

## BAP1

The *BAP1* gene is a tumor suppressor gene. Tumor suppressor genes slow down cell division, repair DNA mistakes, or tell cells when to die. When they don't work properly, cells can grow out of control, which can lead to cancer. The primary roles of *BAP1* are to assist in the repair of damaged DNA and to regulate cell growth and division.

Like most genes, each person has two copies of the *BAP1* gene: one inherited from each parent. A mutation in a single *BAP1* gene inherited from either parent is known to increase risks of melanoma of the skin (cutaneous melanoma) and eye (uveal melanoma), as well as kidney and lung cancer (specifically a type called mesothelioma) and non-cancerous skin growths called melanocytic BAP1-mutated atypical intradermal tumors (MBAITs).

Certain factors can greatly increase risk of melanoma, including an individual's geographic region, ethnicity and sun exposure. For example, melanoma is 20 times more common in Caucasians than it is in African Americans.<sup>1</sup> The risk of kidney cancer also varies depending on whether a person has a history of smoking cigarettes or exposure to certain substances and chemicals.<sup>2</sup> The risk of lung (mesothelioma) cancer is impacted by exposure to asbestos and other harmful substances.<sup>3</sup>

### How common are mutations in the *BAP1* gene?

Mutations in the *BAP1* gene are rare—the exact frequency is not yet known. Studies to establish the frequency of *BAP1* mutations are ongoing.

## How mutations in this gene impact risk

### Women

If a woman has a mutation in the *BAP1* gene, her chances of developing melanoma, kidney, and lung cancer (specifically a type called mesothelioma), are greater than that of the average US woman. This does not mean that she has a diagnosis of cancer or that she will definitely develop cancer in her lifetime.

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<sup>1</sup> What are the risk factors for melanoma skin cancer? American Cancer Society Website. <http://www.cancer.org/cancer/skincancer-melanoma/detailedguide/melanoma-skin-cancer-risk-factors> Updated February 01, 2016.

<sup>2</sup> American Cancer Society. Kidney Cancer. 2/10/16. <http://www.cancer.org/cancer/kidneycancer/> (4/14/16).

<sup>3</sup> American Cancer Society. Malignant Mesothelioma. 2/17/16 <http://www.cancer.org/cancer/malignantmesothelioma/> (4/14/16)

Cancer by age 95	Average US woman	With <i>BAP1</i> mutation
Melanoma	1.6% <sup>4</sup>	Elevated <sup>5,6</sup>
Kidney	1.2% <sup>4</sup>	Elevated <sup>5,7</sup>
Lung (mesothelioma)	<1% <sup>8</sup>	Elevated <sup>5,6</sup>

*Elevated: Risk is increased, but further research may clarify the exact risk figure.*

## Men

If a man has a mutation in the *BAP1* gene, his chances of developing melanoma, kidney, and lung cancer (specifically a type called mesothelioma), are greater than that of the average US man. This does not mean that he has a diagnosis of cancer or that he will definitely develop cancer in his lifetime.

Cancer by age 95	Average US man	With <i>BAP1</i> mutation
Melanoma	2.6% <sup>4</sup>	Elevated <sup>5,6</sup>
Kidney	2% <sup>4</sup>	Elevated <sup>5,7</sup>
Lung (mesothelioma)	<1% <sup>8</sup>	Elevated <sup>5,6</sup>

*Elevated: Risk is increased, but further research may clarify the exact risk figure.*

## Screening guidelines

Below is a summary of screening guidelines from the American Cancer Society (ACS). Because there are no published screening guidelines specific to individuals with *BAP1* mutations, these guidelines are for individuals who have the same risk of melanoma as the average US individual. If you have a mutation in this gene, your healthcare provider may use these ACS Guidelines to help create a customized screening plan for you. They might also make additional recommendations to reduce the risk of melanoma.

<sup>4</sup> Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute. 2010-2012. DevCan software (<http://surveillance.cancer.gov/devcan>) V 6.7.0, Accessed June 2015.

<sup>5</sup> Rai K, Pilarski R, Cebulla CM, Abdel-rahman MH. Comprehensive review of *BAP1* tumor predisposition syndrome with report of two new cases. *Clin Genet*. 2016;89(3):285-94.

<sup>6</sup> Carbone M, Yang H, Pass HI, Krausz T, Testa JR, Gaudino G. *BAP1* and cancer. *Nat Rev Cancer*. 2013;13(3):153-9.

<sup>7</sup> Popova T, Hebert L, Jacquemin V, et al. Germline *BAP1* mutations predispose to renal cell carcinomas. *Am J Hum Genet*. 2013;92(6):974-80.

<sup>8</sup> Betti M, Casalone E, Ferrante D, et al. Inference on germline *BAP1* mutations and asbestos exposure from the analysis of familial and sporadic mesothelioma in a high-risk area. *Genes Chromosomes Cancer*. 2015;54(1):51-62.

## Women and Men

### Melanoma<sup>9</sup>

- Your healthcare provider may discuss skin exams and eye exams to screen for melanoma.
- To reduce the chance of developing melanoma, the American Cancer Society recommends limiting exposure to UV light by avoiding excess sun exposure, wearing a hat, sunglasses and long protective clothing, applying sunscreen with SPF of 30 or higher and avoiding tanning beds and sun lamps.
- Any new, unusual, or changing moles should be reported to your provider or dermatologist.

### Kidney cancer

- Currently, there are no kidney cancer screening guidelines specific to *BAP1* mutation carriers. Your provider may discuss screening or referral to a specialist.

### Lung cancer (mesothelioma)

- Currently, there are no lung cancer screening guidelines specific to *BAP1* mutation carriers. Your provider may discuss screening or referral to a specialist.

## Useful resources

### American Melanoma Foundation

An organization supporting melanoma research, and providing advocacy and public awareness of melanoma.

[www.melanomafoundation.org](http://www.melanomafoundation.org)

### Kintalk

An educational and family communication site for individuals and their families with hereditary cancer conditions.

[www.kintalk.org](http://www.kintalk.org)

*Last updated May 15, 2017*

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<sup>9</sup> Skin Cancer Prevention and Early Detection. The American Cancer Society. Available at [www.cancer.org](http://www.cancer.org). Updated 3/20/2015. Accessed April 2015.