Alcohol - How much is too much?

Leaflet prepared by Dr Eleanor Ivory FRCSEd

The importance of not drinking alcohol in proximity to duty is well known amongst the pilot population. However there is also a much wider issue relating to the use of alcohol in terms of overall risk to health. Long term health risks impact on flight safety. This article aims to expand and explain those risks, to make some recommendations and hopefully provide "food for thought". Contrary to popular belief, most people with severe alcohol induced liver disease are NOT alcoholics, rather they are habitual heavy social drinkers. The alcohol related death rate in the UK increased from 6.9 per 100,000 population in 1991 to 13.0 in 2004. The number has more than doubled from 4144 in 1991 to 8380 in 2004. (Data from the UK Office for National Statistics.) The largest increase in death rate is in men in the age range 35 – 54 where the rate has doubled from 1991 – 2005. The pattern of drinking may be as important as the overall amount consumed. The increasing prevalence of "binge drinking," if a regular occurrence, is especially hazardous. The World Health Organization's Global Burden on Disease Study found that alcohol is the third most important risk factor, after smoking and raised blood pressure for European ill health and premature death. (Ref.4) This puts alcohol as a factor ahead of cholesterol levels and obesity. Most people underestimate their alcohol intake and are not aware of the possible consequences of habitual drinking significantly above the recommended safe levels.

Why is alcohol harmful ? " The Science Bit "

Alcohol is a global cellular toxin. Certain tissues are particularly vulnerable to the effects of alcohol both acutely and in the long term. In particular alcohol is a neuro-toxin. It affects the brain, spinal cord and peripheral nerves. The alcohol found in alcoholic drinks is ethyl alcohol (ethanol) C_2H_5OH diag. Alcoholic drinks do not contain pure alcohol as this would be rapidly toxic. Ethanol concentrations are usually given as % weight / volume. Recommended daily alcohol limits are given in terms of UNITS of alcohol. A UNIT of alcohol is 10mls. 10 mls of ethanol contains 8 g pure ethyl alcohol.

Contrary to popular belief, most people with severe alcohol induced liver disease are NOT alcoholics, rather they are habitual heavy social drinkers.

> *Current UK NHS and Government Advice on drinking recommends a maximum limit of 3-4 units of alcohol a day for men, 2-3 units a day for women. There should be at least 2 drink free days a week. If you do have a heavy drinking session allow a 48hour drink free recovery period.*

To calculate the number of UNITS of alcohol in a drink simply multiply the % w/v x volume (in litres)

- one pint (0.54L) average beer (3.5%) = 0.54 x 3.5 = 1.89 units

- a large glass (250mls 0.25L) of wine (12%) contains 0.25 x 12 = 3 units

- a standard pub measure gin 35mls (0.035L) at 40% contains 0.035x40 = 1.4 units

One important point to note is that the alcohol content of drinks varies markedly these days. So the often quoted: a pint beer = 2 units, a glass of wine = 1 unit a shot of spirits = 1 unit *may be misleading*. Beers may vary in strength between 2% and 9%, Wines from 8% - 18%, Spirits from 24%- 90%

Gender differences

Women tolerate excess alcohol significantly less well than men. This is well known and is reflected in the reduced limit in the recommendations above. There are a number of reasons for this. Women have a greater proportion of body fat than men. As alcohol is distributed in the non fatty tissue, the cellular concentration of alcohol for a given dose will be greater for a women than a man even if they are of the same body weight. The toxic potential both acutely and in the longer term is therefore greater in women. Women also have reduced levels of the key liver enzymes necessary to metabolise alcohol *(see below – alcohol metabolism)*.

Alcohol Metabolism – What happens when we drink?

Alcohol enters the stomach where 10-20% of the alcohol is absorbed. The rest enters the small intestine where the remaining 80-90% is rapidly absorbed into the blood. Blood from the intestines and stomach passes directly to the liver for processing. As alcohol is essentially a toxin, removing it from the blood is a priority for the liver over a number of its other functions such as maintaining blood sugar levels – gluconeogenesis, protein manufacture and reduction of blood lipids. 90% of alcohol metabolism takes place in the liver; the rest is excreted unchanged by the urine, breath, sweat and saliva.

Liver metabolism.
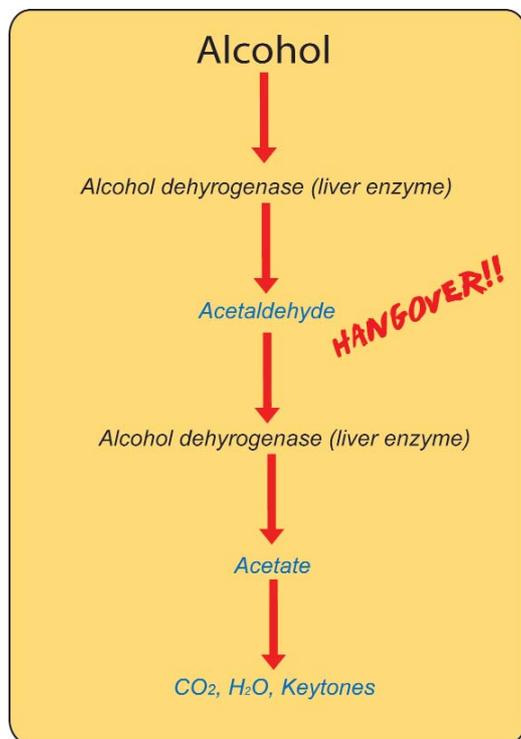
Alcohol is first broken down to *Acetaldehyde* by the liver enzyme alcohol dehydrogenase. Enzymes are proteins that act as catalysts for chemical reactions in the body. *Acetaldehyde* is a relatively toxic substance and is the intermediate metabolic product of alcohol break down. It needs to be broken down further. However the next step is rate limiting, as it requires both another enzyme – *acetaldehyde dehydrogenase*, and another substance called *Glutathione*. The liver's stores of *Glutathione* are limited. When larger amounts of alcohol enter the system the toxic *Acetaldehyde* levels build up in the blood while the liver makes more glutathione. *Acetaldehyde* is the chemical largely responsible for the symptoms of a hangover.

The drug *Antabuse* (disulfiram) which is used to stop alcoholics from drinking, blocks the action of acetaldehyde dehydrogenase allowing acetaldehyde to build up rapidly. This causes severe headaches and vomiting. Acetaldehyde is then broken down to ACETATE which is non toxic. This is then metabolised to carbon dioxide and water or used to form ketones. ketones are used for energy when glucose levels are low. They give a characteristic "sweet smell" to the breath often noted during a hangover.

Effects in the liver of excess alcohol metabolism

As stated above, the liver prioritises alcohol break down. The necessary enzymes increase in their levels over time giving a degree of tolerance to alcohol, but this alters the balance of other liver functions. As a consequence of enzyme induction other processes also increase. Formation of cholesterol is increased. Formation of harmful lipoproteins increases. (LDLs low density lipoproteins.) Levels of *Triglycerides* also increase. All these are well known risk factors for heart disease. Acetaldehyde (the hangover toxin) also has a major role in directly damaging liver cells leading to scarring which ultimately causes liver cirrhosis.
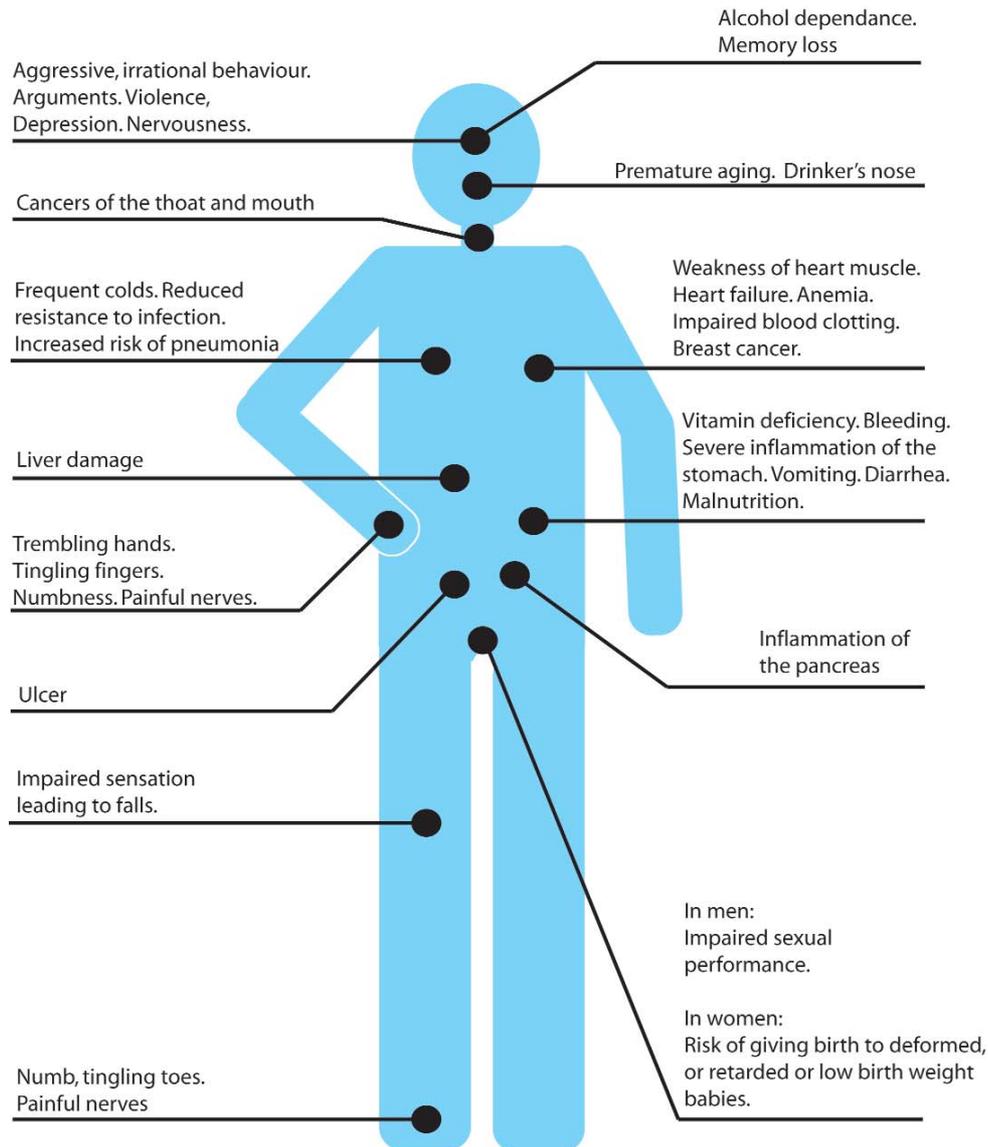
There are 3 forms of alcoholic liver disease.

- Fatty liver
- Alcoholic hepatitis
- Alcoholic cirrhosis

The important point is that the first two may be reversible. Fatty liver can be caused by a single heavy drinking session. Alcoholic hepatitis occurs in heavy drinkers, and can result in widespread destruction of the liver. It may be fatal, but it may also be reversible if drinking is reduced or ceases. Cirrhosis is not. This is permanent scarring leading to loss of function and ultimately liver failure.

The effect of alcohol on other systems of the body

The acute effects of alcohol are well known, but an awareness of the potential damage to the systems in the long term, even from moderate habitual drinking, are less well appreciated. Alcohol and its metabolic products may cause wide spread cellular damage

even at relatively low levels. The most vulnerable systems being the nervous system and the gastrointestinal system (including the liver and pancreas.)

Alcohol dependance.
Memory loss

Aggressive, irrational behaviour.
Arguments. Violence,
Depression. Nervousness.

Premature aging. Drinker's nose

Cancers of the thoat and mouth

Weakness of heart muscle.
Heart failure. Anemia.
Impaired blood clotting.
Breast cancer.

Frequent colds. Reduced
resistance to infection.
Increased risk of pneumonia

Vitamin deficiency. Bleeding.
Severe inflammation of the
stomach. Vomiting. Diarrhea.
Malnutrition.

Liver damage

Trembling hands.
Tingling fingers.
Numbness. Painful nerves.

Inflammation of
the pancreas

Ulcer

Impaired sensation
leading to falls.

In men:
Impaired sexual
performance.

In women:
Risk of giving birth to deformed,
or retarded or low birth weight
babies.

Numb, tingling toes.
Painful nerves

High risk drinking may lead to social, legal, medical, domestic, job and financial problems.
It may also reduce your lifespan and lead to injury or death through alcohol related accidents

Nervous system
► The brain, spinal cord and peripheral nervous system.
► Long term excessive alcohol can impair memory, and intellectual functions.
► Sleep is of reduced quality.
► Encephalopathy and psychosis - major cerebral conditions in chronic alcoholism.
► Increased risk of stroke and head injury
► Cerebellar degeneration leading to poor coordination and loss of balance.
► Tingling and loss of sensation in hands and feet.

Gastro-intestinal system
► As well as liver damage, increased acid reflux / heart burn, gastritis, gastric ulcers.
► Oesophageal (gullet) varices (abnormal blood vessels) with rupture and bleeding.
► Pancreatitis – inflammation of the pancreas causing severe pain and internal fluid loss. Chronic inflammation of the pancreas leading to diabetes and malabsorption of food.

Change in body shape
► Wasting of peripheral muscles and redistribution of body fat to the abdomen and trunk (Beer gut!)
► Alcohol is fattening! White wine has approximately the same calorific value of milk.
► One unit of alcohol is approximately 70 KCalories.

Hormonal changes
► Gynaecomastia - men may develop female breasts
► Reduced sexual function. Abnormal sperm count.

Heart Disease
► Increased risk as described above due to lipid / cholesterol increases.
► Direct cellular damage to the heart.
► Increased risk of high blood pressure.
► Abnormal heart rhythms.

Alcoholic bone disease.
► Chronic alcohol excess is an important cause of osteoporosis.

Cancers.
► Associated with increased risks of cancer of the mouth and throat.
► Increases the risk of breast cancer.
► Liver cancer.

Kidneys
► Increased risk of kidney stones.
► Gout due to impaired secretion of uric acid.

Skin
► Facial flushing.
► Premature aging. & "Drinkers nose."

Moderate alcohol consumption may confer some protection against coronary heart disease for some age groups.

Low level regular drinking – the good news
For men over 40 and post menopausal women, moderate alcohol consumption may confer some protection against coronary heart disease. Moderate alcohol consumption means 1 to 2 units a day.

Summary and Recommendations
Sustained drinking at levels over the recommended limits is hazardous to the long term health. This has implications for well being and flight safety. Death rates and illness due to alcohol related disease is dramatically increasing in the UK. Many people are unaware of the hazards of sustained heavy "social drinking" Many people underestimate the amount of alcohol they regularly drink. There is also a wealth of information and shared experience to be obtained to help and advise any one who has concerns about alcohol use. Blood tests of liver function, including cholesterol and triglycerides as well as simple questioning can help to identify problem drinking. A simple 4 part question test known as CAGE is one such.
The combination of CAGE questionnaire, MCV and GGT activity will detect about 75% of people with an alcohol problem. (MCV & GGT are blood tests used to detect excessive alcohol intake)

CAGE questionnaire - screen for alcohol misuse
Alcohol dependence is likely if the patient gives two or more positive answers to the following questions:

Have you ever felt you should **C**ut down on your drinking?

Have people **A**nnoyed you by criticising your drinking?

Have you ever felt bad or **G**uilty about your drinking?

Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (**E**ye-opener)?

However the main aim of this leaflet is to highlight the problems associated with *moderate* alcohol use. There is a lack of understanding of the dangers of moderate habitual drinking. Government statistics show a very worrying trend of ill health and deaths from alcohol related illness in the UK.

Education and self awareness of these issues will contribute to both health and flight safety. The WHO (World Health Organisation) has devised a well validated questionnaire known as AUDIT (Alcohol Use Disorders Identification Test) Ref 5. This is attached below along with the "Alcohol Pyramid". These are tools to assess an individuals level of alcohol use.

Go on take the test!

I·F·A·L·P·A
The Global Voice of Pilots

Medical
Briefing Leaflet

ALCOHOL USE DISORDERS IDENTIFICATION TEST

1. How often do you have a drink containing alcohol?
(0) Never (Skip to question 9 & 10)
(1) Monthly or less
(2) 2 to 4 times a month
(3) 2 to 3 times per week
(4) 4 or more times per week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?
(0) 1 or 2
(1) 3 or 4
(2) 4 or 5
(3) 7, 8, 9
(4) 10 or more

3. How often do you have six or more drinks on one occasion?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

Skip to questions 9 & 10 if your score total score from questions 2 and 3 is 0.

4. How often in the last year have you found that you were not able to stop drinking once you had started?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

5. How often in the last year have you failed to do what was expected of you because of drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

6. How often in the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

7. How often during the last year have you had a feeling of guilt or remorse after drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

8. How often in the last year have you been unable to remember what happened the night before because you had been drinking?
(0) Never
(1) Less than monthly
(2) Monthly
(3) Weekly
(4) Daily or almost daily

9. Have you or someone else been injured as the result of your drinking?
(0) No
(2) Yes, but not in the last year
(4) Yes, during the last year

10. Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down?
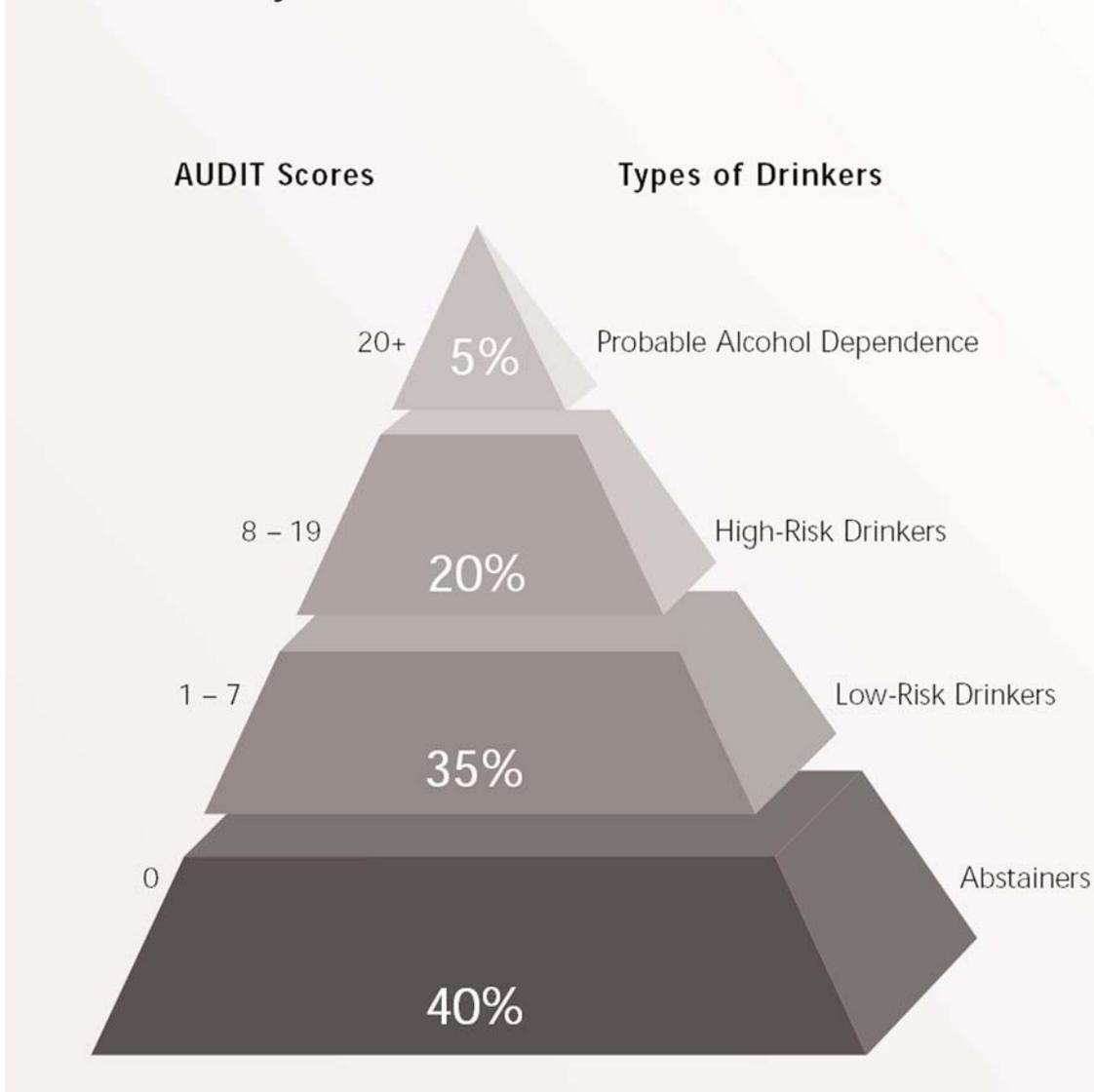(0) No
(1) Yes, but not in the last year
(2) Yes, during the last year

Total Score

To complete the audit simply select the answer which most closely fits your drinking habits and record the points value in the box provided. When you have completed this add the scores together and apply the sum to the "Alcohol Pyramid" to discover what level of risk your habits pose to your general health.

The Drinkers' Pyramid

AUDIT Scores   **Types of Drinkers**

20+   5%   Probable Alcohol Dependence

8 – 19   20%   High-Risk Drinkers

1 – 7   35%   Low-Risk Drinkers

0   40%   Abstainers

Links and further information
www.dh.gov.uk/alcohol
www.ias.org.uk
www.downyourdrink.co.uk

References
1 AIC 99/2004 (Pink 72) Medication, Alcohol and Flying. www.ais.org.uk
2 Railway & Transport Safety Act 2003 – DfT
3 3 FODCOM 28/2003 Implementation of the Railways and Transport Safety Act 2003 –
Aviation Alcohol and Drugs. http://www.caa.co.uk/publications
4 The world Health Report 2002. Reducing Risks, Promoting Healthy Life. WHO Geneva, 2002.
5 The Alcohol Use Disorders Identification Test 2nd Edition WHO Publications
6 CMO Update Winter 2006 issue 45. Department of Health Publications
7 Office of National Statistics.
8 JA Ewing "Detecting Alcoholism: The CAGE Questionnaire" JAMA 252: 1905-1907, 1984.
10 THE LOG Medical Study

This leaflet was prepared by Dr Eleanor Ivory from her article which appeared originally in the BALPA journal "The Log".