



The Lancet Digital Health publishes the results of an international study led by Lille-based researchers on weight loss prediction after bariatric surgery

The Lille-based teams under Professors François Pattou (Lille University, Lille University Hospital, INSERM and the Institut Pasteur in Lille) and Philippe Preux (Lille University and INRIA) have developed a digital medical device which can predict the expected weight loss of an individual patient in the 5 years following their bariatric surgery. Based on 7 variables as well as artificial intelligence, it was developed from a cohort of 1,500 patients operated on and monitored for more than 15 years at Lille University Hospital. The effectiveness of the model was then validated among more than 10,000 patients monitored in France (Montpellier, Lyon, Valenciennes and Boulogne) and other countries (the Netherlands, Finland, Sweden, Switzerland, Singapore, Mexico and Brazil), as part of the European IMI Sophia project. The application is already online and available to healthcare teams and patients. The publication of these results in the prestigious Lancet Digital Health journal highlights the excellence of this original interdisciplinary project, initiated 3 years ago.

Personalising patient care with artificial intelligence

In response to the increasing prevalence of obesity in our societies, bariatric surgery has proven to be an effective solution for sustainable weight loss and extended life expectancy in good health. It is nevertheless difficult to predict long-term weight loss after an operation. Numerous models have been developed to provide surgeons with tools to predict this post-operative weight loss. For these models to be relevant from a clinical perspective, however, they must enable weight loss prediction over a period of at least 5 years.

Professor François Pattou, head of the General and Endocrine Surgery Department at Lille University Hospital, and director of the Translational Research Laboratory for Diabetes (INSERM, the Pasteur Institut in Lille, Lille University and Lille University Hospital), teamed up with Philippe Preux, Professor at Lille University and head of the INRIA SCOOOL project-team (part of the Lille University-CNRS-Centrale Lille Institut joint laboratory, CRIStAL), to develop his own tool based on data relating to outcomes of bariatric surgery, which he has been collecting since 2006. Using this data, the researchers thus implemented algorithms capable of predicting expected weight loss following bariatric surgery. 'We had a vast amount of data for each patient, but the number of patients was limited to a few thousand', Patrick Saux, INRIA PhD student and main author of the publication, explains. 'We therefore offset this reduced sample by calling on the expertise of doctors and nutritionists. This is the real advantage of interdisciplinary work.'

An outstanding collaboration between artificial intelligence researchers and healthcare professionals

The model takes the form of a curve, specific to each individual, which describes the expected weight change in the 5 years following surgery. This offers several advantages; for the patient firstly, who can easily visualise their future weight loss. 'Some patients have unrealistic expectations after bariatric surgery. A visual support helps to avoid too great a gulf between expectation and reality and enables better acceptance of outcome of the operation', Patrick Saux believes. For doctors, secondly, as a large discrepancy with the expected change may point to a complication, the need for further surgery or a modification in post-operative care.

The algorithms used for this model draw on decision trees, i.e. series of questions such as the patient's age, weight, smoker or non-smoker, presence of diabetes and the type of surgery planned. These highly robust algorithms offer relatively accurate predictions and are easy to interpret. Doctors were thus able to check if the algorithms took the relevant criteria sufficiently into account when producing their predictions.

Healthcare experts also contributed to fine-tuning the smoothing algorithms: as the model was created solely from data collected periodically (prior to surgery, then three months, one year and two years, etc. after surgery), the gaps between these data collections had to be filled. 'Here, again, doctors know what a weight curve usually looks like, so they help us to look in the right direction' Patrick Saux says.

An article in *The Lancet Digital Health* presents the research results

The aims of the study were as follows:

- > Design a system to predict post-operative weight loss
- > Study the model's effectiveness on a global scale, firstly by validating the trajectories predicted by the algorithms in ten independent cohorts, in Europe but also Singapore, Mexico and Sao Paulo. The results revealed the advanced performance of the new algorithm compared to existing models. This study also confirmed the impact of the type of operation, the duration of diabetes in patients and differences between smokers and non-smokers.
- > Implement the model in a user-friendly tool, enabling an individual pre-operative prediction of the post-operative weight loss trajectory.

At present, one of the purposes of this tool is to predict the usefulness of post-operative visits and enlighten clinical decision-making. The tool is available from the following address: bariatric-weight-trajectory-prediction.univ-lille.fr

10,231 participants monitored over **5** years in **8** countries and **3** continents

About Lille University

The University of Lille is an experimental public institution, certified with the 'French Excellence Initiative' label, and one of France's major public research and higher education institutions. It has 80,000 students (10% from overseas) across its 15 faculties, schools, institutions and its 64 research units. The University of Lille is firmly rooted in the Métropole Européenne de Lille (MEL) and the Hauts-de-France region, and is committed to social responsibility and international outreach. The University strives for scientific excellence, technological innovation, socioeconomic development and the self-fulfilment of all those working and studying there. Particularly attuned to the needs of its region, the University of Lille develops projects designed to be useful to its ecosystem and at the heart of our society's technological, economic, health, social and environmental transitions.

About Lille University Hospital

With more than 16,000 professionals and 10 hospitals located on one campus, Lille University Hospital ranks among France's 4 major university hospitals and forms one of the largest campuses in Northern Europe. A centre for referral, teaching, innovation and research, it serves the 6 million inhabitants of the Hauts-de-France region. Open 24/7, the hospital ensures equal access to expert care and admits 1.4 million in- and out-patients annually. It provides community-based and referral care thanks to state-of-the-art equipment and medical expertise in numerous fields. It is the referring establishment for the Northern Defence Zone and leads the regional hospital group (GHT), which brings together 10 public health establishments from Lille Métropole and the surrounding area, working in close cooperation to improve patient care.

About Inria

INRIA is France's national institute for research in digital science and technology. World-class research, technological innovation and entrepreneurial risk are an integral part of its DNA. Within 220 project-teams, the majority of which work jointly with major research universities, more than 3,900 researchers and engineers explore new paths, often through an interdisciplinary approach and in association with business partners to meet ambitious challenges. In its role as a technology institute, INRIA supports the diversity of innovation, from open-source software publishing to the creation of technology start-ups (DeepTech).

About INSERM

Founded in 1964, INSERM is a public science and technology institution, under the dual supervision of the Ministries for Health and Research. Dedicated to biological, medical and human health research, its activities extend from the research laboratory to the patient's bedside. On an international level, it works alongside the world's major institutions to address the challenges and further scientific progress in these fields.

About the Hauts-de-France region

Hauts-de-France is a rich breeding ground for scientists, researchers and excellence research & innovation establishments, all of which contributes to the employment prospects, economic growth and attractiveness of the region. The Regional Strategy for Higher Education, Research & Innovation (SRESRI), developed by all players, drives the region's major ambitions, including the desire to create a genuine virtuous circle between training, research & innovation, which addresses societal challenges through close academic and business collaboration. To achieve these goals, the Region thus supports higher education, research and innovation by investing in the quality of establishments, the recruitment of qualified staff and the carrying out of PhDs addressing key concerns for our region.

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This project is funded by the Hauts-de-France Regional Authority to the amount of €200 000 via its STIMuLE scheme and the setting up of a protocol with INRIA and Lille University to support the further development of the project.