SPHERE
methodS in
Patient-centered outcomes
& HEalth ResEarch

PhD position in Biostatistics

Response shift analysis at the item level in longitudinal self-reported outcome studies across multiple time points

Self-Reported Outcomes (SRO) such as anxiety or quality of life are frequently measured with questionnaires to better understand the subjective experience of individuals and to inform healthcare decision-making. Faced with a major life event (e.g. COVID-19 crisis), people may change their perception of the SRO and of the questionnaire, a phenomenon called response shift (RS). If RS is not accounted for, the estimation of longitudinal changes in SRO may be biased and the clinical interpretation may be obfuscated. Furthermore, RS may provide more insight into changes in SRO in the face of a major event and may be linked with psychological adaptation.

Most of RS analyses based on statistical methods consider two measurement occasions (before and after a major event). Yet, changes of SRO over time are often assessed over multiple time points. In this context, the trajectory of the construct is continuous by essence and RS could also be envisioned as a continuous process. Furthermore, the exact timing of assessments may also vary across individuals even if visits are usually planned. Thus, the timescale of the study has often to be treated as continuous rather than discrete with equally spaced time points.
RS analyses also generally assume that most individuals experience RS in the same way regardless of individual characteristics. However, it is likely that RS may occur for some individuals only, in different ways and at different times. As such, trajectories of RS are likely to be heterogeneous within a sample.
Last, RS detection methods most often perform RS analysis at the domain level using subscale scores combining several items. These methods cannot distinguish which items are specifically affected by RS and domain-level RS analysis might not always appropriately reflect what is going on at the item level, especially if RS has opposite effects depending on the item. Thus, item-level RS analyses in continuous time accounting for heterogeneity would give more insight on RS and on the interpretation of psychological adaptation than traditional approaches. Methods able to detect and adjust for item-level RS over multiple time points in studies with continuous time while accounting for heterogeneity in trajectories of RS are lacking.

The PhD student will have to develop and validate a method for RS analysis at the item level in longitudinal SRO studies across multiple time points.

Rasch models have shown good performances for item-level RS detection between two time points with heterogeneous RS. A first objective will be to operationalize RS over multiple time points in an appropriate continuous-time model, an innovative combination of linear mixed models and Rasch models. The PhD

student will have then to develop an item-level RS detection method using this continuous-time Rasch model. It will aim at investigating RS in depth in order to detect RS, examine items expected to be affected by RS, type and size of RS effects. The method will be automated in a module of a statistical software to disseminate more largely the developed method.
To ensure that the proposed method for RS analysis is valid and reliable, different simulation studies will be performed. Homogeneity of RS will be assumed in the first simulation study and different patterns of RS depending on one or more covariates will be simulated in the further studies.

Main tasks

- Operationalization of RS over multiple time points in an appropriate continuous-time model
- Development of an item-level RS detection method using continuous-time Rasch models
- Validation of the proposed method for RS analysis with simulation studies
    - Generation of the data
    - Analysis and reporting of the results
- Dissemination
    - Development of a module of a statistical software
    - Technical reports
    - Publications in international biostatistical journals
    - Oral presentations in international conferences

This PhD project is part of the REsponse shift evaluation with ContinUous timE Rasch models (RESCUE) project funded by the French National Research Agency. The work will be carried out in close collaboration with the multidisciplinary team of the RESCUE project (biostatisticians/psychometricians and researchers in health psychology and health economics).

Skills

- Applicants should have a masters degree in biostatistics, or statistics and have an interest in statistical methods in health science.
- Since theoretical development in a longitudinal setting is a part of the project, strong training in mixed-effect modelling is necessary.
- Programming skills in R and/or Stata and being comfortable with IT programming are considered an advantage.
- Some knowledge in psychometrics or simulation studies is an advantage.

Personal qualities

- The candidate should have the ability to collaborate across academic disciplines, strong organizational and communication skills, and a keen interest in health research
- Basic fluency in oral and written English (B2)

Application

Applications (in French or English) should contain the following documents:

- A detailed Curriculum vitae
- A motivation letter, including a brief description of past experiences and future interests, as well as the earliest possible starting date
- Copies of master's degree certificates and transcripts
- Name and contact details of at least two referees

About the position

Research unit: INSERM U1246 SPHERE « methodS in Patient-centered outcomes and HEalth REsearch »
http://www.sphere-inserm.fr/

The SPHERE research unit is a two-site inter-regional research unit jointly accredited by the Nantes University, the University of Tours and the INSERM. This is a multidisciplinary unit that aims at developing, validating, and applying methods in a pluridisciplinary perspective to address a variety of challenges encountered in health research and decision making, taking into account both individuals' environments and perceptions. The PhD candidate will join the researchers involved in the "Methods for the measurement and interpretation of Self-Reported Outcomes" axis of the unit. The group is composed of professors, research engineers and doctoral students.

Supervisors: Véronique Sébille, full professor in biostatistics and Myriam Blanchin, research engineer in biostatistics
Location: Nantes

Starting date: autumn 2023
Language : French or English
Teaching : opportunities to participate in teaching
The PhD student will be employed 3 years full-time by Nantes University.

Contact information

Myriam Blanchin
myriam.blanchin@univ-nantes.fr