

## Breast Cancer Early Detection

by mammography screening

Numbers for women aged 50 years or older who participated in screening for 10 years

HARDING CENTER FOR  
RISK LITERACY

	1,000 women without screening	1,000 women with screening
<b>Benefits</b>		
How many women died from breast cancer?	5	4
How many women died from all types of cancer?	21	21
<b>Harms</b>		
How many women without cancer experienced false alarms or biopsies?	–	100
How many women with non-progressive cancer had unnecessary partial or complete breast removal?	–	5

Source: Gettsche, PC, Jørgensen, KJ (2013). *Cochrane Database of Systematic Reviews* [6]. CD001877. Numbers in the fact box are rounded. [www.harding-center.de](http://www.harding-center.de)

Where no data for women above 50 years of age are available, numbers refer to women above 40 years of age.

## THE ART OF RISK COMMUNICATION Gerd Gigerenzer

# Breast cancer screening pamphlets mislead women

All women and women's organisations should tear up the pink ribbons and campaign for honest information

Why should I have mammography? That question is regularly asked in pamphlets for screening. The answer is also regularly misleading. Women are told what they should do, but without being given the facts necessary to make informed decisions.

As a result of paternalism and pink ribbon culture, almost all women have a false impression of the benefit of mammography screening. For instance, 98% of women in France, Germany, and the Netherlands overestimated its benefit by a factor of 10, 100, or more, or did not know.<sup>1</sup> Most surprisingly, those who frequently consulted their physicians and health pamphlets were slightly worse informed. Russian women gave the most realistic estimates among those in nine European countries studied—not because they have more information at their disposal but because there are fewer misleading pink ribbon pamphlets in Russia.

Misinformation needs to stop. All pamphlets should show a “fact box” that explains benefits and harms in a transparent way.<sup>2</sup> The figure shows one based on the most recent Cochrane review for women age 50 to 69.<sup>3</sup>

In sum, the absolute reduction in mortality from breast cancer is about 1 in 1000 women, but the reduction in total cancer mortality (including breast cancer) is 0. The difference between breast cancer and total cancer deaths is important because it is not always easy to determine the type of cancer from which a person died, and total cancer mortality is thus a more reliable measure.

A look at a sample of pamphlets reveals patterns in how the benefits of screening are communicated (for the sake of brevity, I do not deal with the harms). Four strategies are frequently used:

### 1. Zero number policy: tell women what to do without stating benefits

In the US the Food and Drug Administration's Office of Women's Health leaflet (in pink) says on its first page that “Mammograms can help save lives.” Similarly, the American Cancer Society's 2014 pamphlet *Breast Cancer: Early Detection* tells women, “Most doctors feel that early detection tests for breast cancer save thousands of lives each year, and that many more lives could be saved if even more women and their health care providers took advantage of these tests,” and the National Cancer Institute's fact sheet

says, “Screening mammography can help reduce the number of deaths from breast cancer among women ages 40 to 70, especially for those over age 50.”

In each case, no information is given about how large the benefit is. In the first two cases, the reduction in breast cancer mortality is misleadingly presented as “saving lives,” even though there is no reduction in total cancer mortality (including breast cancer): no life is saved. Note the American Cancer Society's formulation that most US doctors “feel” that lives are saved, which may be technically true. This zero number policy seems to be widespread in the US, unlike in the rest of the Western world.

### 2. Report relative risks only

The second strategy is to report the reduction in breast cancer mortality as a relative risk rather than absolute risk reduction. That is, the reduction from 5/1000 to 4/1000 is expressed as a 20% reduction, sometimes generously rounded up to over 30%. This makes the benefit look larger than the 0.1% absolute reduction. The Welsh NHS leaflet *Breast Screening Explained* says, “Breast screening has been shown to reduce the risk of dying from breast cancer by around 35%.” And one by the New Zealand Breast Cancer Foundation claims that “Screening mammograms . . . reduce the chance of dying from breast cancer by approximately 33%.”

None of these pamphlets tells women that there is no difference in total cancer mortality.

### 3. Report five year survival rates

The third strategy is to use another misleading statistic: five year survival rates. It is well known that these rates say nothing about mortality reduction. In fact, increases in survival rates are not even correlated with decreases in mortality rates,  $r=0.0$ .<sup>4</sup> Lead time bias (diagnosis of breast cancer through screening at an early stage that does nothing but advance the date of diagnosis) and overdiagnosis (diagnosis of a type of breast cancer that would never cause symptoms or death during a woman's lifetime) inflate five year survival rates without reducing mortality.<sup>4</sup> Nevertheless, high survival rates continue to be used to impress women. For example, the Avon Foundation's breast health resource guide says, “There is a 97% 5-year survival rate when breast cancer is caught early before it spreads to other parts of the body.”

### 4. Report absolute risk reduction but use unrealistically high numbers

Several pamphlets have stopped reporting misleading relative risks and five year survival rates. They report understandable absolute risks but inflate these. The leaflet produced by BreastScreen Australia states: “For every 1000 women who are screened every two years from age 50 to age 74 through BreastScreen (over 25 years): around 8 (between 6 and 10) deaths from breast cancer will be prevented.” And the NHS leaflet for England tells women, “Screening saves about 1 life from breast cancer for every 200 women who are screened.”

One way to artificially inflate the absolute risk reduction (for about 10 years, as reported in the fact box) is to assume that the benefit will increase linearly if you consider 25 years (as BreastScreen does). But there is no evidence for this assumption. The only study that has actually investigated risk over 25 years found no reduction of breast cancer deaths at all.<sup>5</sup>

### A right to be informed

In Germany, the Harding Center for Risk Literacy (of which I am a director) successfully exposed health organisations for misinforming the public about mammography screening. As a consequence, since about 2010, all deceptive relative risks and five year survival rates have been removed from German information literature, and harms are now reported in absolute numbers. Thus far, however, no German organisation has dared to publish a fact box. In Austria, the Tyrolean Society for General Medicine did and was immediately attacked by representatives of the local gynaecology departments. The leaflet of the Canadian Task Force *Should I be screened with mammography for breast cancer?* is another good example of how to inform women honestly.

I call on all women and women's organisations to tear up the pink ribbons and campaign for honest information. Only by correcting the current misinformation rate of 98% in various countries will women be able to make informed decisions. Gerd Gigerenzer is director, Harding Center for Risk Literacy and Centre for Adaptive Behaviour and Cognition, Max Planck Institute for Human Development, Berlin, Germany [gigerenzer@mpib-berlin.mpg.de](mailto:gigerenzer@mpib-berlin.mpg.de) Competing interests: None declared. Full version of this article with references is on [bmj.com](http://bmj.com). Cite this as: *BMJ* 2014;348:g2636

YANKEE DOODLING **Douglas Kamerow**

# The world's deadliest animal

Lions or tigers or bears? Oh, no

What is the most dangerous animal in the world? In the United States we seem to be obsessed with the great white shark, so much so that one television network has an annual “shark week” dedicated to nothing but stories about this fabled killer. The reality, though, is that sharks kill only about 10 or 20 people a year worldwide.

Africa has many really dangerous big animals. Take your pick from lions, elephants, cape buffalos, crocodiles, or hippos. None actually stalks people, but each of these species is responsible for up to a few hundred human deaths a year.

What about the poisonous creatures? Yes, there are all kinds of deadly exotic species, ranging from the box jellyfish, with enough toxin in each of its 60 tentacles to kill 60 people, to the poison dart frog, whose slimy neurotoxin has the power to kill 10 men. They don't get around much, though, and are responsible for only a scattering of human deaths.

The animal that comes closest to fulfilling our nightmare expectations is the snake. Feared since antiquity and present in most of the world's regions, snakes really do take a large human toll. When you sum the deaths from poisonous snakes such as the black mamba, the Asian cobra, and the boomslang, you get around 50 000 a year. This is at least double the number of deaths caused by dogs, man's best friend (except when rabid).

But as pointed out recently in a blog post by the Microsoft founder and health philanthropist Bill Gates,<sup>1</sup> all these numbers pale when compared with the havoc caused by the real deadliest animal in the world: the mosquito. Depending on who you ask and how you count, mosquitoes are responsible for between 700 000 and 2.5 million human deaths a year.

The big killer is, of course, malaria, with more than 600 000 deaths a year, the overwhelming majority of which are in Africa. Half the world's

population lives in areas at risk of malaria transmission, with young children, pregnant women, and travellers at greatest risk of infection.<sup>2</sup> Mosquitoes also transmit yellow fever (30 000 deaths a year) and the viruses that cause dengue fever and several types of arboviral encephalitides.

Although we tend to think of the diseases transmitted by mosquito as being a problem only in the tropical areas of the world, in fact many are threats to parts of the US as well. Malaria itself, though not endemic to the US, is imported in ever greater numbers by tourists venturing to areas where it is endemic. It is occasionally transmitted within the US too, by transfusion, from mother to child, or even by domestic mosquitoes (the last outbreak was in Florida in 2003).

Dengue fever is endemic in all the US tropical territories: Puerto Rico, the Virgin Islands, Samoa, and Guam. The most recent epidemic occurred in Puerto Rico in 2007, with 10 000 cases. Recent outbreaks have also been reported in Hawaii, Texas, and in 2010 in the Florida Keys.<sup>3</sup>

The virus most commonly transmitted by mosquitoes to humans in the US is West Nile virus. Over 2300 cases and 114 deaths were reported in 2013. Most infected people have no symptoms; about 20% have a fever and other symptoms; and less than 1% develop neuroinvasive disease, which can be fatal. No specific treatments are available.<sup>4</sup>

Other arboviruses transmitted by mosquitoes to humans cause rare diseases such as eastern equine and western equine encephalitis, St Louis encephalitis, and LaCrosse encephalitis. In all these diseases many infected people have no symptoms and the infections are discovered only through antibody testing related to blood donations. People who do become ill, however, develop severe neuroinvasive disease, leading to seizures, coma, or paralysis. Again, no specific treatments are available.



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**The most dangerous animal in the world can, with a little preparation and care, be defeated**  
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Finally, a novel mosquito transmitted virus is apparently now heading towards the US: chikungunya virus, which leads to headache, fever, and muscle and joint pain. It is most often spread by the same mosquitoes that transmit dengue, which bite mostly during the daytime. Outbreaks have occurred throughout the world, and in 2013 it spread to the Caribbean. Most experts expect it to appear in the US soon, perhaps this year.<sup>5</sup>

All these diseases, which range from bothersome to deadly, are spread by this incredibly efficient blood-injecting machine, the mosquito. We need to continue to support activities to control mosquitoes in endemic areas, such as providing bed nets treated with insecticide and indoor residual spraying, as well as supporting research to develop vaccines against malaria and other mosquito transmitted diseases. But my main message, as a (long overdue) spring and summer begin here in the US, is a much less daunting and expensive one: prevent mosquito bites.

The Centers for Disease Control and Prevention recommends a wide range of effective mosquito repellants.<sup>6</sup> To help prevent infection with West Nile virus, the most common mosquito transmitted disease in the US, they need to be applied only around dusk and dawn. Or stay indoors. Or wear long sleeves. Or plug in a fan when you sit in your backyard or deck: mosquitoes, it turns out, are not very strong flyers. Simple.

The most dangerous animal in the world can, with a little preparation and care, be defeated.

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