ECOLE DOCTORALE PIERRE LOUIS DE SANTE PUBLIQUE A PARIS
EPIDEMIOLOGIE ET SCIENCES DE L'INFORMATION BIOMEDICALE

Directeur : Pierre-Yves Boëlle
Responsable pour l'Université Paris Cité : Isabelle Boutron

PROPOSITION DE SUJET DE THESE

SIGLE ET NOM DU LABORATOIRE : CRESS, CENTRE OF RESEARCH IN EPIDEMIOLOGY AND STATISTICS
NOM DE L'EQUIPE : EPIAGEING
DIRECTEUR DE THESE : SEVERINE SABIA
ADRESSE : UNIVERSITE PARIS CITE, 10 AVENUE DE VERDUN, 75010 PARIS

TITRE DE LA THÈSE : **Importance of the activity intensity distribution for health across the lifespan**

CO-ENCADRANT ÉVENTUEL : **Dr Eivind Aadland** (https://www.hvl.no/en/employee/?user=Eivind.Aadland)
EQUIPE DU CO-ENCADRANT : Department of Sport, Food and Natural Sciences
LABORATOIRE : Western Norway University of Applied Sciences, Inndalsveien 28, 5063 Bergen, Norvège

As part of a European consortium (https://labda-project.eu/), the project will be conducted in collaboration with **Dr Bjorge Herman Hansen** from the University of Agder in Norway (https://www.uia.no/en/research/helse-og-idrettsvitenskap/pahls-physical-activity-and-health-across-the-lifespan) and **Dr Nicolas Berger** from Sciensano in Belgium (https://www.sciensano.be/en/people/nicolas-berger).

PHD PROJECT

Background
Research on the association between accelerometer-measured physical activity and health has focussed on descriptors of time spent in a few, gross intensity categories, ignoring the continuum of energy expenditure. Most of the research is indeed on variables such as time in sedentary behaviour (defined as acceleration<40 milligravity (m*g*)), light physical activity (acceleration between 40-100 m*g*), and moderate-to-vigorous physical activity (acceleration between >100 m*g*). This is an oversimplification of the real activity intensity distribution. It is possible that differences for health are seen at different threshold and the dose-response association to differ in shape according to activity intensity.(1)

Research questions
This project aims to get insight of physical behaviour along the life course by examining the full spectrum of intensity instead of the most commonly used intensity levels (sedentary behaviour, light and moderate to vigorous physical activity). Using innovative statistical analyses and multiple data sources spanning ages from 3 to more than 80 years old, the project will examine how age shapes activity distribution and whether the association between the intensity distribution and health differs across age groups. This will provide knowledge for future targeted prevention.

The objectives of the present project are:
1. To describe the activity intensity distribution across the lifespan using multiple data sources

2. To explore and compare methods allowing for the use of the complete activity intensity distribution during waking hours: functional data analysis (FDA)(2) and multivariate pattern analysis (MPA)(3)
3. To identify activity intensities associated with health across the lifespan using the full intensity spectrum using both FDA & MPA and assess the interpretability of the findings.

les sources de données qui seront utilisées

A total of 4 data sources will be used to cover the full age range (from 3 to 85 years). All of them have been collected and are available to conduct the analysis. They include:

- Active Learning Norwegian Preschool(er)s study: 1003 Norwegian preschool children aged 3-5 years (4)
- Belgium National Food consumption survey 2014-2015: 1000 boys and girls aged between 3-17 years (5)
- Norwegian surveillance data : 4000 men and women aged between 20-85 years (6)
- Whitehall accelerometer sub-study: 4000 men and women aged between 60-83 years (2)

Methods

1. In order to describe the distribution of activity intensity over waking hours, functional data analysis with the activity intensity distribution as the outcome will be used to describe differences by age, sex, social background (education and/or parental education). (2)

2. In order to examine the association between activity intensity distribution and health outcome (BMI and fitness, two health outcomes that can be interpretable over the lifespan), both functional data analysis (7) and multivariate pattern analysis (3) will be used with the health measures as the dependent variable. Findings will be compared between the two approaches.

3. Analyses from point 2, will be split between age groups to examine the impact of age the associations of physical activity distribution and health. Whenever possible (based on the possibility of pooling the datasets), the interaction between age and the activity distribution will be tested.

Power

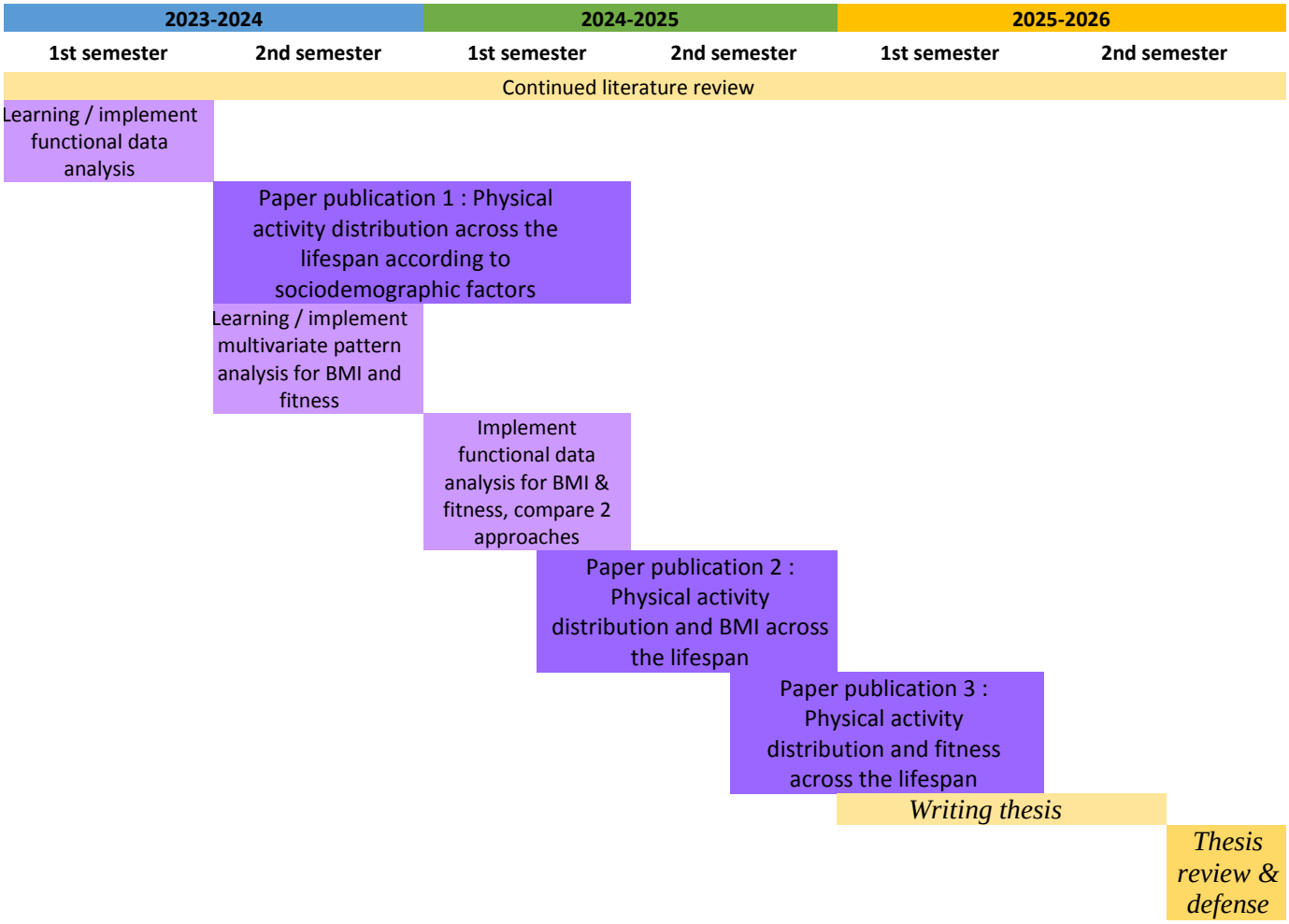
Using 4 datasets with each of them having more than 1000 individuals ensure statistical power and test of generalisability of findings.

References

1. Migueles J, Aadland E, Andersen L, Brønd J, Chastin S, Hansen B, Konstabel K, Kvalheim O, McGregor D, Rowlands A, Sabia S, Van Hees V, Walmsley R, Ortega F. The GRANADA consensus on analytical approaches to assess associations with accelerometer-determined physical behaviours (physical activity, sedentary behaviour, and sleep) in epidemiological studies. Br J Sports Med. 2021;In press.
2. Chen M, Yerramalla MS, van Hees VT, Bloomberg M, Landre B, Fayosse A, Benadjaoud MA, Sabia S. Individual Barriers to an Active Lifestyle at Older Ages Among Whitehall II Study Participants After 20 Years of Follow-up. JAMA network open. 2022;5:e226379.
3. Aadland E, Kvalheim OM, Hansen BH, Kriemler S, Ried-Larsen M, Wedderkopp N, Sardinha LB, Moller NC, Hallal PC, Anderssen SA, Northstone K, Andersen LB, International Children's Accelerometry Database C. The multivariate physical activity signature associated with metabolic health in children and youth: An International Children's Accelerometry Database (ICAD) analysis. Prev Med. 2020;141:106266.

4. Aadland E, Nilsen AKO, Haugland ES, Vabo KB, Aadland KN. The multivariate physical activity signatures associated with body mass index and waist-to-height ratio in 3-5-year-old Norwegian children. Prev Med Rep. 2022;29:101930.
5. Bel S, Van den Abeele S, Lebacq T, Ost C, Brocatus L, Stievenart C, Teppers E, Tafforeau J, Cuypers K. Protocol of the Belgian food consumption survey 2014: objectives, design and methods. Arch Public Health. 2016;74:20.
6. Hansen BH, Kolle E, Steene-Johannessen J, Dalene KE, Ekelund U, Anderssen SA. Monitoring population levels of physical activity and sedentary time in Norway across the lifespan. Scand J Med Sci Sports. 2019;29:105-112.
7. Benadjaoud MA, Menai M, van Hees VT, Zipunnikov V, Regnaux JP, Kivimaki M, Singh-Manoux A, Sabia S. The association between accelerometer-assessed physical activity and respiratory function in older adults differs between smokers and non-smokers. Sci Rep. 2019;9:10270.

Calendar



le thème de chacun des articles prévus. Une proposition de sujet de thèse doit comporter au moins deux articles originaux.

Paper 1: Physical activity distribution across the lifespan according to sociodemographic factors
Paper 2: Physical activity distribution and BMI across the lifespan
Paper 3: Physical activity distribution and fitness across the lifespan

PRÉREQUIS, FORMATION : MASTER IN BIOSTATISTICS, PUBLIC HEALTH, EPIDEMIOLOGY, OR PHYSICAL ACTIVITY AND SPORTS SCIENCES, WITH A GOOD BACKGROUND IN STATISTICS

This project is part of a Marie Curie european doctoral network, to be eligible for this position, the applicant must satisfy the following requirements conform the Marie Curie admission requirements:

- Must not already hold a doctoral degree;
- Must comply with the mobility rule: not have resided or carried out their main activity (work, studies, etc.) in France for more than 12 months in the three years immediately prior to their recruitment.

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SPECIALITE DE LA THESE

Santé publique - Epidémiologie ☒