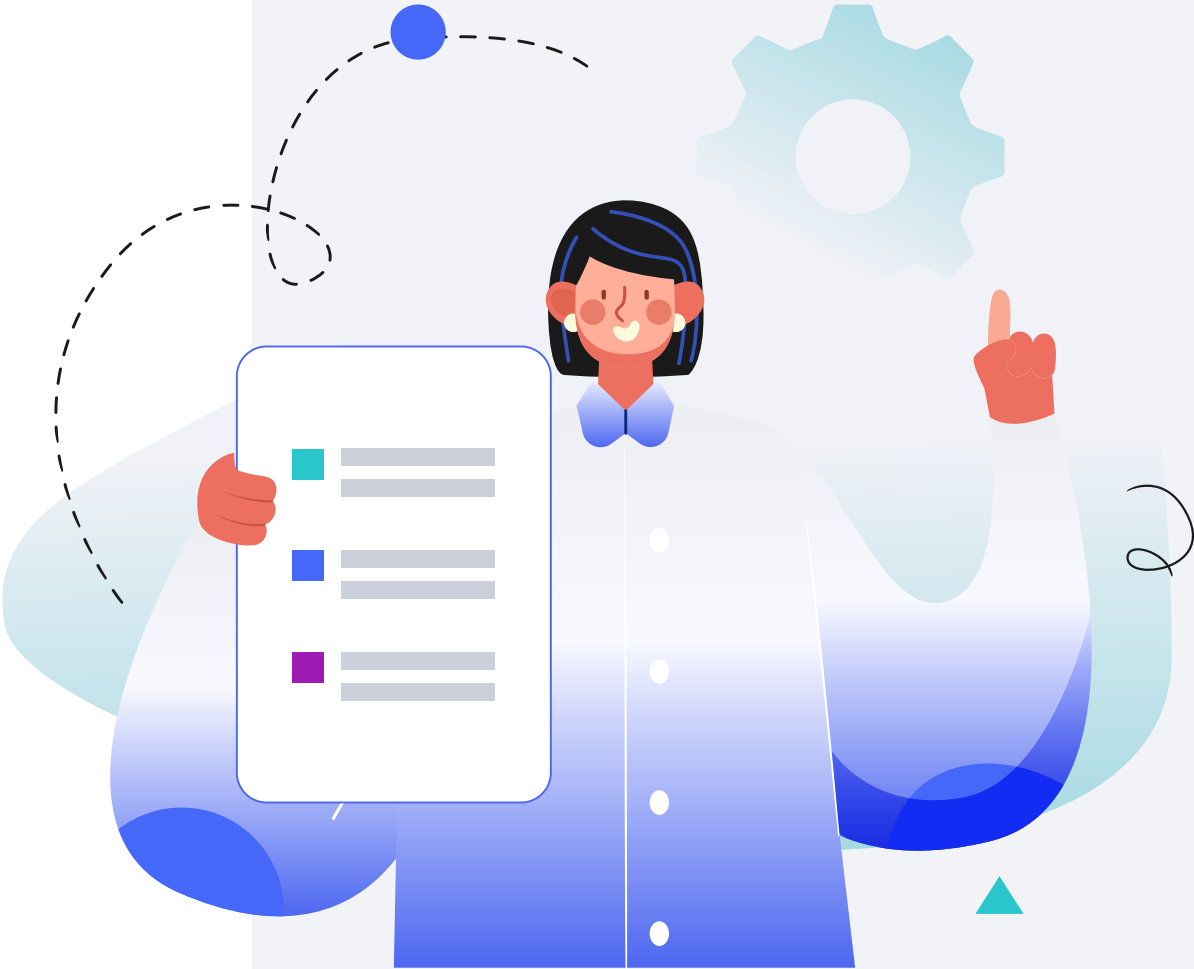
Male

HEIGHT

5ft 5" 165cm

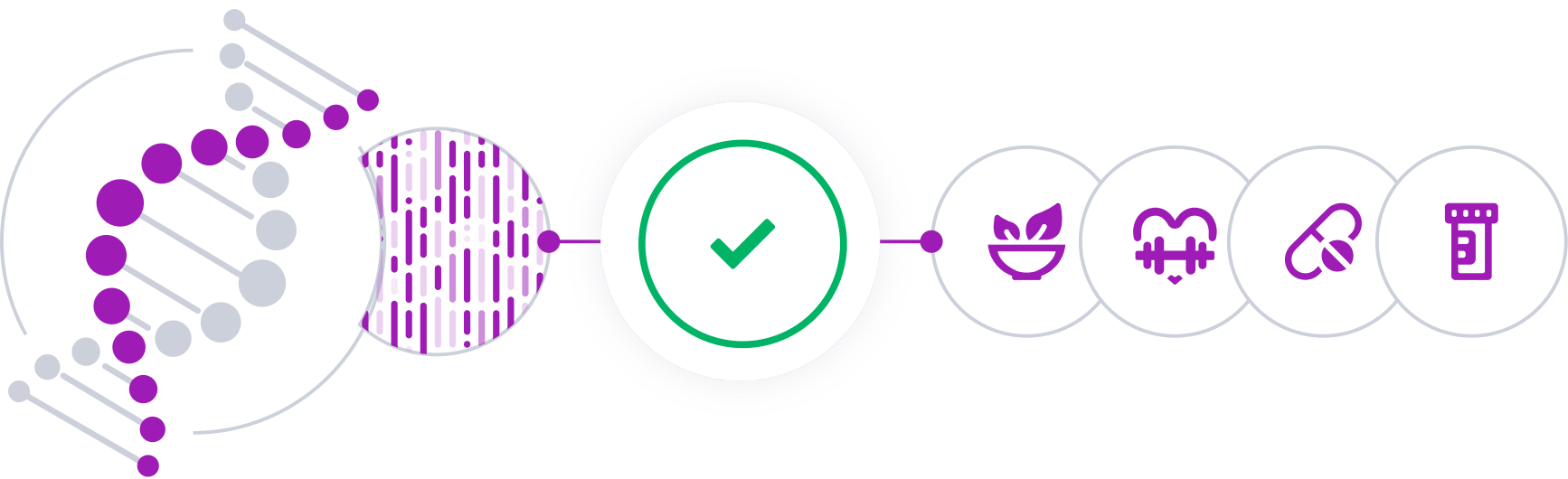
WEIGHT

137lb 62kg



How this works

Our Wellness Reports analyze how your DNA influences your health.
We then use this analysis to give you personalized risk estimates and recommendations.

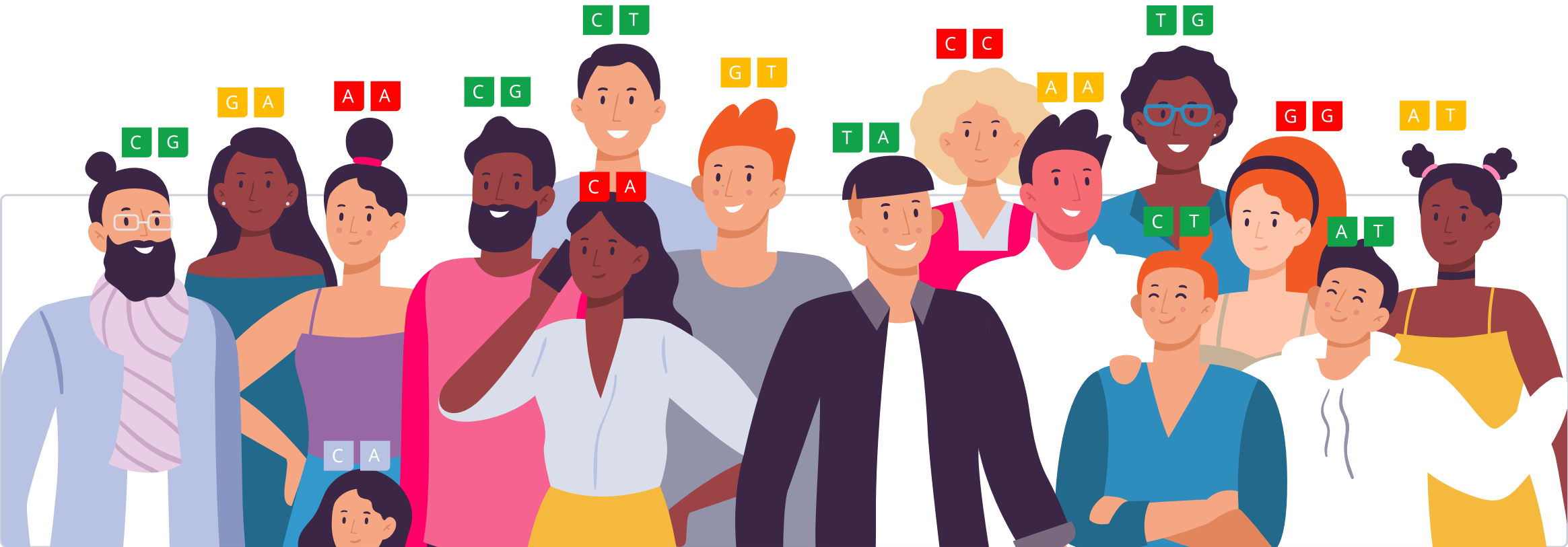


Similarly, our Trait Reports look at how your DNA influences your traits.



Your DNA is like an instruction manual — it contains a lot of information.
You can think of it as a blueprint for your body.

Genetic variants are parts of DNA that differ from person to person. Some can make you more vulnerable to certain health issues, while others may influence traits such as eye color.



We use artificial intelligence and machine learning to analyze all this information.
We then summarize your results as a risk score or display it on a gauge.

In total, we analyze up to 83 million genetic variants.

When we give a risk score, the risk icon tells you if you are at a higher or lower risk compared to other people:



Genotype color info:

AA

You don't have any risk alleles

AA

You have 1 risk allele

AA

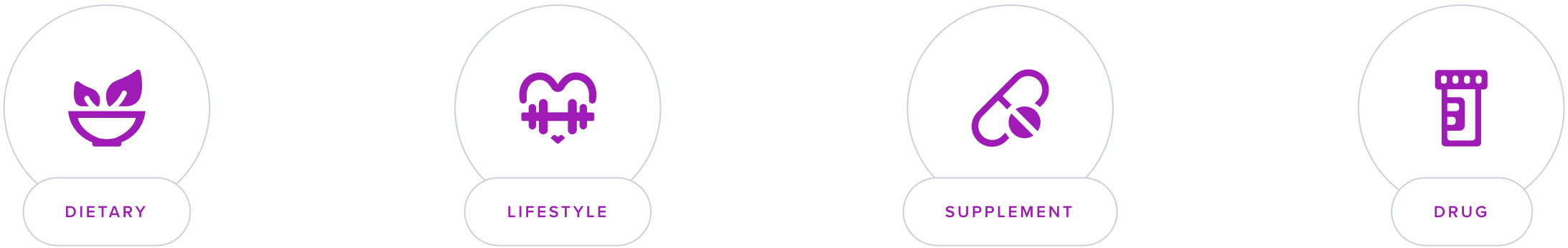
You have 2 risk alleles

Your risk is also displayed as a percentile. This will tell you how your risks compare to our sample population. The lower your percentile number, the lower your risk. The "50th percentile" would be an average risk.

Similarly, the gauge tells you your relative risk score compared to our sample population, or it indicates a specific trait or haplotype you are more likely to have based on your genetic variants.

When applicable, we also list top evidence-based recommendations that may help lower your risk. The focus is on recommendations that may be of benefit to you, based on your genetics.

Our recommendations come in four categories: lifestyle, diet, supplements and drugs.
The following icons tell you which category a recommendation falls into:



Our team of scientists also ranks each recommendation.
We rank based on impact and the strength of evidence in the medical literature.

Impact shows how strongly a recommendation will affect your health in a certain area.
Evidence is how much scientific support there is for the recommendation. Rankings are from 1 to 5 (low to high):



Impact

Impact scores range from 1-5. These scores reflect how much of an effect each recommendation can have. An impact score of 5 predicts the biggest effect.

When a recommendation affects something we can measure, we use those measurements to assign the impact score. For example, a recommendation that decreases cholesterol by 20% will have a higher impact score than one that decreases it by 5%.

Some recommendations affect things that we cannot directly measure, like stress or mood. For these, the impact score is based on how well they work relative to other recommendations and standard treatments. The best ones get the highest scores.

If there is a lot of research that shows a recommendation works especially well for your genotype, the impact score gets increased.

Recommendation Evidence

- 5 / 5
- Recommendations that are considered effective and generally recommended by experts and medical bodies.
-
- 4 / 5
- Recommendations that are considered likely effective and that have multiple independent meta-analyses and a great many studies supporting them.
-
- 3 / 5
- Recommendations that are considered possibly effective and have many studies supporting them
-
- 2 / 5
- Recommendations that have insufficient evidence, with two or several clinical trials supporting them, or many studies but with ambiguous results.
-
- 1 / 5
- Recommendations that have insufficient evidence, with a single clinical trial, or with many studies most of which didn't find support for the recommendation.
-
- 0 / 5
- No evidence in humans.

Genotype-specific Evidence

- High-quality
- Direct evidence that a recommendation helps more in people with your gene variant (many clinical trials, a few large clinical trials, or a meta-analysis).
- Medium-quality
- Direct evidence that a recommendation helps more in people with your gene variant (a few clinical trials or one large clinical trial).
- Low-quality
- Direct evidence that a recommendation helps more in people with your gene variant (a single clinical trial or more trials with inconsistent results).
- Indirect
- A recommendation may help more in people with your gene variant because it targets a specific gene or protein affected by your variant (e.g., MTHFR, dopamine).
- In theory
- A recommendation may help more in people with your gene variant because it targets a specific mechanism affected by your variant (e.g., inflammation, oxidative stress).

Some things to keep in mind:

- Genetics doesn’t play a considerable role in a condition or a trait.
- There is not enough research available to estimate a genetic predisposition.
- There are technical limitations to estimating or presenting a genetic predisposition.
- The topic is sensitive, and a genetic predisposition should only be estimated and presented by a healthcare professional.

Introduction

Benzene is a colorless, flammable liquid with a sweet odor, widely used as a solvent and in the production of chemicals like plastics, resins, and synthetic fibers.

Benzene occurs naturally in crude oil and is found in tobacco smoke, vehicle emissions, and industrial processes. It can also be released from burning fossil fuels, such as coal and oil.

Short-term exposure may result in dizziness, headaches, and drowsiness. Importantly, benzene is a known carcinogen. Chronic exposure, especially common in petroleum industry workers, can cause damage to bone marrow, leading to a decrease in red blood cells and other health issues such as:

- Leukemia [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#), [\[R\]](#)
- Lymph node cancer [\[R\]](#), [\[R\]](#)
- Lung cancer [\[R\]](#), [\[R\]](#)
- Breast cancer [\[R\]](#)
- Head and neck cancer [\[R\]](#)
- Colorectal cancer [\[R\]](#)

Benzene may contribute to these conditions by causing DNA damage [\[R\]](#), [\[R\]](#).

Genetics of Benzene Sensitivity

Some gene variants may affect benzene sensitivity by influencing benzene detoxification and DNA damage repair.

The [NQO1](#) gene encodes an enzyme called NAD(P)H quinone oxidoreductase 1. NQO1 is an important antioxidant enzyme involved in fighting oxidative stress, DNA damage, and benzene toxicity. The ‘A’ allele of [rs1800566](#) (NQO1*2) reduces enzyme activity and has been associated with **up to 7.6 times higher risk of benzene toxicity**, even from low-level exposure [\[R, R, R, R, R, R\]](#).

The [XRCC1](#) gene encodes a protein called X-ray repair cross-complementing protein 1 and involved in DNA repair. The ‘T’ allele of [rs25487](#) and the ‘A’ allele of [rs1799782](#) have been associated with chronic benzene poisoning, as well as with chromosome aberrations in people exposed to this chemical [\[R, R, R, R\]](#).

The [ERCC1](#) gene encodes another enzyme involved in DNA repair. The ‘A’ allele of [rs11615](#) has been associated with chronic benzene poisoning, especially in non-smokers, women, and those exposed for over 12 years [\[R\]](#).

The [EPHX1](#) gene encodes an enzyme that converts epoxides from the degradation of aromatic compounds to trans-dihydrodiols, which can be conjugated and excreted from the body. The major ‘T’ allele of [rs1051740](#) has been associated with chronic benzene poisoning, as well as with decreased telomere length and increased DNA damage in people exposed to this chemical [\[R, R, R\]](#).

The [GSTP1](#) gene codes for a [phase II](#) detox enzyme that helps eliminate toxins using the “master antioxidant” [glutathione](#). The ‘A’ allele of [rs1695](#) has been associated with chronic benzene poisoning, especially in people who drink alcohol [\[R\]](#).



Predisposed to typical benzene sensitivity based on 14 genetic variants we looked at

Your top variants that most likely impact your genetic predisposition:

GENE	SNP	GENOTYPE
GSTP1	rs1695	AA
EPHX1	rs1051740	TT
MPO	rs2333227	CC
ERCC1	rs11615	AA
CDKN2A	rs3731245	CC
CYP2D6	rs1065852	GG
NQO1	rs1800566	GG
XRCC1	rs25487	CC
XRCC1	rs1799782	GG
UGT1A6	rs6759892	TT
SYCE1	rs3813867	GG
MTG1	rs2031920	CC
TNF	rs1800629	GG
UGT1A6	rs1105879	AA

The number of "risk" variants in this table doesn't necessarily reflect your overall result.

The [MPO](#) gene encodes myeloperoxidase, an enzyme that produces toxic molecules that harm bacteria. However, these molecules also damage the body’s tissues. The minor ‘T’ allele of [rs2333227](#) has been associated with decreased odds of chromosome aberrations and bladder cancer in response to benzene exposure [[R](#), [R](#)].

The [CYP2D6](#) gene encodes one of the [cytochrome P450](#) monooxygenases (CYPs). This enzyme accounts for only 2-5 % of the liver CYPs but metabolizes 25% of all drugs. The ‘G’ allele of [rs1065852](#) has been linked to chronic benzene poisoning [[R](#), [R](#), [R](#), [R](#)].

Another cytochrome P450 monooxygenase, [CYP2E1](#), is involved in the detoxification of drugs, toxic chemicals, and environmental toxins. The ‘T’ allele of [rs2031920](#) and the ‘C’ allele of [rs3813867](#) have been associated with DNA damage and low white blood cell counts in people chronically exposed to benzene [[R](#), [R](#), [R](#)].

[CYP1A1](#) encodes another cytochrome enzyme. The ‘T’ allele of [rs4646903](#) has been associated with chronic benzene poisoning [[R](#)].

The low-activity [UGT1A6](#) variants ‘G’ at [rs6759892](#) and ‘C’ at [rs1105879](#) have been associated with chronic benzene poisoning [[R](#)].

The [CDKN2A](#) gene encodes several proteins, which includes p16(INK4a) and the p14(ARF) proteins. Both function as tumor suppressors and help regulate the cell cycle. The ‘CC’ genotype of [rs3731245](#) has been associated with chronic benzene poisoning [[R](#), [R](#)].

The [TNF](#) gene encodes a cytokine (TNF-alpha or cachexin) that plays a central role in the immune response and [inflammation](#). The ‘A’ allele of [rs1800629](#) is associated with 6-7 times higher levels of TNF-alpha and has been linked to chronic benzene poisoning [[R](#)].

Your Recommendations

Your recommendations are prioritized according to the likelihood of it having an impact for you based on your genetics, along with the amount of scientific evidence supporting the recommendation.

You’ll likely find common healthy recommendations at the top of the list because they are often the most impactful and most researched.

- 1

Avoid Exposure To Organic Solvents
- 2

Avoid Exposure To Toxic Chemicals
- 3

Avoid Exposure to Heavy Metals
- 4

Avoid Lead Exposure
- 5

Avoid Cadmium Exposure
- 6

Avoid PCBs

1



Avoid Exposure To Organic Solvents

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Ensure to work in well-ventilated areas and wear protective gear when handling products like paints, varnishes, and adhesives. When possible, choose solvent-free or water-based products to minimize exposure. Regularly check labels for any solvents listed and strive to limit their use in both personal and professional settings.

Description

Avoiding exposure to organic solvents, commonly found in paints, adhesives, and cleaning products, can protect against the potential health risks associated with inhalation or skin contact, such as respiratory issues and skin irritation.

Organic solvents are used in various industries and workplaces for tasks like cleaning, painting, and manufacturing.

However, their use can be hazardous to workers' health. Exposure to these solvents can lead to problems such as breathing difficulties, skin irritation, and reduced fertility [\[R\]](#).

How it helps

Avoiding organic solvents mitigates the risk of respiratory complications and skin irritation in individuals sensitive to benzene, as it reduces exposure to harmful chemicals that can exacerbate symptoms and promote overall respiratory health.

2



Avoid Exposure To Toxic Chemicals

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

To implement this recommendation, avoid using plastic containers for heating food in microwaves, choose personal care products that are free from parabens and phthalates, and use natural cleaning products whenever possible. When handling or being near chemicals such as pesticides or heavy-duty cleaners, wear protective gear such as gloves and masks. Try to reduce the use of products with strong chemical scents or aerosols. Aim to make these changes as a permanent part of your lifestyle to minimize toxic chemical exposure.

Description

Avoiding exposure to toxic chemicals, whether in household products or environmental contaminants, is crucial to prevent potential health issues, including respiratory problems, neurological effects, and long-term health risks.

Toxic chemicals are found everywhere. Short- and long-term exposure to them can be harmful to your health [\[R\]](#), [\[R\]](#), [\[R\]](#).

Short-term exposure may cause [\[R\]](#):

- Skin irritation
- Breathing problems
- Allergic reactions

Long-term exposure may contribute to [\[R\]](#), [\[R\]](#):

- Liver problems
- Reproductive issues
- Hearing loss
- Cancer

Examples of common toxic chemicals include [\[R\]](#), [\[R\]](#):

- Building materials (asbestos, formaldehyde)
- Heavy metals (lead, mercury, cadmium)
- Pesticides and herbicides (organochlorines)
- Industrial chemicals (nitriles, solvents, cleaners)

How it helps

Avoiding exposure to toxic chemicals minimizes the risk of exacerbating symptoms associated with benzene sensitivity, such as respiratory and neurological issues. This proactive measure helps maintain overall health and prevents long-term complications linked to chemical exposure.

3



Avoid Exposure to Heavy Metals

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

To avoid exposure to heavy metals, ensure you're not using cosmetic products with heavy metals, opt for organic foods to minimize pesticide exposure, and use filters for drinking water to remove possible contaminants. Check for lead-based paints in older homes and avoid cooking or storing food in uncoated metal containers. When possible, choose glass or BPA-free plastics instead.

Description

Heavy metals are elements naturally found in the environment. They are also used for agricultural, industrial, and medicinal purposes. Some can even be found in small amounts in your body [\[R, R\]](#).

Long-term exposure to high amounts of heavy metals can be harmful to your health [\[R, R\]](#).

Heavy metals that are most often linked to health problems include [\[R, R\]](#):

- Lead
- Cadmium
- Arsenic
- Chromium
- Mercury

How it helps

Avoiding exposure to heavy metals helps mitigate the overall toxic burden on the body, which can enhance resilience to environmental toxins like benzene. This proactive measure supports neurological health and reduces the risk of compounded organ damage from multiple harmful substances.

4



Avoid Lead Exposure

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

Prevent lead exposure by using cold water for drinking and cooking, regularly cleaning dust from windowsills and floors, and ensuring that your home's paint is not chipping if it was built before 1978. For occupations involving potential lead exposure, use protective gear and follow safety protocols. Test your home for lead if it's old or you're concerned about contamination.

Description

Lead is a heavy metal. It is naturally found in the environment in small amounts [\[R\]](#), [\[R\]](#).

Exposure to lead can cause it to build up in the body. A buildup of lead can contribute to oxidative stress and cell damage. This is called **lead poisoning** [\[R\]](#), [\[R\]](#).

Lead is no longer used in the manufacturing of some products like gasoline and paint. However, it can still be found in some pipes, batteries, and the wall paint of older homes [\[R\]](#), [\[R\]](#), [\[R\]](#).

How it helps

Avoiding lead exposure is essential for individuals with benzene sensitivity, as the toxic effects of lead can exacerbate overall health deterioration, thus compounding the risk of adverse effects. Furthermore, minimizing exposure to multiple toxic substances reduces the cumulative burden of toxicity on the body.

5



Avoid Cadmium Exposure

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

To avoid cadmium exposure, refrain from smoking or exposure to secondhand smoke, reduce consumption of foods high in cadmium like shellfish, liver, kidney meats, and certain leafy vegetables, and use ceramic or glass containers instead of plastic when microwaving food. Limit intake of cadmium-contaminated workplace air by using protective gear if you work in battery manufacturing, welding, or metal refining industries.

Description

Avoiding cadmium exposure is essential to prevent potential health risks associated with this heavy metal, such as kidney damage and increased cancer risk. Reducing exposure to cadmium-containing products and contaminated foods is crucial.

Heavy metals are elements naturally found in the environment. They are also used for agricultural, industrial, and medicinal purposes. Some can even be found in small amounts in your body [\[R\]](#), [\[R\]](#).

Long-term exposure to high amounts of heavy metals can be harmful to your health [\[R\]](#), [\[R\]](#).

Heavy metals that are most often linked to health problems include [\[R\]](#), [\[R\]](#):

- Lead
- Cadmium
- Arsenic
- Chromium
- Mercury

How it helps

Avoiding cadmium exposure helps minimize the cumulative toxin burden on the body, reducing the risk of additional stress on the immune and detoxification systems. This is particularly critical for individuals with benzene sensitivity, as heightened environmental toxicity can exacerbate symptoms and health risks.

6



Avoid PCBs

IMPACT

1 / 5

EVIDENCE

1 / 5

How to implement

To avoid PCBs (Polychlorinated Biphenyls), do not use old electrical equipment manufactured before 1977, avoid consuming fish from contaminated waters, especially larger species such as shark and swordfish which are higher in the food chain, and check for and properly dispose of any old fluorescent lighting fixtures that may contain PCBs. Pay attention to local advisories regarding the safety of locally caught fish and wildlife.

Description

PCBs are toxic chemicals that can cause cancer, reproductive problems, and developmental problems. Avoiding exposure to PCBs is important for protecting your health.

Polychlorinated biphenyls (PCBs) are man-made chemicals. They were used in the industry until their **ban in 1979**. PCBs are considered **persistent organic pollutants** (POPS) due to their slow degradation in the environment. They may also **accumulate** in the food chain and the human body [\[R, R\]](#).

We may be exposed to PCBs through contaminated [\[R, R\]](#):

- **Food** (e.g., fish, meat, rice)
- Soil
- Air

PCBs may have toxic effects on [\[R, R\]](#):

- Immunity
- Nervous system
- Reproductive system
- Hormone levels

They may also increase the risk of cancer and reduce lifespan [\[R, R\]](#).

How it helps

Avoiding polychlorinated biphenyls (PCBs) reduces the risk of toxic exposure that can exacerbate benzene sensitivity symptoms by minimizing the cumulative toxic burden on the body, thereby supporting overall health and reducing the potential for serious health complications.