PRESS RELEASE

Reliable Medical Image Data for the German National Cohort – Fraunhofer MEVIS Delivers Digital Infrastructure for Germany's Largest Health Study

June marks the beginning of the National Cohort (NAKO), a long-term study of 200,000 subjects, the broadest of its kind in Germany to date. Gathering MRI data of up to 30,000 subjects is central to the study. These images help scientists gain valuable insight into the formation and development of diseases. As a partner in this research project, the Fraunhofer Institute for Medical Image Computing MEVIS in Bremen is responsible for making images directly available in reliably high quality – a significant prerequisite for the success of the study. The software system from MEVIS facilitates the participating radiologists' access to the image data. This allows experts to notice abnormalities in the scans quickly and reliably and notify test subjects of serious problems promptly.

How do diseases such as diabetes, cancer, or dementia arise? What are the effects of genetics, environment, and lifestyle? The National Cohort will tackle these questions. The results of the study, which is planned to run for the next ten years, should improve both disease prevention and therapy. Since May 2014, 200,000 randomly selected men and women between the ages of 20 and 69 have been invited to undergo a comprehensive examination. During the examination, which lasts up to four hours, medical personnel check the subject's weight, blood pressure, and heart rate and inquire about the subject's lifestyle and social environment. 40,000 subjects will be surveyed in more detail, undergoing a 24-hour sleep analysis, a smell test, and 3D echocardiography.

Another central element of the longitudinal study is the examination of 30,000 subjects with magnetic resonance imaging (MRI), which produces 3D images of the inside of the body without using harmful x-rays. Thereafter, a whole-body scan is produced at relatively low resolution. "To do this, MR scanners will be procured for five locations," says MEVIS project director Prof. Matthias Günther. "To ensure that the data from these five locations can be compared, we will use the same type of device at each location, and examinations will follow the same procedure."

After one of the five MRI centers produces a scan, the data will be uploaded directly to the server in Bremen. Data privacy is of utmost importance and is respected throughout the project: all data is 'pseudonymized', meaning that names of subjects are replaced with reference numbers. In addition, the images are transferred to Bremen over secure connections. For each subject, 6,000 images are taken, creating a data volume of approximately three gigabytes.

This is where MEVIS experts will apply their expertise: the Fraunhofer institute will serve as the collection center to preprocess medical image data and ensure its consistency. The data processed in Bremen will be inspected for incidental results by participating radiologists across Germany and

stored in a long-term archive at the University of Greifswald and the German Cancer Research Center (DKFZ) in Heidelberg.

Next, quality assurance software is employed. "This software automatically analyzes the quality of image data and ensures that it can be compared with other data," says Günther. The software checks whether all data is available or if some is missing. If images are produced twice, the software decides which should be used for the radiologists' reading. In addition, the software checks all relevant measurement parameters and recognizes when the MR scanner produces an error or when a scan is blurry due to patient movement. "We notify the centers of deviations immediately, so that the personnel know when something goes wrong," says Günther. "This minimizes the chance that the same error occurs during the next scan."

Because up to 30,000 subjects will undergo MRI scans in the upcoming years, signs of disease may be discovered in some, such as early-stage tumors that are not yet felt by the patient but that could soon become dangerous. For this reason, radiologists at all five MRI centers review the images. They aim to inform subjects of potential problems within days, a requirement for timely diagnosis or treatment.

To achieve this, Fraunhofer MEVIS uses a browser-based implementation for remote inspection. Instead of sending complete, quality-assured image data via internet from Bremen to the five MRI centers and the reading center in Heidelberg, radiologists can easily review the scans in a web browser without needing to download the original data. This solution is integrated in a web-based platform developed and employed at the Greifswald University Hospital and the DKFZ in Heidelberg and functions as the central point for standardized input of all NAKO examination data. "This web-based implementation alleviates and accelerates quick access to information, so that clinicians can find possible abnormalities without delay," explains Günther. "In addition, our software informs whether a radiologist at the MRI center has noticed something."

The MR scanners will deliver images for the National Cohort for four years; the longitudinal study is financed for this time span. "It makes sense to examine the subjects again afterwards," says Günther. Before-and-after comparisons could generate valuable insight into the formation of diseases. According to Günther, "This is our goal, but the funding for the second phase is still pending."

The National Cohort (NAKO)
Researching together for a healthier future is the goal of the National Cohort, currently the largest population study in Germany. In the upcoming years, 200,000 men and women across the country between the ages of 20 and 69 will be medically examined in 18 study centers and surveyed about their lifestyles. With the help of medical data, biosamples, and questionnaires about the participants, chronic illnesses will be more thoroughly researched. NAKO researchers hope to answer the following questions: How do diseases form? Are there factors that promote diseases formation? What roles do genetics, exposure to environmental factors, social contact, or lifestyle play? Can we protect ourselves from these diseases? How can these diseases be detected early? The project is financed by the Federal Ministry of Education and Research, 14 German states, and the Helmholtz Association of German Research Centers.
www.nationale-kohorte.de/index_en.html

Embedded in a worldwide network of clinical and academic partners, **Fraunhofer MEVIS** develops real-world software solutions for image-supported early detection, diagnosis, and therapy. Strong focus is placed on cancer as well as diseases of the circulatory system, brain, breast, liver, and lung. The goal is to detect diseases earlier and more reliably, tailor treatments to each individual, and make therapeutic success more measurable. In addition, the institute develops software systems for industrial partners to undertake image-based studies to determine the effectiveness of medicine and contrast agents. To reach its goals, Fraunhofer MEVIS works closely with medical technology and pharmaceutical companies, providing solutions for the entire chain of development from applied research to certified medical products.

The **Fraunhofer-Gesellschaft** is the leading organization for applied research in Europe. Its research activities are conducted by 67 institutes and research units at locations throughout Germany. The Fraunhofer-Gesellschaft employs a staff of more than 23,000, who work with an annual research budget totaling 2 billion euros. Of this sum, more than 1.7 billion euros is generated through contract research. More than 70 percent of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. International collaborations with excellent research partners and innovative companies around the world ensure direct access to regions of the greatest importance to present and future scientific progress and economic development.