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-----**Fraunhofer ITWM Participates in Pilot Project HealthFaCT-Cor**

Optimizing Medical Care – Even More In Times Of Corona

Together with other scientific institutions, the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern has investigated how medical care in rural areas can be ensured and improved, especially during the Corona pandemic. Mathematically based optimization and decision systems support the planning of ambulance transports, emergency pharmacy services and the establishment of vaccination centers. The pilot project »HealthFaCT-Cor« was funded by the German Federal Ministry of Education and Research (BMBF).

The Corona pandemic put the healthcare system to the acid test. But even before the pandemic, an aging society, the centralization of medical facilities and dwindling resources posed major challenges to outpatient medical care. Especially in rural areas.

In the HealthFaCT pilot project, which was extended shortly after the start of the pandemic and has been renamed to HealthFaCT-Cor, algorithm-based decision-making systems were developed to support control centers, public health departments and pharmacists' associations. A first scientific [paper](#) was recently published. The Fraunhofer ITWM team was involved in all three research areas. »The corona crisis has impressively shown the importance of careful medical care planning«, says Dr. Neele Leithäuser, deputy head of department at Fraunhofer ITWM. »The already tense situation was further aggravated by a previously unknown disease, extensive hygiene and protection measures, and increased sick leave in the care facilities.«

Hedging Uncertainties, Optimizing Timing

In the project, researchers at Fraunhofer ITWM developed a data-driven tool which focuses on the decision-makers: It shows various options objectively and offers opportunities to find the best solution interactively. For this purpose, the researchers combine optimization methods with insights from a detailed data analysis. »From a mathematical point of view, mainly location, covering as well as route planning problems are investigated. The most challenging aspects are robust hedging against uncertainties and real-time optimization«, Leithäuser explains.

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Even before the approval of the first vaccines against COVID-19, the researchers at Fraunhofer ITWM have faced the completely new task of planning vaccination centers. Together with the Robert Koch Institute (RKI) and the Technical University of Kaiserslautern, the modeling of the strategic planning of emergency physician locations was adapted to this special task. The result was a mathematically sound decision support for vaccine distribution that shows good trade-offs in terms of how long vaccinees need to travel and the number of needed locations.

»At the planning stage, we assumed 500,000 vaccine doses per week. Not only this number has changed, but by involving general practitioners as well, we now have different requirements«, Leithäuser explains. »For us, however, it was a good practical test that showed us that the planning based on our modeling can also be implemented and adapted very well in other situations.«

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Securing Pharmaceutical Supply

Another research focus is the nationwide supply of people with medicines, which was already proving to be a challenge before Corona: the demand for medicines from the aging society is increasing, while the already low density of pharmacies threatens to decline further. Optimization models for fair emergency service planning and location planning were developed to close gaps in supply. HealthFaCT-Cor aims to ensure a »robust« 24-hour supply of pharmaceuticals. This means that despite short-term failures of emergency services, e.g. due to quarantine, every citizen should be able to reach an emergency pharmacy within a reasonable distance. In the project, a web-based tool for the analysis of emergency service schedules has been developed at the Fraunhofer ITWM in cooperation with the RWTH Aachen University, which is currently being evaluated by the Pharmacist Chamber North-Rhine.

Patient Transport of Infected and Non-Infected Patients

Optimizing patient transport is also an important component of HealthFaCT-Cor. »The particular difficulty in this area is that urgent ad hoc transports that become known at short notice lead to delays in transports that can be scheduled«, explains Prof. Dr. Frauke Liers from the Department of Data Science at Friedrich Alexander University Erlangen-Nuremberg, who is coordinating the HealthFaCT-Cor collaborative project. »However, such delays can be problematic, for example when appointments are scheduled for surgeries or dialysis.« Transport logistics under pandemic conditions were based on the results of infection models and, for example, ambulances were divided into pools: those intended exclusively for patients with known COVID-19 infection and those transporting all other people.

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About the Project:

Since 2017, a consortium of researchers from Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), RWTH Aachen University, TU Kaiserslautern, and the Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern have been investigating how to better plan pharmacy emergency services, emergency doctor locations, and ambulance transports in three subprojects of the BMBF-funded project »Health: Facility Location, Covering, and Transport« (HealthFaCT).

In order to develop helpful tools for difficult conditions during the Corona pandemic, the BMBF approved an increase in funding for the project: HealthFaCT was followed by HealthFaCT-Cor, with the suffix for »Corona«. The project ended on December 31, 2020, and the results are expected to make a valuable contribution in the future to both day-to-day healthcare planning and crisis management. In a follow-up project, Fraunhofer ITWM is currently working on a study to optimize the location of ambulance stations in the rescue service areas Bad Kreuznach and Rheinhessen.

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Visuals:

GEFÖRDERT VOM



Bundesministerium
für Bildung
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In the HealthFaCT-Cor project, a team led by Dr. Neele Leithäuser (left) of the Fraunhofer Institute for Industrial Mathematics ITWM developed a software-based optimization and decision-making system to improve medical care. © Fraunhofer ITWM

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About the Fraunhofer Institute for Industrial Mathematics ITWM

The Fraunhofer Institute for Industrial Mathematics ITWM in Kaiserslautern is one of the largest research institutes for industrial mathematics worldwide. We see our task in further developing mathematics as a key technology and providing innovative impetus. Our focus is on the implementation of mathematical methods and technology in application projects and their further development in research projects. The close cooperation with partners from industry guarantees the high practical relevance of our work.

Their integral components are consulting, implementation and support in the application of high-performance computer technology and the provision of tailor-made software solutions. Our various competencies address a wide range of customers: automotive industry, mechanical engineering, textile industry, energy and finance. This also benefits from our good networking, for example in the High performance center "Simulation- and software-based innovation".