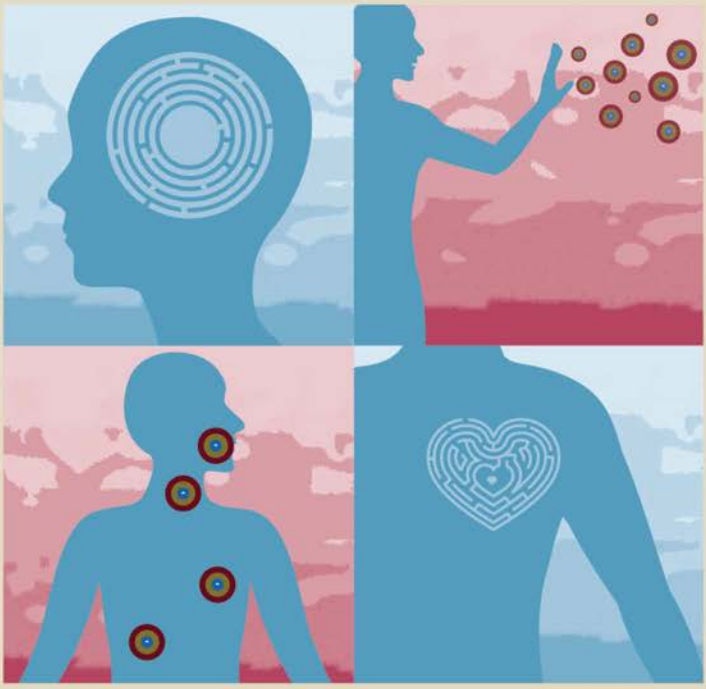

Beyond Hangovers

understanding **alcohol's impact** on your **health**

National Institute on Alcohol Abuse and Alcoholism

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Beyond hangovers

A brightly colored cosmopolitan is the drink of choice for the glamorous characters in *Sex and the City*. James Bond depends on his famous martini—shaken, not stirred—to unwind with after confounding a villain. And what wedding concludes without a champagne toast?

Alcohol is part of our culture—it helps us celebrate and socialize, and it enhances our religious ceremonies.

But drinking too much—on a single occasion or over time—can have serious consequences for our health.

Most Americans recognize that drinking too much can lead to accidents and dependence. But that's only part of the story. In addition to these serious problems, alcohol abuse can damage organs, weaken the immune system, and contribute to cancers.

Plus, much like smoking, alcohol affects different people differently. Genes, environment, and even diet can play a role in whether you develop an alcohol-related disease.

On the flip side, some people actually may benefit from drinking alcohol in small quantities.

Sound complicated? It sure can be.

To stay healthy, and to decide what role alcohol should play in your life, you need accurate, up-to-date information. This brochure is designed to offer you guidance based on the latest research on alcohol's effect on your health.

A LITTLE GOES A LONG WAY: KNOW THE AMOUNTS

Knowing how much alcohol constitutes a "standard" drink can help you determine how much you are drinking and understand the risks.

One standard drink contains about 0.6 fluid ounces or 14 grams of pure alcohol. In more familiar terms, the following amounts constitute one standard drink:

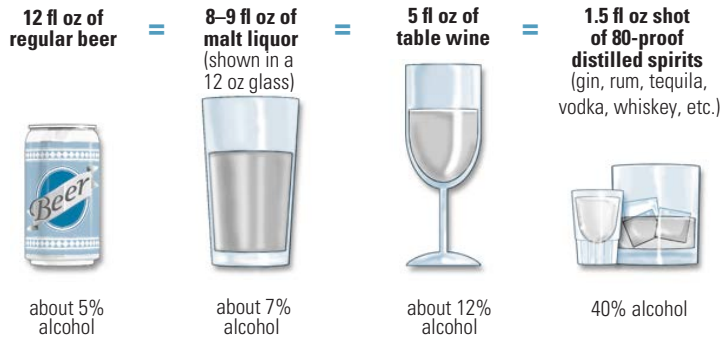
- 12 fluid ounces of beer (about 5% alcohol)
- 8 to 9 fluid ounces of malt liquor (about 7% alcohol)
- 5 fluid ounces of table wine (about 12% alcohol)
- 1.5 fluid ounces of 80-proof distilled spirits (40% alcohol)

Research demonstrates "low-risk" drinking levels for men are no more than 4 drinks on any single day AND no more than 14 drinks per week. For women, "low-risk" drinking levels are no more than three drinks on any single day AND no more than seven drinks per week. To stay low-risk, you must keep within both the single-day and weekly limits.

Even within these limits, you can have problems if you drink too quickly, have health conditions, or are over age 65. Older adults should have no more than three drinks on any day and no more than seven drinks per week.

Based on your health and how alcohol affects you, you may need to drink less or not at all. People who should abstain from alcohol completely include those who:

- Plan to drive a vehicle or operate machinery
- Are pregnant or trying to become pregnant
- Take medications that interact with alcohol
- Have a medical condition that alcohol can aggravate



Effects on the brain

You're chatting with friends at a party and a waitress comes around with glasses of champagne. You drink one, then another, maybe even a few more. Before you realize it, you are laughing more loudly than usual and swaying as you walk. By the end of the evening, you are too slow to move out of the way of a waiter with a dessert tray and have trouble speaking clearly. The next morning, you wake up feeling dizzy and your head hurts. You may have a hard time remembering everything you did the night before.

These reactions illustrate how quickly and dramatically alcohol affects the brain. The brain is an intricate maze of connections that keeps our physical and psychological processes running smoothly. Disruption of any of these connections can affect how the brain works. Alcohol also can have longer-lasting consequences for the brain—changing the way it looks and works and resulting in a range of problems.

Most people do not realize how extensively alcohol can affect the brain. But recognizing these potential consequences will help you make better decisions about what amount of alcohol is appropriate for you.

WHAT HAPPENS INSIDE THE BRAIN?

The brain's structure is complex. It includes multiple systems that interact to support all of your body's functions—from thinking to breathing and moving.

These multiple brain systems communicate with each other through about a trillion tiny nerve cells called

neurons. Neurons in the brain translate information into electrical and chemical signals the brain can understand. They also send messages from the brain to the rest of the body.

Chemicals called *neurotransmitters* carry messages between the neurons. Neurotransmitters can be very powerful. Depending on the type and the amount of neurotransmitter, these chemicals can either intensify or minimize your body's responses, your feelings, and your mood. The brain works to balance the neurotransmitters that speed things up with the ones that slow things down to keep your body operating at the right pace.

Alcohol can slow the pace of communication between neurotransmitters in the brain.

DISCOVERING THE BRAIN CHANGES

There still is much we do not understand about how the brain works and how alcohol affects it. Researchers are constantly discovering more about how alcohol interrupts communication pathways in the brain and changes brain structure, and the resulting effects on behavior and functioning. A variety of research methods broaden our understanding in different ways:

- BRAIN IMAGING – Various imaging tools, including structural magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI), diffusion tensor imaging (DTI), and positron emission tomography (PET), are used to create pictures of the brain. MRI and DTI create images of brain structure, or what the brain looks like. fMRI looks at brain function, or what the brain is doing. It can detect changes in brain activity. PET scans look at changes in neurotransmitter function. All of these imaging techniques are useful to track changes in the alcoholic brain. For example, they can show how an alcoholic brain changes immediately after drinking stops, and again after a long period of sobriety, to check for possible relapses.

- PSYCHOLOGICAL TESTS – Researchers also use psychological tests to evaluate how alcohol-related brain changes affect mental functioning. These tests demonstrate how alcohol affects emotions and personality, as well as how it compromises learning and memory skills.

- ANIMAL STUDIES – Testing the effect of alcohol on animals'

brains helps researchers better understand how alcohol injures the human brain, and how abstinence can reverse this damage.

DEFINING THE BRAIN CHANGES

Using brain imaging and psychological tests, researchers have identified the regions of the brain most vulnerable to alcohol's effects. These include:

- CEREBELLUM – This area controls motor coordination. Damage to the cerebellum results in a loss of balance and stumbling, and also may affect cognitive functions such as memory and emotional response.
- LIMBIC SYSTEM – This complex brain system monitors a variety of tasks including memory and emotion. Damage to this area impairs each of these functions.
- CEREBRAL CORTEX – Our abilities to think, plan, behave intelligently, and interact socially stem from this brain region. In addition, this area connects the brain to the rest of the nervous system. Changes and damage to this area impair the ability to solve problems, remember, and learn.

ALCOHOL SHRINKS AND DISTURBS BRAIN TISSUE

Heavy alcohol consumption—even on a single occasion—can throw the delicate balance of neurotransmitters off course. Alcohol can cause your neurotransmitters to relay information too slowly, so you feel extremely drowsy. Alcohol-related disruptions to the neurotransmitter balance also can trigger mood and behavioral changes, including depression, agitation, memory loss, and even seizures.

Long-term, heavy drinking causes alterations in the neurons, such as reductions in the size of brain cells. As a result of these and other changes, brain mass shrinks and the brain's inner cavity grows bigger. These changes may affect a wide range of abilities, including motor coordination; temperature regulation; sleep; mood; and various cognitive functions, including learning and memory.

One neurotransmitter particularly susceptible to even small amounts of alcohol is called *glutamate*. Among other things, glutamate affects memory. Researchers believe that alcohol interferes with glutamate action, and this may be what causes some people to temporarily "black out," or forget

much of what happened during a night of heavy drinking.

Alcohol also causes an increased release of *serotonin,* another neurotransmitter, which helps regulate emotional expression, and *endorphins,* which are natural substances that may spark feelings of relaxation and euphoria as intoxication sets in.

Researchers now understand that the brain tries to compensate for these disruptions. Neurotransmitters adapt to create balance in the brain despite the presence of alcohol. But making these adaptations can have negative results, including building alcohol tolerance, developing alcohol dependence, and experiencing alcohol withdrawal symptoms.

WHAT FACTORS MAKE A DIFFERENCE?

Different people react differently to alcohol. That is because a variety of factors can influence your brain's response to alcohol. These factors include:

- HOW MUCH AND HOW OFTEN YOU DRINK – The more you drink, the more vulnerable your brain is.
- YOUR GENETIC BACKGROUND AND FAMILY HISTORY OF ALCOHOLISM – Certain ethnic populations can have stronger reactions to alcohol, and children of alcoholics are more likely to become alcoholics themselves.
- YOUR PHYSICAL HEALTH – If you have liver or nutrition problems, the effects of alcohol will take longer to wear off.

ARE BRAIN PROBLEMS REVERSIBLE?

Abstaining from alcohol over several months to a year may allow structural brain changes to partially correct. Abstinence also can help reverse negative effects on thinking skills, including problem-solving, memory, and attention.

OTHER ALCOHOL-RELATED BRAIN CONDITIONS

LIVER DAMAGE THAT AFFECTS THE BRAIN

Not only does alcoholic liver disease affect liver function itself, it also damages the brain. The liver breaks down alcohol—and the toxins it releases. During this process, alcohol's byproducts damage liver cells. These damaged liver cells no longer function as well as they should and allow too much of these toxic substances, ammonia and manganese in particular,

to travel to the brain. These substances proceed to damage brain cells, causing a serious and potentially fatal brain disorder known as *hepatic encephalopathy*.

Hepatic encephalopathy causes a range of problems, from less severe to fatal. These problems can include:

- Sleep disturbances
- Mood and personality changes
- Anxiety
- Depression
- Shortened attention span
- Coordination problems, including asterixis, which results in hand shaking or flapping
- Coma
- Death

Doctors can help treat hepatic encephalopathy with compounds that lower blood ammonia concentrations and with devices that help remove harmful toxins from the blood. In some cases, people suffering from hepatic encephalopathy require a liver transplant, which generally helps improve brain function.

FETAL ALCOHOL SPECTRUM DISORDERS

Alcohol can affect the brain at any stage of development—even before birth. Fetal alcohol spectrum disorders are the full range of physical, learning, and behavioral problems, and other birth defects that result from prenatal alcohol exposure. The most serious of these disorders, *fetal alcohol syndrome* (FAS), is characterized by abnormal facial features and is usually associated with severe reductions in brain function and overall growth. FAS is the leading preventable birth defect associated with mental and behavioral impairment in the United States today.

The brains of children with FAS are smaller than normal and contain fewer cells, including neurons. These deficiencies result in life-long learning and behavioral problems. Current research is investigating whether the brain function of children and adults with FAS can be improved with complex rehabilitative training, dietary supplements, or medications.

Effects on the heart

Americans know how prevalent heart disease is—about 1 in 12 of us suffer from it. What we don't always recognize are the connections heart disease shares with alcohol. On the one hand, researchers have known for centuries that excessive alcohol consumption can damage the heart. Drinking a lot over a long period of time or drinking too much on a single occasion can put your heart—and your life—at risk. On the other hand, researchers now understand that drinking moderate amounts of alcohol can protect the hearts of some people from the risks of coronary artery disease.

Deciding how much, if any, alcohol is right for you can be complicated. To make the best decision for yourself, you need to know the facts and then consult your physician.

KNOW THE FUNCTION:

Your cardiovascular system consists of your heart, blood vessels, and blood. This system works constantly—every second of your life—delivering oxygen and nutrients to your cells, and carrying away carbon dioxide and other unnecessary material.

Your heart drives this process. It is a muscle that contracts and relaxes over and over again, moving the blood along the necessary path. Your heart beats about 100,000 times each day, pumping the equivalent of 2,000 gallons of blood throughout your body.

The two sides, or chambers, of the heart receive blood and pump it back into the body. The right ventricle of the heart pumps blood into the lungs to exchange carbon dioxide from the

cells for oxygen. The heart relaxes to allow this blood back into its left chamber. It then pumps the oxygen-rich blood to tissues and organs. Blood passing through the kidneys allows the body to get rid of waste products. Electrical signals keep the heart pumping continuously and at the appropriate rate to propel this routine.

KNOW THE RISKS:

ALCOHOLIC CARDIOMYOPATHY

Long-term heavy drinking weakens the heart muscle, causing a condition called *alcoholic cardiomyopathy*. A weakened heart droops and stretches and cannot contract effectively. As a result, it cannot pump enough blood to sufficiently nourish the organs. In some cases, this blood flow shortage causes severe damage to organs and tissues. Symptoms of cardiomyopathy include shortness of breath and other breathing difficulties, fatigue, swollen legs and feet, and irregular heartbeat. It can even lead to heart failure.

ARRHYTHMIAS

Both binge drinking and long-term drinking can affect how quickly a heart beats. The heart depends on an internal pacemaker system to keep it pumping consistently and at the right speed. Alcohol disturbs this pacemaker system and causes the heart to beat too rapidly, or irregularly. These heart rate abnormalities are called *arrhythmias*. Two types of alcohol-induced arrhythmias are:

- ATRIAL FIBRILLATION – In this form of arrhythmia, the heart's upper, or atrial, chambers shudder weakly but do not contract. Blood can collect and even clot in these upper chambers. If a blood clot travels from the heart to the brain, a stroke can occur; if it travels to other organs such as the lungs, an embolism, or blood vessel blockage, occurs.

- VENTRICULAR TACHYCARDIA – This form of arrhythmia occurs in the heart's lower, or ventricular, chambers. Electrical signals travel throughout the heart's muscles, triggering contractions that keep blood flowing at the right pace. Alcohol-induced damage to heart muscle cells can cause these electrical impulses to circle through the ventricle too many times, causing too many contractions. The heart beats too quickly, and so does not fill up with enough blood between each beat. As a result, the rest of the body does

not get enough blood. Ventricular tachycardia causes dizziness, lightheadedness, unconsciousness, cardiac arrest, and even sudden death.

Drinking to excess on a particular occasion, especially when you generally don't drink, can trigger either of these irregularities. In these cases, the problem is nicknamed "holiday heart syndrome," because people who don't usually drink may consume too much alcohol at parties during the holiday season.

Over the long-term, chronic drinking changes the course of electrical impulses that drive the heart's beating, which creates arrhythmia.

STROKES

A stroke occurs when blood cannot reach the brain. In about 80 percent of strokes, a blood clot prevents blood flow to the brain. These are called *ischemic strokes*. Sometimes, blood accumulates in the brain, or in the spaces surrounding it. This causes *hemorrhagic strokes*.

Both binge drinking and long-term heavy drinking can lead to strokes even in people without coronary heart disease. Recent studies show that people who binge drink are about 56 percent more likely than people who never binge drink to suffer an ischemic stroke over 10 years. Binge drinkers also are about 39 percent more likely to suffer any type of stroke than people who never binge drink.

In addition, alcohol exacerbates the problems that often lead to strokes, including hypertension, arrhythmias, and cardiomyopathy.

HYPERTENSION

Chronic alcohol use, as well as binge drinking, can cause high blood pressure, or *hypertension*. Your blood pressure is a measurement of the pressure your heart creates as it beats, and the pressure inside your veins and arteries. Healthy blood vessels stretch like elastic as the heart pumps blood through them. Hypertension develops when the blood vessels stiffen, making them less flexible. Heavy alcohol consumption triggers the release of certain stress hormones that in turn constrict blood vessels. This elevates blood pressure. In addition, alcohol may affect the function of the muscles within the blood vessels, causing them to constrict and elevate blood pressure.

KNOW THE BENEFITS:

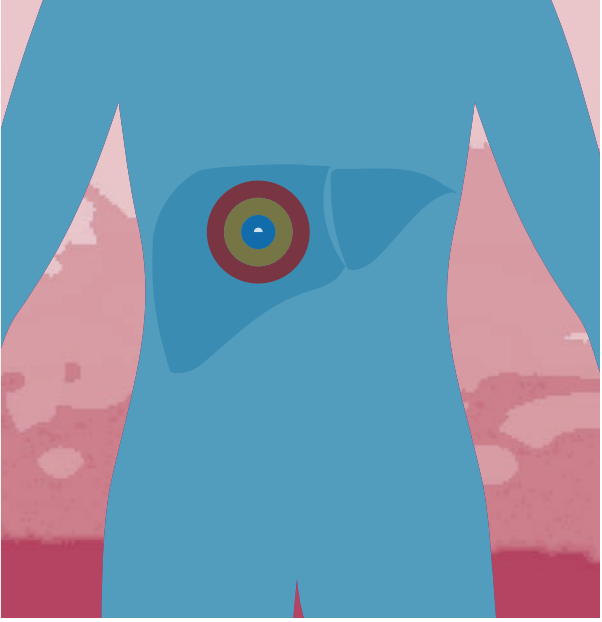
Research shows that healthy people who drink moderate amounts of alcohol may have a lower risk of

developing coronary heart disease than nondrinkers. Moderate drinking is usually defined as no more than two drinks in a given day for men and one drink per day for women who are not pregnant or trying to conceive.

A variety of factors, including diet, genetics, high blood pressure, and age, can cause fat to build up in your arteries, resulting in coronary heart disease. An excess of fat narrows the coronary arteries, which are the blood vessels that supply blood directly to the heart. Clogged arteries reduce blood supply to the heart muscle, and make it easier for blood clots to form. Blood clots can lead to both heart attacks and strokes.

According to recent studies, drinking moderately can protect your heart from these conditions. Moderate drinking helps inhibit and reduce the build-up of fat in the arteries. It can raise the levels of HDL—or "good" cholesterol—in the blood, which wards off heart disease. It can help guard against heart attack and stroke by preventing blood clots from forming and by dissolving blood clots that do develop. Drinking moderately also may help keep blood pressure levels in check.

These benefits may not apply to people with existing medical conditions, or who regularly take certain medications. In addition, researchers discourage people from beginning to drink just for the health benefits. Rather, you can use this research to help you spark a conversation with your medical professional about the best path for you.



Effects on the liver

KNOW THE FACTS:

Liver disease is one of the leading causes of illness and death in the United States. More than 2 million Americans suffer from liver disease caused by alcohol.

In general, liver disease strikes people who drink heavily over many years.

While many of us recognize that excessive alcohol consumption can lead to liver disease, we might not know why. Understanding the connections between alcohol and the liver can help you make smarter decisions about drinking and take better control of your health.

KNOW THE FUNCTION:

Your liver works hard to keep your body productive and healthy. It stores energy and nutrients. It generates proteins and enzymes your body uses to function and ward off disease. It also rids your body of substances that can be dangerous—including alcohol.

The liver breaks down most of the alcohol a person consumes. But the process of breaking alcohol down generates toxins even more harmful than alcohol itself. These by-products damage liver cells, promote inflammation, and weaken the body's natural defenses. Eventually, these problems can disrupt the body's metabolism and impair the function of other organs.

Because the liver plays such a vital role in alcohol detoxification, it is especially vulnerable to damage from excessive alcohol.

KNOW THE CONSEQUENCES:

Heavy drinking—even for just a few days at a time—can cause fat to build up in the liver. This condition, called *steatosis,* or fatty liver, is the earliest stage of alcoholic liver disease and the most common alcohol-induced liver disorder. The excessive fat makes it more difficult for the liver to operate and leaves it open to developing dangerous inflammations, like *alcoholic hepatitis*.

For some, alcoholic hepatitis does not present obvious symptoms. For others, though, alcoholic hepatitis can cause fever, nausea, appetite loss, abdominal pain, and even mental confusion. As it increases in severity, *alcoholic hepatitis* dangerously enlarges the liver, and causes jaundice, excessive bleeding, and clotting difficulties.

Another liver condition associated with heavy drinking is *fibrosis,* which causes scar tissue to build up in the liver. Alcohol alters the chemicals in the liver needed to break down and remove this scar tissue. As a result, liver function suffers.

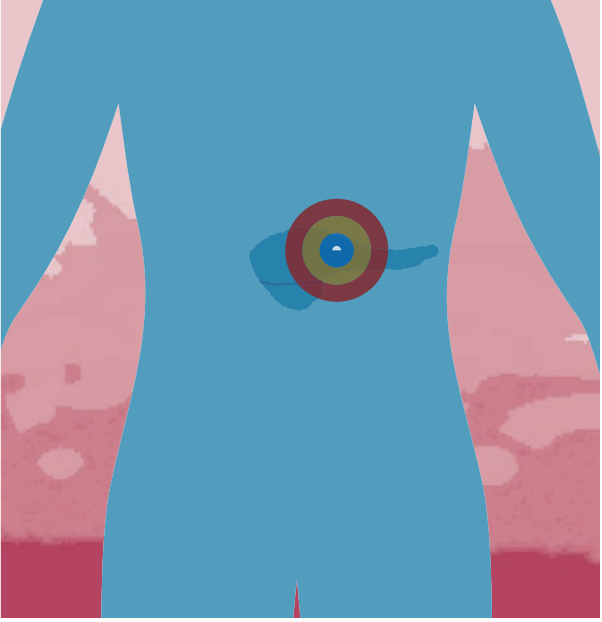
If you continue to drink, this excessive scar tissue builds up and creates a condition called *cirrhosis,* which is a slow deterioration of the liver. Cirrhosis prevents the liver from performing critical functions, including managing infections, removing harmful substances from the blood, and absorbing nutrients.

A variety of complications, including jaundice, insulin resistance and type 2 diabetes, and even liver cancer, can result as cirrhosis weakens liver function.

Risk factors ranging from genetics and gender, to alcohol accessibility, social customs around drinking, and even diet can affect a person's individual susceptibility to alcoholic liver disease. Statistics show that about one in five heavy drinkers will develop alcoholic hepatitis, while one in four will develop cirrhosis.

KNOW THERE'S A BRIGHT SIDE:

The good news is that a variety of lifestyle changes can help treat alcoholic liver disease. The most critical lifestyle change is abstinence from alcohol. Quitting drinking will help prevent further injury to your liver. Cigarette smoking, obesity, and poor nutrition all contribute to alcoholic liver disease. It is important to stop smoking and improve your eating habits to keep liver disease in check. But when conditions like cirrhosis become severe, a liver transplant may be the primary treatment option.



Effects on the pancreas

KNOW THE FACTS:

Each year, acute pancreatitis sends more than 200,000 Americans to the hospital. Many of those who suffer from pancreatic problems are also heavy drinkers. Habitual and excessive drinking damages the pancreas, and commonly causes pancreatitis.

Learning more about the links between alcohol and pancreatic problems can help you make better decisions to protect your health.

KNOW THE FUNCTION:

The pancreas plays an important role in food digestion and its conversion into fuel to power your body. It sends enzymes into the small intestine to digest carbohydrates, proteins, and fat. It also secretes insulin and glucagon, hormones that regulate the process of utilizing glucose, the body's main source of energy. Insulin and glucagon control glucose levels, which helps all cells use the energy glucose provides. Insulin also ensures that extra glucose gets stored away as either glycogen or fat.

When you drink, alcohol damages pancreatic cells and influences metabolic processes involving insulin. This process leaves the pancreas open to dangerous inflammations.

KNOW THE RISKS:

A pancreas unaffected by alcohol sends enzymes out to the small intestine to metabolize food. Alcohol jumbles this process. It causes the pancreas to secrete its digestive juices internally, rather than sending the enzymes to the small intestine.

These enzymes, as well as *acetaldehyde*—a substance produced from metabolizing, or breaking down the alcohol—are harmful to the pancreas. If you consume alcohol excessively over a long time, this continued process can cause inflammation, as well as swelling of tissues and blood vessels.

This inflammation is called *pancreatitis,* and it prevents the pancreas from working properly. Pancreatitis occurs as a sudden attack, called *acute pancreatitis*. As excessive drinking continues, the inflammation can become constant. This condition is known as *chronic pancreatitis*.

Pancreatitis is also a risk factor for the development of pancreatic cancer.

A heavy drinker may not be able to detect the build-up of pancreatic damage until the problems set off an attack.

An acute pancreatic attack causes symptoms including:

- Abdominal pain, which may radiate up the back
- Nausea and vomiting
- Fever
- Rapid heart rate
- Diarrhea
- Sweating

Chronic pancreatitis causes these symptoms as well as severe abdominal pain, significant reduction in pancreatic function and digestion, and blood sugar problems. Chronic pancreatitis can slowly destroy the pancreas and lead to diabetes or even death.

While a single drinking binge will not automatically lead to pancreatitis, the risk of developing the disease increases as excessive drinking continues over time.

These risks apply to all heavy drinkers, but only about 5 percent of people with alcohol dependence develop pancreatitis. Some people are more susceptible to the disease than others, but researchers have not yet identified exactly what environmental and genetic factors play the biggest role.

TREATMENT HELPS—BUT DOES NOT CURE

Abstinence from alcohol can slow the progression of pancreatitis and reduce its painful symptoms. A low-fat diet also may help. It is also critical to guard against infections and to get supportive treatment. Treatment options, including enzyme-replacement therapy or insulin, can improve pancreatic function. In some cases, surgery is necessary to relieve pain, clear blockages, and reduce attacks.

The effects of alcoholic pancreatitis can be managed, but not easily reversed.

Cancer risks

KNOW THE RISKS:

Genetics, environment, and lifestyle habits can all heighten your risk of getting cancer. We can't do anything to change our genes, and we often can't do much to change our environment. But lifestyle habits are a different story.

Drinking too much alcohol is one lifestyle habit that can increase your risk of developing certain cancers. This does not mean that anyone who drinks too much will develop cancer. But numerous studies do show the more you drink, the more you increase your chances of developing certain types of cancer.

For example, a group of Italy-based scientists reviewed more than 200 studies examining alcohol's impact on cancer risk. The collective results of these studies clearly demonstrate that the more you drink, the higher your risk for developing a variety of cancers. The National Cancer Institute identifies alcohol as a risk factor for the following types of cancer:

- Mouth
- Esophagus
- Pharynx
- Larynx
- Liver
- Breast

At least 7 out of 10 people with mouth cancer drink heavily. Drinking five or more drinks per day can also increase your risk of developing other types of cancers, including colon or rectal cancer. In fact, summary estimates from the recent World Cancer Research Fund report indicate that women who drink five standard

alcohol drinks each day have about 1.2 times the risk of developing colon or rectal cancer than women who do not drink at all.

People who drink are also more likely to smoke, and the combination increases the risk significantly. Smoking alone is a known risk factor for some cancers. But smoking and drinking together intensifies the cancer-causing properties of each substance. The overall effect poses an even greater risk.

The risk of throat and mouth cancers is especially high because alcohol and tobacco both come in direct contact with those areas. Overall, people who drink and smoke are 15 times more likely to develop cancers of the mouth and throat than nondrinkers and nonsmokers. In addition, recent studies estimate that alcohol and tobacco together are responsible for:

- 80 percent of throat and mouth cancer in men
- 65 percent of throat and mouth cancer in women
- 80 percent of *esophageal squamous cell carcinoma*, a type of esophagus cancer
- 25 to 30 percent of all liver cancers

WOMEN AND CANCER

One recent, groundbreaking study followed the drinking habits of 1.2 million middle-aged women over 7 years. The study found that alcohol increases women's chances of developing cancers of the breast, mouth, throat, rectum, liver, and esophagus. The researchers link alcohol to about 13 percent of these cancer cases.

In addition, the study concluded that cancer risk increases no matter how little or what kind of alcohol a woman drinks. Even one drink a day can raise risk, and it continues to rise with each additional drink. While men did not participate in this study, the researchers believe this risk is likely similar for men.

This study also attributes about 11 percent of all breast cancer cases to alcohol. That means that of the 250,000 breast cancer cases diagnosed in the United States in 2008, about 27,000 may stem from alcohol.

KNOW THE REASONS:

Scientists are still trying to figure out exactly how and why alcohol can promote cancer. There are a variety of possible explanations.

One explanation is that alcohol itself is not the primary trigger for cancer. We know that metabolizing, or breaking down, alcohol results in harmful toxins in the body. One of these toxins is called acetylaldehyde.

Acetylaldehyde damages the genetic material in cells—and renders the cells incapable of repairing the damage. It also causes cells to grow too quickly, which makes conditions ripe for genetic changes and mistakes. Cancer can develop more easily in cells with damaged genetic material.

In addition, recent animal studies have shown that as cells try to break down alcohol, they cause the body to produce additional amounts of a protein called *vascular endothelial growth factor* (VEGF). VEGF promotes the growth of blood vessels and organ tissue. But, the flip side of having too much VEGF is that it allows blood vessels to grow in cancer cells that would die on their own. This allows the cancer cells to develop into tumors.

We also know that alcohol can damage the liver, causing *cirrhosis*. Cirrhosis results when too much scar tissue builds up within the liver and leaves it unable to perform its vital functions. One of the many complications that can result from cirrhosis is liver cancer.

Hormones may be the link between alcohol and breast cancer. Alcohol can increase the amounts of some hormones in the body, including estrogen. An excess of estrogen may lead to breast cancer.

Finally, genetics may play a role in preventing some heavy drinkers from developing cancer. A European research team examined 9,000 people with similar lifestyle habits to determine why some of them developed mouth and throat cancers, and some did not. Of the participants who were heavy drinkers, those who did not develop cancers had a particular genetic alteration that enabled them to break down alcohol about 100 times faster than in those without it. The study suggested that this gene is the reason why some people are less likely to develop cancer in response to heavy drinking.

KNOW THERE'S A BRIGHT SIDE:

Fortunately, studies show that you can reduce your risk for cancer by drinking less. A recent Canadian report analyzed studies from 1966 through 2006 and concluded that risk reduction is possible, specifically for head and neck cancers. The study found that as people abstained from drinking, their risk for developing cancer plunged. After 20 years of abstinence, former drinkers had the same risk for head and neck cancers as people who never drank.

Effects on the immune system

Germs and bacteria surround us everywhere. Luckily, our immune system is designed to protect our bodies from the scores of foreign substances that can make us sick. Drinking too much alcohol weakens the immune system, making your body a much easier target for disease.

Understanding the effect alcohol can have on your immune system can inform the decisions you make about drinking alcohol.

KNOW THE FACTS:

Your immune system is often compared to an army. This army defends your body from infection and disease. Your skin and the mucous that lines your respiratory and gastrointestinal tracts help block bacteria from entering or staying in your body. If foreign substances somehow make it through these barriers, your immune system kicks into gear with two defensive systems: innate and adaptive.

The *innate system* exists in your body before you are exposed to foreign substances like bacteria, viruses, fungi, or parasites. These substances, which are called *antigens*, can invade your body and make you sick. The components of the innate system include:

- WHITE BLOOD CELLS – White blood cells form your first line of defense against infection. They surround and swallow foreign bodies quickly.

- NATURAL KILLER (NK) CELLS – Natural Killers are special white

blood cells that detect and destroy cells infected with cancer or viruses.

- CYTOKINES – White blood cells send out these chemical messengers directly to an infected site. Cytokines trigger inflammatory responses, like dilating blood vessels and increasing blood flow to the affected area. They also call on more white blood cells to swarm an infected area.

The *adaptive system* kicks in after you are exposed to an infection for the first time. The next time you encounter the same infection, your adaptive system fights it off even faster and more efficiently than the first time. The components of the adaptive system include:

- T-LYMPHOCYTE CELLS – T-cells reinforce the work of white blood cells by targeting individual foreign substances. T-cells can identify and destroy a vast array of bacteria and viruses. They can also kill infected cells and secrete cytokines.

- B-LYMPHOCYTE CELLS – B-cells produce antibodies that fight off harmful substances by sticking to them and making them stand out to other immune cells.

- ANTIBODIES – After B-cells encounter antigens, they produce antibodies. These are proteins that target specific antigens and then remember how to combat the antigen.

KNOW THE RISKS:

Alcohol suppresses both the innate and the adaptive immune systems. Chronic alcohol use reduces the ability of white blood cells to effectively engulf and swallow harmful bacteria. Excessive drinking also disrupts the production of cytokines, causing your body to either produce too much or not enough of these chemical messengers. An abundance of cytokines can damage your tissues, whereas a lack of cytokines leaves you open to infection.

Chronic alcohol use also suppresses the development of T-cells and may impair the ability of NK cells to attack tumor cells. This reduced function makes you more vulnerable to bacteria and viruses, and less capable of destroying cancerous cells.

With a compromised immune system, chronic drinkers are more liable to contract diseases like pneumonia and tuberculosis than people who do not drink too much. There is also data linking alcohol's damage to the immune system with an increased

susceptibility to contracting HIV infection. HIV develops faster in chronic drinkers who already have the virus.

Drinking a lot on a single occasion also can compromise your immune system. Drinking to intoxication can slow your body's ability to produce cytokines that ward off infections by causing inflammations. Without these inflammatory responses, your body's ability to defend itself against bacteria is significantly reduced. A recent study shows that slower inflammatory cytokine production can reduce your ability to fight off infections for up to 24 hours after getting drunk.

STILL LOOKING FOR THE BRIGHT SIDE

At this point, scientists do not know whether abstinence, reduced drinking, or other measures will help reverse the effects of alcohol on the immune system.

Nevertheless, it is important to keep in mind that avoiding drinking helps minimize the burden on your immune system, particularly if you are fighting a viral or bacterial infection.

Additional resources

MEDICAL AND HEALTH INFORMATION

Brain:

National Institute of Mental Health
www.nimh.nih.gov
866–615–6464

National Institute of Neurological Disorders and Stroke
www.ninds.nih.gov
800–352–9424

Heart:

National Heart, Lung, and Blood Institute
www.nhlbi.nih.gov
301–592–8573

Liver and Pancreas:

National Institute of Diabetes and Digestive Diseases
www.niddk.nih.gov
301–496–3583

Cancer:

National Cancer Institute
www.cancer.gov
800–422–6237

Immune System:

National Institute of Allergies and Infectious Diseases
www.niaid.nih.gov
866–284–4107

ALCOHOL AND ITS HEALTH EFFECTS

National Institute on Alcohol Abuse and Alcoholism
www.niaaa.nih.gov
301–443–3860

National Clearinghouse for Alcohol and Drug Information
www.ncadi.samhsa.gov
800–729–6686

SUPPORT FOR REDUCING OR QUITTING DRINKING

Rethinking Drinking
www.RethinkingDrinking.niaaa.nih.gov

Additional reading

***Rethinking Drinking*—**offers research-based information about risky drinking patterns, how to recognize the signs of an alcohol problem, and strategies for cutting back or quitting drinking. Available as a publication or interactive Web site www.rethinkingdrinking.niaaa. nih.gov.

***Harmful Interactions: Mixing Alcohol With Medicines*—** provides information on medications and herbal preparations that may cause harm when combined with alcohol.

***A Family History of Alcoholism: Are You at Risk?*—**describes how heredity may increase the risk for developing problems with alcohol and how to limit that risk.

***Alcohol: A Women's Health Issue*—** provides information on the effects of alcohol on women's health throughout the lifespan, including the risks and benefits of drinking.

***Older Adults and Alcohol: You Can Get Help*—**describes how alcohol affects the health of older drinkers and offers tips for stopping or reducing drinking.

***Drinking and Your Pregnancy*—**explains how drinking can hurt a developing baby, the problems that children born with fetal alcohol syndrome have, how to stop drinking, and where to go for help.

***Make a Difference: Talk to Your Child About Alcohol*—** offers guidance to parents and caregivers of young people ages 10 to 14 on preventing underage drinking.

To order, write to: National Institute on Alcohol Abuse and Alcoholism, Publications Distribution Center, P.O. Box 10686, Rockville, MD 20849-0686. The full text of all of the above publications is available on NIAAA's Web site (www.niaaa.nih.gov).

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