

The COMplete-Project – Functional aging in healthy and heart failure



Background and idea of the project

Our life expectancy has risen steadily within the last decades. Yet, traditional, curative medicine often prolongs the phase of illness and infirmity rather than adding healthy years to our lives. If alternatively or additionally, more emphasis would be placed on improving physical fitness, the function of the heart, cardiovascular system, and musculature could be better preserved and we had a better chance to live a healthier and more independent life.

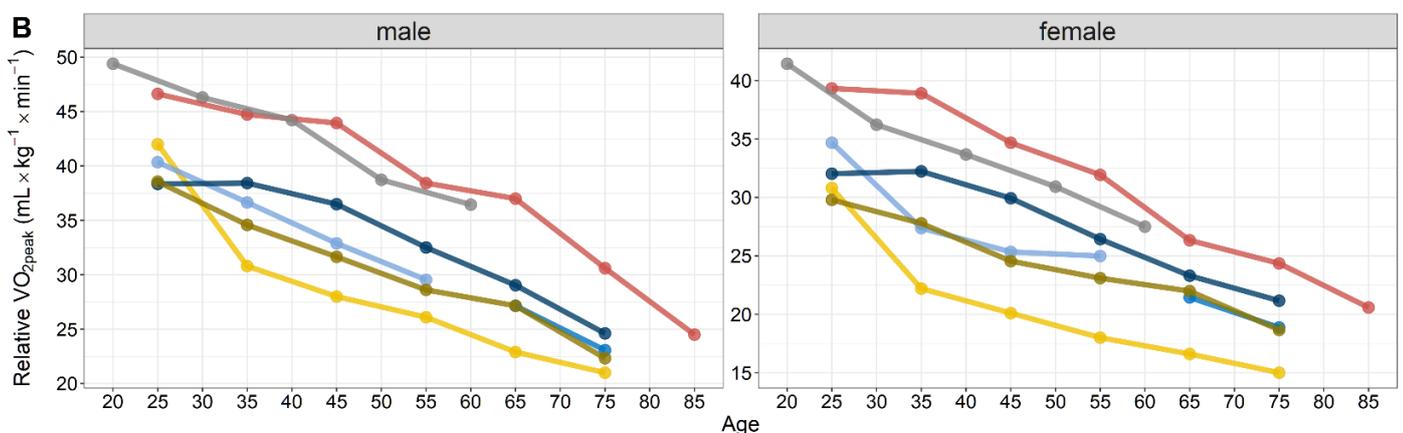
In the COMplete-Project, we tested the physical fitness of 680 healthy men and women from the Basel region aged between 20 and 91 years. Furthermore, 80 patients with heart failure were studied in the same way (Wagner et al BMC Cardiovasc Disord. 2019).

The research project has yielded important insights for prevention and treatment of chronic diseases, that have been published in recognized international journals. Some key findings are described below.

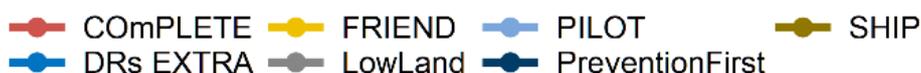
Key findings:

Cardiorespiratory fitness:

- The project was able to produce reference values for the cardiorespiratory fitness for Switzerland for the first time. These reference values are of major importance for sports physicians, cardiologists and pneumologists in clinical practice.



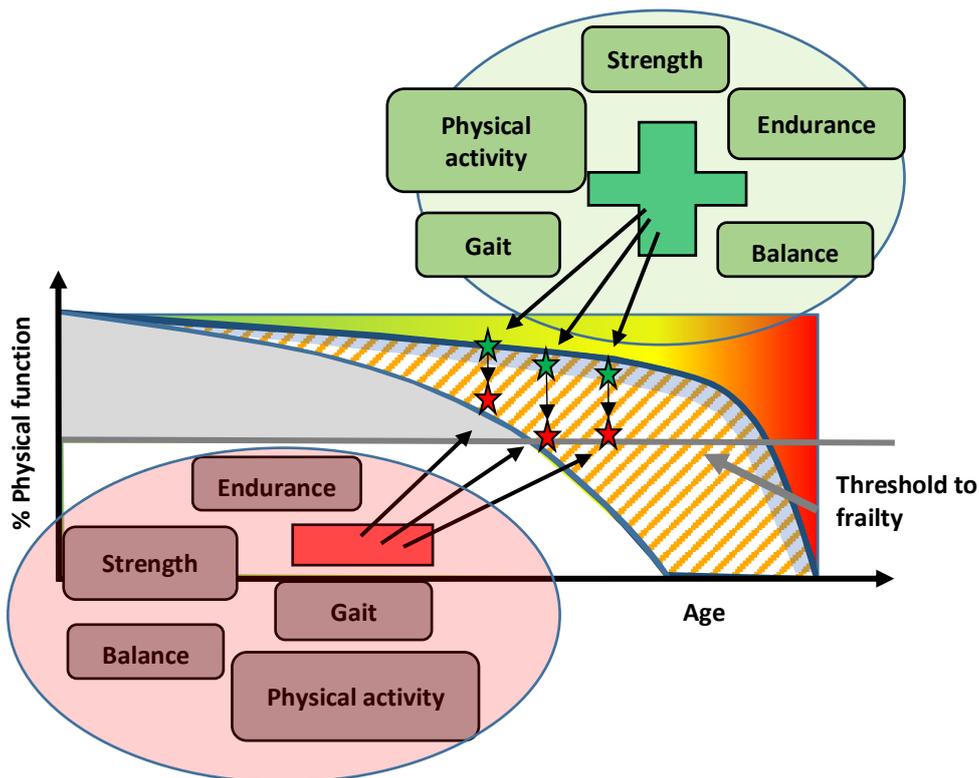
Per Wagner et al Med Sci Sports Exerc. 2021



- The reference values of the **maximum oxygen uptake** (VO_{2peak}) of **COMplete** turned out **very well** in an international comparison and only the LowLand cohort from the Netherlands could show similarly high values. The lowest values were those from the USA (FRIEND) (see Fig.).
- Moreover, we were able to show that there is a strong relationship between physical activity and cardiorespiratory fitness. We found that the more and intense the physical activity, the higher the cardiorespiratory fitness. A health-relevant difference was observed after only **four minutes of additional intense physical activity per day**. Light physical activities, on the other hand, had no beneficial effect on cardiorespiratory fitness.

Functional health-distance:

- Complex statistical methods have been used to distinguish between early stages of **heart failure** and healthy individuals based on dozens of biomarkers of fitness. Most **important** seems to be the **improvement in cardiorespiratory fitness**.
- This innovative development was achieved thanks to international cooperation.
- With the help of this calculated marker «Functional health-distance», cases with heart failure could be predicted successfully. The «Functional health-distance» was clearly superior in its predictive power to traditional clinical biomarkers such as blood pressure or markers of inflammation.
- The application and calculation of «Functional health-distance» from fitness biomarkers strengthens the evaluation of an individual's physical fitness and health status in research and clinical practice (Wagner et al Front Physiol. 2020).



This figure illustrates the theory behind health-distance. The physical function (y-axis) – i.e., overall fitness consisting of cardiorespiratory fitness, muscular strength and neuromuscular coordination – decreases with age. For healthy individuals (green stars), the progression is ideally nearly perpendicular, meaning it stays at a high level for a long time before the physical function declines at the end of life. The physical function is ideally good (green plus). The decline is faster in those with disease (red stars). The physical function is worse (red minus). They fall more quickly below the threshold of frailty (grey arrow points there), which may be characterized by a limited quality of life and dependence on outside help. We were not able to show this ideal picture of healthy aging, but

perhaps this will be possible with **COMplete2** when we **repeat** these studies in **2022/2023** and as many people as possible participate.

- The «Functional health-distance» seems to be a suitable target for interventions to decelerate the decline in physical fitness with aging and to **extend the time of healthy aging**. This brings the goal of living as long, healthy and independent a life as possible a little closer.

Further development of methods and discovery of new biomarkers:

- Thanks to the COMplete-Project, various measurement methods, including cardiopulmonary exercise testing, have been further developed and improved. With the help of criteria that emerged from the data of the COMplete study, cardiorespiratory fitness can be determined even more precisely in the future (*Wagner et al Med Sci Sports Exerc. 2020*).
- For the first time, a new biomarker of arterial health, the **vasoactive span**, was also studied in healthy 20-91 years old individuals. The vasoactive span is a marker of one of the most important cells in the body, endothelial cells. They line the arteries and are kept healthy by blood flow. **The more we move, the more blood flow, the healthier** are our arteries. The vasoactive span, measured at the brachial artery, presented itself as a good predictor for future cardiovascular disease in otherwise healthy adults. The research team hopes that this modern, non-invasive ultrasound method will be used in the future to more precisely target individuals for prevention who would benefit most from vasoprotective measures (*Königstein et al J Hypertens. 2021*).

And finally, the MOST IMPORTANT!

We would like to sincerely thank everyone that participated in the COMplete-Project. Without your support, this project would have come to fruition. We would be very pleased if you continued to participate and support us in our research projects on healthy aging in the future.

Warm regards from the COMplete-team

Principal investigator: Prof. Dr. Arno Schmidt-Trucksäss

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