

# SCREENING FOR BREAST CANCER WITH MAMMOGRAPHY



**What are the benefits and harms of attending a screening programme for breast cancer?**

**How many will benefit from being screened, and how many will be harmed?**

**What is the scientific evidence for this?**

*What you always wanted to know about breast screening*

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## Summary

When we first published this leaflet in 2008, the Summary was:

“It may be reasonable to attend for breast cancer screening with mammography, but it may also be reasonable not to attend, as screening has both benefits and harms.

If 2000 women are screened regularly for 10 years, one will benefit from the screening, as she will avoid dying from breast cancer.

At the same time, 10 healthy women will, as a consequence, become cancer patients and will be treated unnecessarily. These women will have either a part of their breast or the whole breast removed, and they will often receive radiotherapy, and sometimes chemotherapy.

Furthermore, about 200 healthy women will experience a false alarm. The psychological strain until one knows whether or not it was cancer, and even afterwards, can be severe.”

These numbers were derived from the randomised trials of mammography screening. However, since the trials were performed, treatment of breast cancer has improved considerably. More recent studies suggest that mammography screening may no longer be effective in reducing the risk of dying from breast cancer.

Screening produces patients with breast cancer from among healthy women who would never have developed symptoms of breast cancer. Treatment of these healthy women increases their risk of dying, e.g. from heart disease and cancer.

It therefore no longer seems reasonable to attend for breast cancer screening. In fact, by avoiding going to screening, a woman will lower her risk of getting a breast cancer diagnosis. However, despite this, some women might still wish to go to screening.

## What is screening?

Screening means examining a group of people in order to detect disease or to find people at increased risk of disease.

In many countries, women between 50 and 69 years of age are offered an X-ray examination of the breasts – screening with mammography - every second or third year. The purpose of the screening examination is to find women who have breast cancer in order to offer them earlier treatment.

Screening with mammography has both benefits and harms. The aim of this leaflet is to help each woman weigh up the pros and cons in the light of her own values and preferences, in order that she can make a personal decision whether she wishes to attend.

If nothing abnormal is found by screening, it makes the woman feel reassured that she is healthy. But almost all women feel healthy before they are invited to screening. Furthermore, the invitation itself may cause insecurity. Therefore, screening creates both security and insecurity.

## Benefits

**Reduced risk of dying from breast cancer** - Regular screening with mammography cannot prevent breast cancer, but it can perhaps reduce the risk of dying from breast cancer. A systematic review of the randomised trials of mammography screening found that:

*If 2000 women are screened regularly for 10 years, one will benefit from screening, as she will avoid dying from breast cancer because the screening detected the cancer earlier.*

Since these trials were undertaken, treatment of breast cancer has improved considerably. Women today also seek medical advice much earlier than previously, if they have noted anything unusual in their breasts. In addition, diagnosis and treatment have been centralised in many countries and are now provided by teams of breast cancer experts.

Because of these improvements, screening is less effective today and newer studies suggest that mammography screening is no longer effective in reducing the risk of dying from breast cancer (see *Documentation for the facts and figures* below).

Screening does not reduce the overall risk of dying, or the overall risk of dying from cancer (including breast cancer).

## Harms

**Overdiagnosis and overtreatment** - Some of the cancers and some of the early cell changes (carcinoma in situ) that are found by screening grow so slowly that they would never have developed into a real cancer. Many of these screen-detected "pseudo-cancers" would even have disappeared spontaneously, if they had been left alone, without treatment.

Since it is not possible to tell the difference between the dangerous and the harmless cell changes and cancers, all of them are treated. Therefore, screening results in treatment of many women for a cancer disease they do not have, and that they will not get. Based on the randomised trials, it appears that:

*If 2000 women are screened regularly for 10 years, 10 healthy women will be turned into cancer patients and will be treated unnecessarily. These women will have either a part of their breast or the whole breast removed, and they will often receive radiotherapy, and sometimes chemotherapy. Treatment of these healthy women increases their risk of dying, e.g. from heart disease and cancer.*

*Unfortunately, some of the early cell changes (carcinoma in situ) are often found in several places in the breast. Therefore, the whole breast is removed in one out of four of these cases, although only a minority of the cell changes would have developed into cancer.*

**More extensive surgery and aftertreatment** - For women diagnosed at screening with a small "true" cancer, the operation and aftertreatment may be less extensive than if the cancer had been detected at a later time. However, as screening also leads to overdiagnosis and subsequent overtreatment of healthy women,

more women in total will have a breast removed when there is screening than if there had not been screening. Also, more women will receive radiotherapy unnecessarily.

**False alarm** - If the X-ray shows something that might be cancer, the woman is recalled for additional investigations. In some cases it turns out that what was seen on the X-ray was benign, and that it was therefore a false alarm.

*If 2000 women are screened regularly for 10 years, about 200 healthy women will experience a false alarm. The psychological strain until it is known whether or not there is a cancer can be severe. Many women experience anxiety, worry, despondency, sleeping problems, changes in the relationships with family, friends and acquaintances, and a change in sex drive. This can go on for months, and in the long term some women will feel more vulnerable about disease and will see a doctor more often.*

**Pain at the examination** - The breast is squeezed flat between two plates while an X-ray is taken. It only takes a moment, but about half of the women find it painful.

**False reassurance** - Mammography screening cannot detect all cancers. It is important, therefore, that the woman sees a doctor if she finds a lump in her breast, even if she has had a mammogram recently.

## Documentation for the facts and figures

In our scientific publications and in a book (1), we have explained in detail why information on the benefits and harms of breast screening provided in invitations for screening (1-3) and on web sites from cancer charities and other interest groups (1,4) is often misleading. We provide the background for our information in this leaflet below.

## Benefits

The most reliable results come from trials where the women have been randomly assigned to be screened with mammography or not to be screened. About 600,000 healthy women have participated in such trials (5). Half of the trials have been carried out in Sweden. A review of the Swedish trials from 1993 showed that screening reduced breast cancer mortality by 29% (6).

While this appears to be a large effect, here's what the 29% actually means. The review noted that after 10 years of screening, this reduction in breast cancer mortality corresponded to one woman out of 1000 avoiding dying from breast cancer.

The benefit of screening is thus very small. The reason for this is that in a period of 10 years only 3 women out of 1000 get breast cancer and die from it. The absolute reduction in breast cancer mortality was therefore only 0.1% (1 out of 1000) after 10 years in the Swedish trials. Screening for more than 10 years might increase the benefit, but it will also increase the harms.

The reason why we only describe a period of 10 years is that there are no reliable data for longer time periods.

Another review of the Swedish trials, from 2002, found a reduction in breast cancer mortality of only 15% with one method of calculation, and 20% with another method (7).

The two reviews of the Swedish trials have the shortcoming that the researchers did not take into account that some of the trials had been better done - and therefore are more reliable - than others (5).

The most thorough evaluation of all the randomised trials that exists is a Cochrane review (5). Here, the breast cancer mortality reduction was 10% in the most reliable trials and 25% in the least reliable trials. Since unreliable trials usually overestimate the effect, the reduction was estimated to be 15% (5).

Another thorough evaluation of the trials by independent researchers was carried out on behalf of the U.S. Preventive

Services Task Force. The researchers found a reduction of 16% (8).

Hence, these two systematic reviews found an effect on breast cancer mortality that was only half as large as in the first Swedish review from 1993. This means that regular screening of 2000 women for 10 years is necessary to save one of them from dying of breast cancer. The absolute reduction in breast cancer mortality was therefore only 0.05%.

Screening does not reduce the overall risk of dying, or the overall risk of dying from cancer (including breast cancer) (5). It therefore seems that women who go to screening do not live longer than women who do not go to screening.

Since the randomised trials were carried out, there have been important advances in diagnosis and treatment. This means that the effect of screening is smaller today. In fact, more recent, rigorous studies suggest that screening is no longer effective (1,9).

In Denmark, for example, screening was introduced in only two regions, corresponding to one fifth of the population. Throughout 17 years, women living in the rest of the country were not offered screening, and very few of these women had a screening mammogram. The annual decline in breast cancer mortality in the age group that could benefit from screening was 1% in the screened areas and 2% in the non-screened areas. In women who were too young to benefit from screening the declines were larger, 5% and 6%, respectively (10). This means that these declines in breast cancer mortality were not caused by screening but by better treatment.

Women below age 50 years are rarely offered screening in Europe. Yet there was a 37% drop in breast cancer mortality between 1989 and 2005 in these women, whereas it was only 21% in women aged 50-69 years (11). The declines began before organised screening in many countries.

A comparison of three pairs of neighbouring European countries that had introduced screening 10-15 years apart showed no relation between screening start and the reduction in breast cancer mortality (12). The reduction in breast cancer mortality was about



the same in these six European countries as in the United States (13).

An Australian study found that most, if not all, of the reduction in breast cancer mortality could be attributed to improved treatment (hormonal and chemotherapy) (14).

Data on stage and size of tumours provide an explanation for these negative findings (1). If screening does not reduce the occurrence of advanced cancers, then it cannot work. A systematic review of studies from seven countries showed that the rate of advanced breast cancers (defined as malignant tumours larger than 20 millimetres) was not affected by screening (15).

## Harms

The randomised trials showed that screening increased the number of women who were given a breast cancer diagnosis and were treated by 30%, compared with the women in the group that was not screened (5). This high level of overdiagnosis has also been found in large population studies from European countries, the United States, Canada and Australia. A systematic review of countries with organised screening programmes found 52% overdiagnosis (16). In Denmark, which has a non-screened control group, the overdiagnosis rate was 33% (17).

From the Cochrane review (5) it can be calculated what an overdiagnosis of 30% means for women. In the trials from Canada and Malmö, either the whole breast or part of it was removed from 1424 women in the screened group and from 1083 women in the unscreened control group. Since the control group comprised 66,154 women, the overdiagnosis constituted  $(1424-1083)/66,154 \times 2000 = 10$  women per 2000 screened women.

Thus, by screening 2000 women, 10 healthy women will receive a cancer diagnosis they would not have had if they had not been screened. They have breast surgery and usually receive other treatments, too, as if they were cancer patients. Without screening, they would have been OK.

Studies from the United States, Sweden and Norway suggest that half or more of the screen-detected cancers would have disappeared spontaneously, if they had been left alone, without

any treatment at all (18). Most of the earliest cell changes found at screening (carcinoma in situ) are also harmless, as they would never have progressed into invasive cancer (5).

The Cochrane review showed that the breast was removed in 20% more women in the screened group than in the control group (5). Other studies have also shown that more women have a breast removed when there is screening than when there is no screening (5). This has been confirmed with data from both the Danish (9) and the Norwegian (19) screening programmes. Furthermore, in the United Kingdom the whole breast was removed in 29% of those cases where the cancerous lesions were detected in very early stages when they had not spread, although those should have been the very cases where a less extensive operation could have been performed (20).

The psychological strain until it is known whether or not there is a cancer, can be severe (5,21). In the United States it has been calculated that after 10 rounds of screening, 49% of healthy women will have experienced a false alarm (22). In Norway, 21% will have experienced a false alarm after 10 rounds of screening (23).

However, the numbers for Norway and most other countries are too low because recalls due to poor technical quality of the mammogram have usually not been included (23). As the women are just as affected by such recalls as by a real suspicion of cancer (21), they should be counted as false alarms. In Copenhagen, 13% will have experienced a false alarm after 10 years of screening (5 rounds) (24). Using 10% as an overall estimate for Europe, this corresponds to 200 healthy women for each 2000 women screened for 10 years.

As mentioned earlier, about half of women experience pain at mammography when the breasts are squeezed flat. This appears from a systematic review of the relevant studies (25).

## Why have we written this leaflet?

In 1999, when considerable doubt had been raised in Denmark about the value of mammography screening, the Danish National Board of Health asked physician and scientist Peter C Gøtzsche

from The Nordic Cochrane Centre to assess the mammography screening trials (1). The centre's report later became extended as a Cochrane review (5), which is the most comprehensive review of the screening trials there is.

The Nordic Cochrane Centre is an independent research centre, which has published more research on mammography screening than any other independent institution. In 2006, after we had published a critical review of invitations to screening in several countries, including Denmark (2), the Danish National Board of Health held a meeting asking for suggestions for revisions of the Board's information leaflet.

The four authors of the leaflet you are currently reading were invited to the meeting. The Danish National Board of Health paid no attention to our comments and published a revised leaflet that we felt contained serious errors (1). We therefore decided to write our own leaflet, which we published in 2008 after having tested it carefully, both among health professionals and lay people.

As the official leaflet being used in the United Kingdom was equally misleading as the one from the Danish National Board of Health, and as those updating it had been similarly resistant to good arguments as the Board, we wrote a paper solely about the shortcomings of the UK leaflet. We published our observations in the British Medical Journal in 2009 together with a translation of our own leaflet (3).

The US Center for Medical Consumers called our leaflet "the first honest mammography information for women written by health professionals" (1). We think this is the reason that volunteers have translated it into other languages so that it now exists in 13 languages.

The information women receive when they are invited to attend for screening with mammography is insufficient, one-sided and erroneous (1-3). The letters of invitation emphasize the benefits of screening, but they do not describe how many healthy women will experience the most important harms, overdiagnosis and overtreatment.

When women are invited to mammography screening, the practice often is that, when they receive a letter about screening, they are

also given an appointment time for the examination. This procedure puts pressure on women to attend. Because of this, their participation becomes less voluntary. In some countries, they are even phoned at home and encouraged to attend, which is also potentially coercive.

Information on the internet, e.g. on cancer charity web sites, often omits the most important harms. Or they are described as benefits. For example, screening is said to reduce the risk that a woman loses her breast (1). This is not true. Because of overdiagnosis and overtreatment, screening increases the risk of mastectomy.

We recommend the following websites if you would like further information:

- the National Breast Cancer Coalition ([www.stopbreastcancer.org](http://www.stopbreastcancer.org)), whose members are mainly women with breast cancer, and
- the Center for Medical Consumers ([www.medicalconsumers.org](http://www.medicalconsumers.org))

This leaflet provides necessary, basic information about the benefits and harms of screening with mammography to enable a woman - together with her family and her doctor if she wishes - to make a free and informed decision whether to attend for screening.

The leaflet is available at [www.cochrane.dk](http://www.cochrane.dk) and [www.screening.dk](http://www.screening.dk). We welcome comments and criticisms, at [general@cochrane.dk](mailto:general@cochrane.dk).

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Further information can be obtained by contacting the doctor