SCIENTIFIC RESEARCH PROJECT PROPOSAL – TEMPLATE

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Title of SRP project: User-Centered Design and Evaluation of a Clinical Interface for AI-Supported Heart Failure Management

Location of SRP project: Department of Cardiology UMC Utrecht

Introduction

Over the last 15 years, risk prediction has gained a prominent role in clinical decision-making. Clinical guidelines, for example in the cardiovascular field, recommend routinely assessing a patient's risk for an adverse outcome to guide discussions on prognosis, care goals and treatment decisions. Risk prediction scores can assist estimating the personalized likelihood of health states that might be relevant during decision-making. 2, 3, The emergence of Artificial Intelligence (AI) has led to the development of an increasing number of prediction models, enabling risk assessment with models that possibly uncover complex patterns that humans might overlook.

Nonetheless, the uptake of risk prediction models in clinical practice remains limited, possibly because clinicians are concerned that poor accuracy or generalizability of models may lead to patient unsafety. Other possible explanations for this limited use concern limited compatibility with existing clinical workflows, the additional time and cognitive effort required for their use and unknown impact on patient care. 1,6, Specifically regarding AI-based prediction models, concerns about limited transparency of how predictions are generated may hinder acceptance in clinical practice. On top, an interface showing AI-outputs should be highly usable to allow and motivate clinicians to actually use the outcomes in clinical practice.

While the focus in risk prediction research has been on the development of numerous algorithms, less attention has been paid to factors necessary for successful implementation, such as usability, workflow integration, user interface design, and the explainability of model outputs. 9, 10, 11,

Description of the SRP Project/Problem

The SRP project is embedded in the AI4HF project: "Trustworthy Artificial Intelligence for Personalised Risk Assessment in Chronic Heart Failure". This is a collaborative project involving multiple international partners, including nine hospitals. Within AI4HF, various models are being developed that predict outcomes for HF-patients at the point of ED-care, discharge or in outpatient settings. Additionally, interfaces that show outcomes and explainable interpretations of those outcomes are being developed in collaboration with patients and clinicians.

Previously in the AI4HF project (including through an earlier SRP project), needs and wishes of patients and clinicians were identified regarding usability and explainability of AI-prediction models. A mock-up interface with example figures and AI-generated outcomes was tested using the think-aloud method and interviews. This way, usability barriers and facilitators of the interface were identified. This mock-up interface was used to explore which figures, explanations and usability features are needed to support AI-implementation, and to discuss which use-cases would benefit most from such an interface. Based on these insights, a new version of the interface is currently being developed, incorporating the actual AI4HF models and focusing on a specific use-case: a referral platform for advanced HF therapies, such as heart transplants.

During the SRP project, you will have an active role in the development and evaluation of this new interface. You will translate insights from earlier interviews and usability tests to further refine existing system requirements and communicate these with the interface development team. After this, you will test the usability of the new interface with end-users, including cardiologists and nurses. You will translate this input into usability facilitators and barriers, which will allow further improvement of the interface.

The project will allow you to become familiar with the design process and to learn translating user needs and usability insights into practical design decisions as a usability expert.

Next to the proposed research direction, you can explore other aspects of the user experience journey based on your interests. For example, due to the international nature of the project, including partners from Europe, America and Africa, cultural differences may be further investigated targeting the needs and wishes of end-users in specific cultural contexts. Another possible research direction is to examine how newly designed interface fits within clinicians' current workflows and what is needed to facilitate its smooth implementation into clinical practice.

Research objective and research questions

1. What usability and explainability requirements do clinicians have for AI-supported decision support for referral of patients to advanced HF teams?
2. How do clinicians and HF patients experience the user journey when interacting with the AI4HF interface?
3. Which interface elements are expected to hinder or facilitate effective use and decision-making within existing HF-care workflows?
4. *Possibly an additional research question of the student's choice, based on their own interests.*

Expected results

- A scientific thesis, one or more chapter of which may be adapted for a peer-reviewed publication.
- A set of refined system specifications for updating the AI4HF interface, based on input from earlier interviews and usability-tests.
- A set of detailed specifications for refining the AI4HF interface, based on performed usability-tests and interviews in your project.
- Clear criteria for success and failure of the different features of the refined AI4HF interface
    - Clear criteria will be used to evaluate the success of the design optimizations, such as a measurable improvement in usability scores (e.g. X point increase on the System Usability Scale or other relevant identified scales) and positive changes in clinicians' perceived trust and explanation satisfaction, assessed through validated scales.
    - Failure or partial success will be identified if the usability and trust scores do not improve, critical usability barriers remain, or new issues come up during testing. These problems will be analyzed to identify underlying causes for further improvements.

References

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GenAI Authenticity Statement

I accept my responsibility to follow the SRP Rules and Guidelines document fully, including its Generative AI (GenAI) policy (in Section 16.3). I also certify that I am fully responsible for all the content in this document and that I only used GenAI tools (if any) for the purposes I disclose below. I used ChatGPT5.6 (available at chagpt.com) as an aid in the execution of this research, solely for linguistic editing, specifically to improve sentence structure and grammatical accuracy. No content or ideas were generated by the tool.