Offer #2025-09215

PhD Position F/M PhD Offer – 3 years – Oct 2025 to 0ct 2028 Clinical trial designs for assessment of medical devices based on digital twins

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : PhD Position

Context

Medical digital twins (MDTs) are emerging as personalized decision-support tools in medicine [3]. Examples of DMDs include clinical decision support systems for healthcare professionals, physical devices paired with software like closed-loop insulin pumps [1], apps for monitoring chronic diseases and more. DMDs can offer considerable benefits to patients, healthcare providers, and health systems, and their number continues to grow exponentially [2]. Their complex, interactive, and adaptive nature challenges traditional clinical trial designs, which were primarily developed for drug evaluation. Thus, there is a critical need for new methodological frameworks to assess the efficacy of MDTs in a clinical setting.

This PhD project aims to design statistical methods for evaluating the longitudinal efficacy of MDTs within realistic clinical trial settings. The originality of the thesis lies in the adaptation of advanced statistical tools to compare MDTs with standard of care (SoC), accounting for adaptability and interim analyses.

Assignment

We will consider a two-arm randomized clinical trial (MDT vs. SoC) with longitudinal outcomes. The thesis will be organized in three work packages:

1. Final efficacy evaluation: formalizing a design to assess the longitudinal effectiveness of the MDT at the end of the trial.
2. Interim analysis and adaptive designs: integrating interim analyses to allow for early stopping or design adaptation (e.g., switching to a better-performing MDT).

Main activities

A use case considered in this thesis is the use of Interleukin-7 (IL-7) as a complementary intervention to antiretroviral therapy in patients living with HIV with low CD4+ T-cell [4]. Mechanistic models based on ordinary differential equations (ODE) simulate the effect of IL-7 and propose adaptive treatment protocols guided by predictions—representing a concrete MDT strategy. Data of clinical trials for repeated cycle of IL7 are available within the labkey datawarehouse of the SISTM team and will serve as a basis for simulation.

Further application could be exploring how such designs can be adapted for health policy evaluation, such as optimizing vaccination strategies under evolving epidemic conditions.

The candidate will conduct simulation studies using synthetic data to compare the MDT-based approach to standard care in terms of efficacy and efficiency.

Skills

Required skills:

- Solid background in statistics and probability
- Experience with longitudinal data analysis and clinical trial methodology
- Proficiency in statistical programming (R, Python, or Julia)
- Familiarity with simulation studies and model-based inference
- Interest in mechanistic models (ODE) and interdisciplinary research in health
- Ability to work independently and in a team
- Strong scientific writing and communication skills in English

Additional appreciated skills:

- Knowledge of Bayesian inference or adaptive trial design
- Familiarity with medical applications or digital health tools

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Possibility of teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

2300€ / month before taxs

General Information

- **Theme/Domain :** Modeling and Control for Life Sciences
  Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Town/city :** Bordeaux
- **Inria Center :** Centre Inria de l'université de Bordeaux
- **Starting date :** 2025-10-01
- **Duration of contract :** 3 years
- **Deadline to apply :** 2025-07-30

Contacts

- **Inria Team :** SISTM
- **PhD Supervisor :**
  Prague Melanie / melanie.prague@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

The keys to success

Applicants should hold a Master's degree (or equivalent) in one of the following fields:

- Biostatistics
- Applied mathematics
- Statistical modeling

Applications should include a CV, academic transcripts, and a motivation letter. Letters of recommendation are welcome.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Thank you to send:

- CV
- Cover letter
- Master marks and ranking
- Support letter(s)

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.