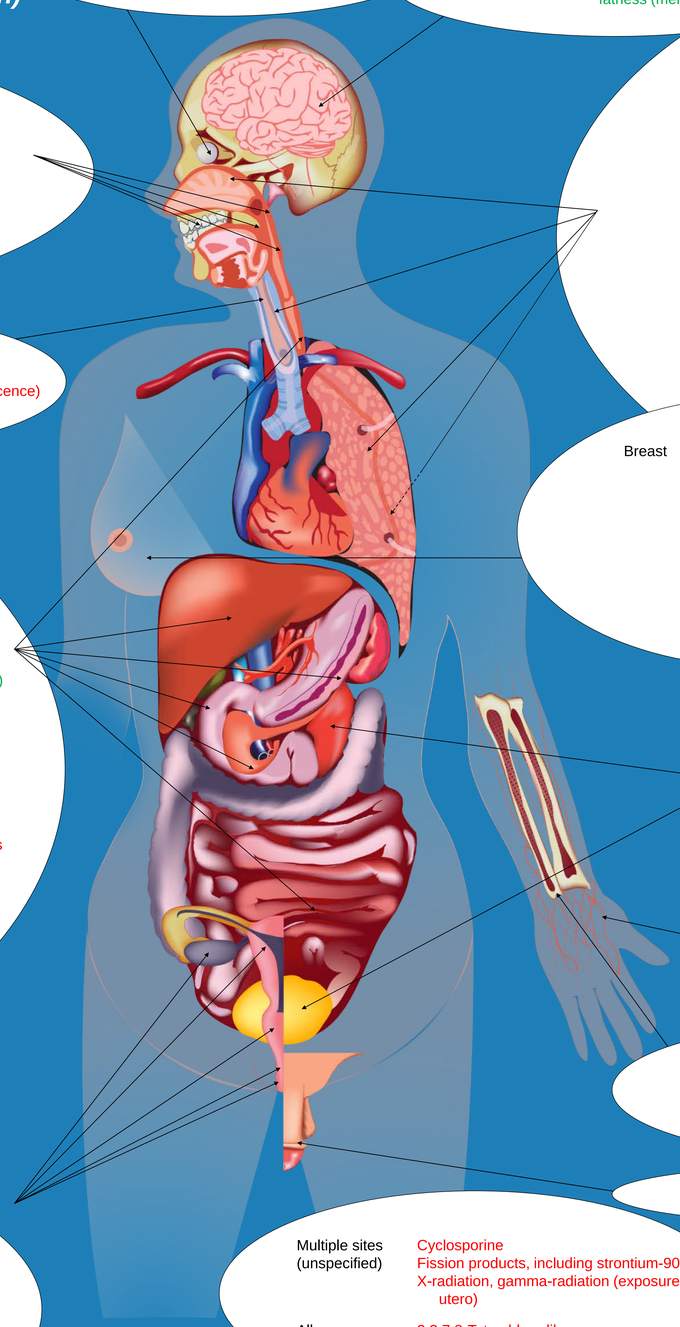
Human Cancer: Known Causes and Prevention by Organ Site

IARC Monographs on the Identification of Carcinogenic Hazards to Humans and *Handbooks of Cancer Prevention*

Monographs 1-132, Handbooks 1-19, updated 18 October 2022
Agents classified as carcinogenic to humans (Group 1) (in red)
Interventions with sufficient evidence of a cancer-preventive effect (in green)



Eye
Human immunodeficiency virus type 1
Ultraviolet emissions from welding
Ultraviolet-emitting tanning devices

Brain and central nervous system
X-radiation, gamma-radiation
Absence of excess body fatness (meningioma)

Oral cavity
Alcoholic beverages
Betel quid with tobacco
Betel quid without tobacco
Human papillomavirus type 16
Quitting alcohol consumption
Quitting tobacco smoking
Quitting use of areca nut products (including betel quid) with or without tobacco
Smokeless tobacco
Tobacco smoking

Pharynx (oro-, hypo- and/or NOS)
Alcoholic beverages
Betel quid with tobacco
Human papillomavirus type 16
Quitting smoking
Tobacco smoking

Nasopharynx
Epstein–Barr virus
Formaldehyde
Salted fish, Chinese-style
Wood dust

Tonsil
Human papillomavirus type 16

Salivary gland
X-radiation, gamma-radiation

Thyroid
Absence of excess body fatness
Radioiodines, including iodine-131 (exposure during childhood and adolescence)
X-radiation, gamma-radiation

Lung
Acheson process (occupational exposure)
Aluminium production
Arsenic and inorganic arsenic compounds
Asbestos (all forms)
Beryllium and beryllium compounds
Bis(chloromethyl)ether; chloromethyl methyl ether (technical grade)
Cadmium and cadmium compounds
Chromium (VI) compounds
Coal, indoor emissions from household combustion
Coal gasification
Coal-tar pitch
Coke production
Diesel engine exhausts
Gamma-radiation
Haematite mining (underground)
Iron and steel founding
MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)
Nickel compounds
Opium (consumption of)
Outdoor air pollution
Outdoor air pollution, particulate matter in
Painter (occupational exposure)
Plutonium
Quitting smoking
Radon-222 and its decay products
Rubber manufacturing industry
Silica dust, crystalline
Soot
Sulfur mustard
Tobacco smoke, secondhand
Tobacco smoking
Welding fumes
X-radiation

Nasal cavity and paranasal sinus
Isopropyl alcohol manufacture using strong acids
Leather dust
Nickel compounds
Radium-226 and its decay products
Radium-228 and its decay products
Tobacco smoking
Wood dust

Larynx
Acid mists, strong inorganic
Alcoholic beverages
Asbestos (all forms)
Opium (consumption of)
Quitting smoking
Tobacco smoking

Pleura or peritoneum (mesothelioma)
Asbestos (all forms)
Erionite
Firefighter (occupational exposure)
Fluoro-edenite fibrous amphibole
Painter (occupational exposure)

Breast
Alcoholic beverages
Absence of excess body fatness (postmenopausal)
Diethylstilbestrol
Estrogen–progestogen contraceptives
Estrogen–progestogen menopausal therapy
Mammography screening (50–74 years)
Regular physical activity
X-radiation, gamma-radiation

Stomach
Absence of excess body fatness (gastric cardia)
Helicobacter pylori
Quitting smoking
Rubber manufacturing industry
Tobacco smoking
X-radiation, gamma-radiation

Upper aerodigestive tract
Acetaldehyde associated with consumption of alcoholic beverages

Liver (hepatocellular carcinoma)
Absence of excess body fatness
Aflatoxins
Alcoholic beverages
Estrogen–progestogen contraceptives
Hepatitis B virus
Hepatitis C virus
Plutonium
Thorium-232 and its decay products
Tobacco smoking (in smokers and in smokers' children)

Liver (angiosarcoma)
Vinyl chloride

Biliary tract
1,2-Dichloropropane
Clonorchis sinensis
Opisthorchis viverrini

Pancreas
Absence of excess body fatness
Quitting smoking
Smokeless tobacco
Tobacco smoking

Oesophagus
Acetaldehyde associated with consumption of alcoholic beverages
Alcoholic beverages
Absence of excess body fatness (adenocarcinoma)
Betel quid with tobacco
Betel quid without tobacco
Quitting smoking (squamous cell carcinoma)
Smokeless tobacco
Tobacco smoking
X-radiation, gamma-radiation

Gall bladder
Absence of excess body fatness
Thorium-232 and its decay products

Colon and rectum
Alcoholic beverages
Absence of excess body fatness
Regular physical activity
Processed meat (consumption of)
Screening with gFOBT
Screening with FIT
Screening with sigmoidoscopy
Screening with colonoscopy
Tobacco smoking
X-radiation, gamma-radiation

Anus
Human immunodeficiency virus type 1
Human papillomavirus type 16

Urinary bladder
Aluminium production
4-Aminobiphenyl
Arsenic and inorganic arsenic compounds
Auramine production
Benzidine
Chlornaphazine
Cyclophosphamide
Firefighter (occupational exposure)
Magenta production
2-Naphthylamine
Opium (consumption of)
Painter (occupational exposure)
Quitting smoking
Rubber manufacturing industry
Schistosoma haematobium
Tobacco smoking
ortho-Toluidine
X-radiation, gamma-radiation

Kidney
Absence of excess body fatness
Quitting smoking
Tobacco smoking
Trichloroethylene
X-radiation, gamma-radiation

Renal pelvis and ureter
Aristolochic acid, plants containing
Phenacetin
Phenacetin, analgesic mixtures containing
Tobacco smoking

Corpus uteri (endometrium)
Absence of excess body fatness
Estrogen menopausal therapy
Estrogen–progestogen menopausal therapy
Tamoxifen

Uterine cervix
Conventional cytology screening
Diethylstilbestrol (exposure in utero)
Estrogen–progestogen contraceptives
Human papillomavirus nucleic acid (DNA or mRNA) testing
Human immunodeficiency virus type 1
Human papillomavirus types 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59
Liquid-based cytology screening
Quitting smoking
Tobacco smoking

Vagina
Diethylstilbestrol (exposure in utero)
Human papillomavirus type 16

Vulva
Human papillomavirus type 16

Ovary
Absence of excess body fatness
Asbestos (all forms)
Estrogen menopausal therapy
Tobacco smoking

Bone
Plutonium
Radium-224 and its decay products
Radium-226 and its decay products
Radium-228 and its decay products
X-radiation, gamma-radiation

Penis
Human papillomavirus type 16

Multiple sites (unspecified)
Cyclosporine
Fission products, including strontium-90
X-radiation, gamma-radiation (exposure in utero)

All cancers combined
2,3,7,8-Tetrachlorodibenzo-*para*-dioxin

Group 1 agents with less than *sufficient* evidence in humans
2,3,4,7,8-Pentachlorodibenzofuran
Polychlorinated biphenyls with a WHO TEF ("dioxin-like")
4,4′-Methylenebis(2-chloroaniline) (MOCA)
Alpha- and beta-particle emitters
Areca nut
Aristolochic acid
Benzidine, dyes metabolized to
Benzo[a]pyrene
Ethanol in alcoholic beverages
Ethylene oxide
Etoposide
Ionizing radiation (all types)
Neutron radiation
N′-Nitrosonornicotine (NNN) and 4-(*N*-nitroso-methylamino)-1-(3-pyridyl)-1-butanone (NNK)
Ultraviolet radiation

Skin (melanoma)
Polychlorinated biphenyls
Solar radiation
Ultraviolet-emitting tanning devices

Skin (other malignant neoplasms)
Arsenic and inorganic arsenic compounds
Azathioprine
Coal-tar distillation
Coal-tar pitch
Cyclosporine
Methoxsalen plus ultraviolet A
Mineral oils, untreated or mildly treated
Shale oils
Solar radiation
Soot
X-radiation, gamma-radiation

Leukaemia/ lymphoma
Absence of excess body fatness (multiple myeloma)
Azathioprine
Benzene
Busulfan
1,3-Butadiene
Chlorambucil
Cyclophosphamide
Cyclosporine
Epstein–Barr virus
Etoposide with cisplatin and bleomycin
Fission products, including strontium-90
Formaldehyde
Helicobacter pylori
Hepatitis C virus
Human immunodeficiency virus type 1
Human T-cell lymphotropic virus type 1
Kaposi sarcoma herpesvirus
Lindane
Melphalan
MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)
Pentachlorophenol
Phosphorus-32, as phosphate
Rubber manufacturing industry
Semustine [1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea, or methyl-CCNU]
Thiotepa
Thorium-232 and its decay products
Tobacco smoking
Treosulfan
X-radiation, gamma-radiation

Endothelium (Kaposi sarcoma)
Human immunodeficiency virus type 1
Kaposi sarcoma herpesvirus

International Agency for Research on Cancer
World Health Organization