Detection and management of atrial fibrillation

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Summary

AF is the most prevalent sustained cardiac arrhythmia and associated with morbidity such as heart failure and an increased risk of thromboembolic complications, and mortality, and significantly increases burden to health care. Patients with AF are considered vulnerable and therefore monitoring of heart rate and heart rhythm is important for the management of AF and prevention of AF-related morbidity. Novel mHealth solutions have been introduced to assist in the detection of AF as well as to support remote management of patients with AF. In this thesis, the current state of art in AF detection and management is evaluated and novel AF detection and management approaches are developed and introduced.

Part 1 focuses on the traditional AF detection and management strategies and the associated clinical challenges and gaps of evidence. To improve AF management, the identification of AF-related symptoms is important as it may identify patients who profit from rhythm control in regard to reduction in symptom burden. Since standardized strategies to assess the association between symptoms and rhythm status are currently not available, we evaluated the current clinical strategy to investigate symptom-rhythm correlation in patients with persistent AF. Spot-check assessment of symptom-rhythm correlation around rhythm control by ECV rarely identified a symptom-rhythm correlation and there was high variability in self-reported symptoms before and after ECV in patients with AF recurrence (**Chapter 3**). One important limitation of this study was that the predominantly self-reported symptoms around ECV were obtained retrospectively from patients' medical records and not simultaneously with heart rhythm information. To overcome this limitation, we developed and further investigated a novel mHealth approach to assess symptom-rhythm correlation in patients with persistent AF. Within the TeleCheck-AF project, a more longitudinal mobile app-based assessment of symptoms during simultaneous heart rhythm monitoring around ECV to guide this 'diagnostic ECV' was evaluated and revealed a relatively low overall symptom-rhythm correlation (**Chapter 12**).

Part 2 discusses the importance of available mHealth solutions for remote AF detection and management. Our systematic review showed that the accuracy of mHealth tools differs with respect to the type and technology used, as well as application setting, and study population (**Chapter 5**). Based on this, we studied the utility of long-term intermittent ECG-based heart rhythm monitoring using AliveCor Kardia (ACK) compared to short continuous ECG-based heart rhythm monitoring using Holter for the detection of AF recurrence after AF ablation. Four weeks ACK monitoring more effectively detected AF recurrences than ≥24h Holter monitoring (**Chapter 6**). Additionally, in **Chapter 7** we prospectively investigated the accuracy of continuous mHealth PPG-based heart rate assessment during AF in comparison with continuous Holter ECG monitoring as a reference. Our results suggest that 1 min mean heart rate estimation using PPG is highly accurate.

In part 3, the implementation process and coordination (**Chapter 8 & 9**) as well as the first results of the TeleCheck-AF approach are described. We found that TeleCheck-AF is associated with relatively low costs, convenience, and broad accessibility of the mHealth solution, which makes it feasible to implement this novel app-based on-demand heart rate and rhythm monitoring infrastructure to efficiently provide teleconsultations in an AF population. The results also confirmed that there is high patient's adherence and motivation to perform the prescribed measures (**Chapter 10**) and that the TeleCheck-AF infrastructure seems beneficial for cardiovascular and comorbidity risk optimization to prevent stroke (**Chapter 11**). Further research is required to verify whether integrating the TeleCheck-AF approach in current AF workflows can improve AF management.

To conclude, mHealth has the extraordinary potential to improve the care of AF and rapidly redefine the framework for its management. Nevertheless, the use of mHealth has also important barriers and challenges. Future high-quality randomized clinical trials should investigate how to integrate mHealth-

derived heart rhythm and rate information into clinical decision-making processes to guide AF management as well as the effect of mHealth use on clinical outcomes in AF patients.
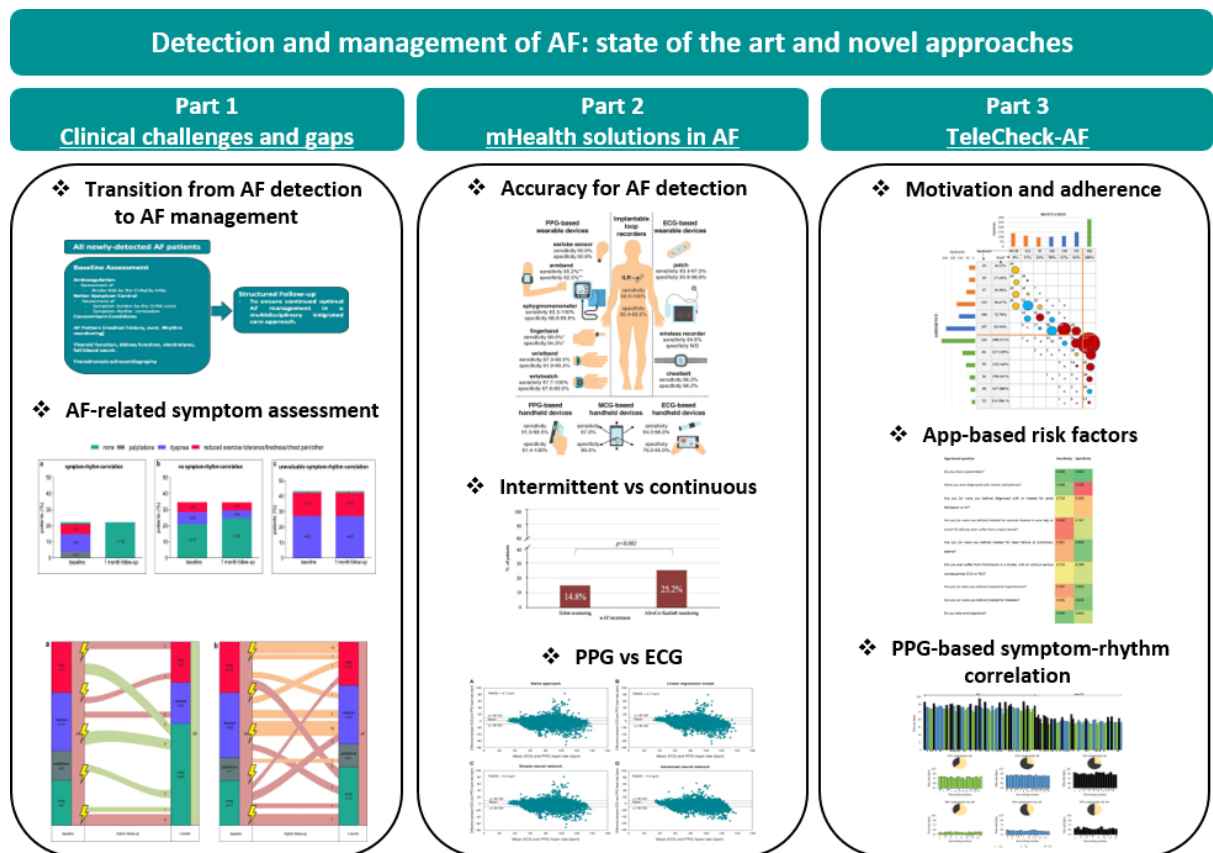
Summarizing figure. Detection and management of AF: state of art and novel approaches.

AF, atrial fibrillation; ECG, electrocardiography; PPG, photoplethysmography