

### How to Use this Factsheet

This risk factor summary was developed to serve as a general fact sheet. It is an overview and should not be considered exhaustive. For more information on other possible risk factors and health effects being researched, please see the References section.

A risk factor is anything that increases a person's chance of developing cancer. Some risk factors can be controlled while others cannot. Risk factors can include *hereditary conditions, medical conditions or treatments, infections, lifestyle factors, or environmental exposures*. Although risk factors can influence the development of cancer, most do not directly cause cancer. An individual's risk for developing cancer may change over time due to many factors, and it is likely that multiple risk factors influence the development of most cancers. Knowing the risk factors that apply to specific concerns and discussing them with your health care provider can help to make more informed lifestyle and health care decisions.

For those cancer types with environmentally-related risk factors, an important factor in evaluating cancer risk is the route of exposure. This is particularly relevant when considering exposures to chemicals in the environment. For example, a particular chemical may have the potential to cause cancer if it is inhaled, but that same chemical may not increase the risk of cancer through skin contact. In addition, the dose and duration of time one might be exposed to an environmental agent is important in considering whether an adverse health effect could occur.

Gene-environment interactions are another important area of cancer research. An individual's risk of developing cancer may depend on a complex interaction between their genetic makeup and exposure to an environmental agent (for example, a virus or a chemical contaminant). This may explain why some individuals have a fairly low risk of developing cancer as a result of an environmental factor or exposure, while others may be more vulnerable.

### Key Statistics

Bone cancer is extremely rare, accounting for less than 0.2% of all cancer diagnoses among adults and children.<sup>1, 6</sup> The American Cancer Society estimates 2,970 individuals will be diagnosed with primary cancer of the bone in the U.S. in 2015.<sup>2</sup>

### Types of Bone Cancer

The term "cancer" is used to describe a variety of diseases associated with abnormal cell and tissue growth. Cancers are classified by the location in the body where the disease originated (the primary site) and the tissue or cell type of the cancer (histology).

Bone tumors can be either malignant (cancerous) or benign (non-cancerous). Both primary and secondary malignant tumors can arise in bone. Secondary bone tumors generally originate elsewhere in the body and then metastasize, or spread, to the bone.

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There are several different types of primary bone tumors: chondrosarcoma (40%) and osteosarcoma (28%) are the two most prevalent, followed by chordoma (10%), Ewing's family of tumors (EFOT) (8%), malignant fibrous histiocytoma/fibrosarcoma (4%), and several rare types. Chondrosarcoma is a cancer of the cartilage cells and is uncommon under the age of 20. After age 20, the risk increases with age until about age 75. Osteosarcoma, also called osteogenic sarcoma, affects the bones themselves and primarily occurs in young people between the ages of 10 and 30. However, about 10% of diagnoses develop in people over the age of 60. It is more common in males than females. Chordoma, which usually occurs in the base of the skull and bones of the spine, occurs most often in adults older than 30 years.<sup>1</sup> EFOT is a group of cancers that start in the bones or nearby soft tissue. It occurs most frequently in children and adolescents and is rare in adults over age 30.<sup>1, 4</sup> Malignant fibrous histiocytoma/fibrosarcoma usually occur in older and middle-aged adults, and typically start in the soft tissue around bones, such as ligaments, tendons, fat, and muscle.<sup>1</sup>

### Established Risk Factors

#### *Environmental Exposures*

Ionizing radiation (i.e., x-rays and gamma rays) has been identified as one of the only environmental factors known to play a role in the development of certain types of bone cancer, such as osteosarcoma. It should be noted, however, that there is little danger of developing bone cancer from a typical diagnostic medical x-ray. Individuals who were treated with radiation therapy for an earlier cancer have a higher risk of later developing bone cancer. Radiation treatment at a younger age as well as radiation treatment with higher doses increases the risk of developing osteosarcoma.<sup>1, 6</sup> In addition, children treated for cancer with alkylating agents (a group of chemotherapy drugs) have an increased risk of later developing bone cancer.<sup>6</sup> Non-ionizing radiation from microwaves, cell phones, and household appliances does not increase the risk of bone cancer.<sup>1</sup>

#### *Hereditary Conditions*

Most bone cancers do not appear to have a hereditary basis. However, children with certain rare inherited syndromes, such as Li-Fraumeni or Rothmund-Thomson syndrome, have an elevated risk of developing osteosarcoma. Children with an inherited form of retinoblastoma, a rare eye cancer, also have an increased risk for developing osteosarcoma. Individuals with multiple exostoses (also known as multiple osteochondromas) syndrome, which is an inherited condition that causes bumps on the bones, have an elevated risk of chondrosarcoma.<sup>1</sup>

### Possible Risk Factors

#### *Medical Conditions*

Several pre-existing medical conditions are associated with the development of certain bone cancers. For example, about 1% of individuals with Paget's disease, which

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primarily affects people over the age of 50 and results in the formation of abnormal bone tissue, develop bone cancers, most often osteosarcomas.<sup>3</sup> Individuals with multiple enchondromatosis, a condition in which many benign cartilage tumors develop, are at increased risk for chondrosarcoma.<sup>1</sup>

### Other Factors That Have Been Investigated

#### *Medical Conditions*

Some studies suggest that bone injury can cause cancer, but this has not been proven and most doctors do not believe this is a significant risk factor. It is more likely that a diagnosis prompts a patient to recall an injury or that an injury draws attention to a pre-existing bone mass.<sup>1</sup>

### Bone Cancer in Children

In children and teenagers (those younger than 20 years), osteosarcoma (56%) and Ewing tumors (34%) are much more common than chondrosarcoma (6%).<sup>1</sup> About 225 children and teens are diagnosed with Ewing tumors in North America each year.<sup>4</sup> About 3% of all childhood cancers are osteosarcomas and about 1 to 2% are EFOTs.<sup>3, 4</sup> Between 2000 and 2009, malignant bone tumors accounted for about 4.1% of all cancers diagnosed among Massachusetts children and adolescents less than 20 years old. Of these diagnoses, 58.1% were osteosarcomas and 36.3% were EFOTs.<sup>11</sup> The risk of osteosarcoma is highest during the teenage "growth spurt". Children with osteosarcoma are usually tall for their age, suggesting a relationship between rapid bone growth and risk of tumor formation.<sup>9</sup> EFOT occurs most often in whites, less often in Asian Americans, and is almost non-existent among African Americans.<sup>4</sup>

### For More Information / References

*Much of the information contained in this summary has been taken directly from the following sources. This material is provided for informational purposes only and should not be considered as medical advice. Persons with questions regarding a specific medical problem or condition should consult their physician.*

American Cancer Society (ACS). <http://www.cancer.org>

1. ACS. 2015. Detailed Guide: Bone Cancer.
2. ACS. 2015. Cancer Facts & Figures 2015.
3. ACS. 2015. Detailed Guide: Osteosarcoma.
4. ACS. 2014. Detailed Guide: Ewing's Family of Tumors.
5. ACS. 2015. Detailed Guide: Cancer in Children.

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6. ASCO. 2014. Guide to Bone Cancer.
7. ASCO. 2014. Guide to Childhood Cancer.
8. ASCO. 2014. Guide to Ewing Family of Tumors – Childhood.
9. ASCO. 2014. Guide to Osteosarcoma – Childhood.

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10. MCR. 2014. Cancer Incidence and Mortality in Massachusetts 2007-2011: Statewide Report. Available at: <http://www.mass.gov/eohhs/docs/dph/cancer/state/registry-statewide-report-07-11.pdf>
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