BEAVER DAM

Eye Study and Epidemiology of Hearing Loss Study
> What are the Beaver Dam Studies?

The Beaver Dam Eye Study (BDES) and the Epidemiology of Hearing Loss Study (EHLS) are population-based, longitudinal studies of age-related eye disease and hearing loss. The purpose of the studies is to evaluate how common age-related eye disease, hearing loss and other sensory disorders are in the community and to identify risk factors associated with these conditions. Funded by the National Eye Institute and the National Institute on Aging, these studies offer a unique opportunity to understand how vision and hearing change as people age. Because the studies are population-based—meaning that everyone within the community is included, rather than only those individuals who have problems or seek medical care—the results provide valuable information regarding how many people are affected by these conditions. We also are interested in why some people develop these conditions while others don’t. The longitudinal nature of the study—participants are re-examined every five years—provides information about the progression of these conditions over time. It also provides clues as to what may make these conditions develop and worsen.

> Why Beaver Dam?

Many factors contributed to the decision to choose Beaver Dam as the site of the studies. The community is an ideal size to provide the right number of study participants for evaluation and is representative of other communities this size in age, economic status and occupation. It is also a very stable community with few people moving away. In addition, there is strong support of these studies by community leaders, civic groups and the local medical care providers.

> History of the Studies

Examinations for The Beaver Dam Eye Study began in March of 1988, however, preparations for a study of this magnitude began months earlier. At the time of the five-year follow-up for the eye study (March 1993) the Epidemiology of Hearing Loss Study was funded and hearing testing was added to the examination.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1987–88</td>
<td>Identified 5,924 people, age 43–84 years, living in Beaver Dam</td>
</tr>
<tr>
<td>1988–90</td>
<td>First Beaver Dam Eye Study Examination</td>
</tr>
</tbody>
</table>
| 1993–95 | First Epidemiology of Hearing Loss Study Examination  
Second Eye Study Examination |
| 1995–97 | Hearing Study Examination follow-up for people 75 years of age and older |
| 1998–2000 | Third Eye Study Examination  
5-year follow-up Hearing Study Examination |
| 2000–02 | 7-year follow-up Hearing Study telephone interview |
> **What happens in the examinations?**

The BDES and EHLS examinations are conducted in a suite of offices on the 4th floor in the old section of the Beaver Dam Community Hospital. The eye examination typically takes 1–2 hours and consists of:

- Vision testing
- Examination of the front and back portions of the eye
- Evaluation for cataract and macular degeneration
- Health history questionnaire
- Blood pressure
- Height, weight, waist and hip measures

The hearing examination takes approximately 1–2 hours and consists of:

- Hearing testing
- Examination of the ear and measure of middle ear functioning
- A hearing-related health history questionnaire
- Quality of life and physical functioning
- Olfaction (sense of smell) testing

In addition to the above testing, blood samples have been collected to measure blood sugar, cholesterol levels and various other factors.

> **What are these conditions, and how many people have them?**

**CATARACT**

The photograph on the left shows a normal lens, the one on the right shows a lens with a cataract.

- 30% of study participants had a cataract at the first eye examination
- 25% of study participants who did not have a cataract at the first exam developed one by the five-year follow-up
MACULAR DEGENERATION

The photograph on the left shows a normal retina, with an arrow pointing to the macula, the area of the retina responsible for vision. The photograph on the right shows a macula with advanced age-related macular degeneration. The scarring in the retina causes a decrease in reading vision.

- 20% of study participants had signs of early macular degeneration at the first eye examination
- 11% of study participants who did not have early age-related macular degeneration at the first examination developed signs of this condition by the five-year follow-up

HEARING LOSS

Hearing levels are plotted on a graph called an audiogram. The figure on the left shows the audiogram of a person with normal hearing. The figure on the right is an audiogram of someone with a hearing loss. The numbers across the top of the audiogram represent the frequency or pitch of sound. As you move from left to
right across the audiogram, the pitch becomes higher. The numbers along the left side of the audiogram represent the loudness of the sound. The marks represent how loud a sound needed to be at a particular frequency in order to be heard.

- 45% of study participants had a hearing loss at the first hearing examination
- 21% of study participants who did not have a hearing loss at the first examination developed a hearing loss by the five-year follow-up

The Beaver Dam Studies have found that each of these conditions is more common than previously believed. By looking at how many of the people, free of these conditions at the first examination, developed them over time, we obtain information critical for understanding how risk factors are associated with these conditions. The Beaver Dam results provide some of the first measures of the risk of developing these conditions.

> What factors are associated with these conditions?

<table>
<thead>
<tr>
<th></th>
<th>Cataract</th>
<th>Macular Degeneration</th>
<th>Hearing Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family History</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Being Male</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>High Blood Pressure</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Atherosclerosis</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>✓</td>
<td></td>
<td>✓</td>
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<tr>
<td>Emphysema</td>
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<td>✓</td>
<td></td>
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<tr>
<td>Gout</td>
<td>✓</td>
<td></td>
<td></td>
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<tr>
<td>Smoking</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Obesity</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Sunlight Exposure</td>
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<td>✓</td>
<td></td>
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<tr>
<td>Ultraviolet-B Exposure</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head Injury</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

> Why is this information important?

The table above shows some of the factors that we have found to be associated with these conditions. While some of these factors, such as family history and being male, cannot be changed, other factors such as smoking and high blood pressure are “modifiable.” Once we understand the risk factors associated with these conditions, it may be possible to identify ways to slow their progression and possibly prevent them from occurring.
The Beaver Dam Studies are recognized worldwide

A number of studies in the United States as well as in other countries are replicating the Beaver Dam Studies findings. Studies in Australia, The Netherlands and Norway have been modeled after the Beaver Dam Studies to determine if hearing and/or vision loss patterns found in Beaver Dam are similar in other countries. Studies conducted in Miami, Florida and Los Angeles, California have used the same procedures developed by the Beaver Dam Studies to investigate vision and/or hearing loss in minority populations.

Results from the Eye Study and Hearing Study are held in high regard by researchers around the world. Drs. Klein, Klein and Cruickshanks present study findings at scientific meetings in the United States as well as at international meetings around the world. More than 150 articles regarding study findings have been published in scientific journals.

Future directions

Both the Beaver Dam Eye Study and the Epidemiology of Hearing Loss study began a new round of examinations in March of 2003. These examinations will tell us about the long-term incidence of cataract, macular degeneration, vision loss and hearing loss. We will investigate the association of atherosclerosis (as measured by the carotid artery ultrasounds during the previous examination phase) with vision and hearing loss and the progression of these diseases. This examination phase will also provide the first information on the incidence of loss of smell in the United States.

Scientists appointed by the National Institutes of Health to review the funding applications said of the studies:

"This longitudinal study has yielded substantial amounts of important information that should prove highly useful to society as the population becomes more elderly." (Eye Study)
"The strength of the study is unparalleled elsewhere in the country. . . the University of Wisconsin and Beaver Dam is an outstanding cooperative arrangement to conduct this study. The committed investigators, participants and community physicians make this a unique opportunity to collect such valuable aging information."

(Hearing Study)

> Community Support

The Beaver Dam Advisory Board was established in 1988. Community leaders, medical professionals and representatives from area civic organizations are invited to serve on the board. The purpose of the Advisory Board is to provide feedback to the researchers regarding the community perceptions of the Eye and Hearing Studies. The input of the Advisory Board members is invaluable to the study staff in planning future research projects.

> The Beaver Dam studies are successful because of you!

Just as the city of Framingham, Massachusetts has taught us much about preventing heart disease, the city of Beaver Dam, Wisconsin is helping to uncover ways to prevent and treat the major causes of sensory loss in aging. There are few population-based studies of any health problem that have continued this long with such good participation. We are fortunate to work with such a wonderful group of citizens that have willingly given their time for this scientific endeavor. We appreciate your participation in this research program. With your help, we are beginning to identify ways to reduce the burden of sensory impairments in older adults everywhere.

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