



Universiteit  
Leiden

The Netherlands

## **Innovations in prehospital emergency cardiac care: alleviating the strain on overcrowded hospitals**

Koning, E.R. de

### **Citation**

Koning, E. R. de. (2026, January 27). *Innovations in prehospital emergency cardiac care: alleviating the strain on overcrowded hospitals*. Retrieved from <https://hdl.handle.net/1887/4287795>

Version: Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/4287795>

**Note:** To cite this publication please use the final published version (if applicable).

**Innovations in Prehospital Emergency Cardiac Care:  
Alleviating the strain on overcrowded hospitals**

**Enrico R. de Koning**

## Colofon

Copyright 2025 © Enrico de Koning

All rights reserved. No parts of this thesis may be reproduced, stored in a retrieval system or transmitted in any form or by any means without permission of the author.

This thesis was written at the Department of Cardiology of the Leiden University Medical Center in Leiden, the Netherlands.

Financial support for the costs associated with the publication of this thesis was received from: Netwerk Acute Zorg West, Hart Onderzoek Nederland, ChipSoft , MSB Gouda and Waleus Bibliotheek

Artwork cover and chapter pages: Hjalmar Haagsman, dachtikhetniet.nl

Provided by thesis specialist Ridderprint, ridderprint.nl

Printing: Ridderprint

Layout and design: Anna Bleeker, persoonlijkproefschrift.nl

# **Innovations in Prehospital Emergency Cardiac Care: Alleviating the strain on overcrowded hospitals**

ter verkrijging van  
de graad van doctor aan de Universiteit Leiden,  
op gezag van rector magnificus prof. dr. S. de Rijcke,  
volgens besluit van het college voor promoties  
te verdedigen op dinsdag 27 januari 2026  
klokke 16:00 uur  
door

**Enrico Raun de Koning**

geboren te 's-Gravenhage  
in 1991

## **Promotiecomissie**

Promotor: Prof. dr. M.J. SchaliJ

Copromotoren: Dr. J.M.J. Boogers  
Dr. S.L.M.A. Beeres

Voorzitter promotiecommissie: Prof. dr. J.W. Jukema

Overige leden: Prof. dr. S.C.E. Klein Nagelvoort - Schuit UMC Groningen, NL  
Prof. dr. R.J. de Winter Amsterdam UMC, NL  
Prof. dr. J. Braun  
Dr. M.C. den Haan  
Prof. dr. A.W.J. van 't Hof Maastricht UMC, NL  
Dr. I. al Amri

## Table of contents

|           |                                                                                                                                                                |     |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Chapter 1 | General introduction                                                                                                                                           | 8   |
| Chapter 2 | Pre-hospital Triage of Acute Cardiac Patients: Study Protocol of HART-c, a multicenter prospective study                                                       | 24  |
| Chapter 3 | Managing Hospital Capacity: Achievements and Lessons from the COVID-19 Pandemic                                                                                | 38  |
| Chapter 4 | Emergency medical services evaluations for chest pain during first COVID-19 lockdown in Hollands-Midden, the Netherlands                                       | 54  |
| Chapter 5 | Artificial Intelligence Algorithm to Predict Acute Coronary Syndrome in Prehospital Cardiac Care: Retrospective Cohort Study                                   | 68  |
| Chapter 6 | Improved Prehospital Triage for Acute Cardiac Care: Results from a Multicentre Prospective Study - Hollands-midden Acute Regional Triage - cardiology (HART-c) | 84  |
| Chapter 7 | Summary, conclusions and future perspective                                                                                                                    | 98  |
|           | Grafische samenvatting                                                                                                                                         | 104 |
| Chapter 8 | Nederlandse samenvatting, conclusies en toekomstperspectief                                                                                                    | 108 |
|           | Appendices                                                                                                                                                     | 118 |
|           | Dankwoord                                                                                                                                                      | 124 |