

Infection and sepsis in the Dutch acute care chain

Citation for published version (APA):

Latten, G. H. P. (2022). *Infection and sepsis in the Dutch acute care chain: opportunities for optimisation of care*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20220916gl>

Document status and date:

Published: 01/01/2022

DOI:

[10.26481/dis.20220916gl](https://doi.org/10.26481/dis.20220916gl)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy

If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

IMPACT PARAGRAPH

In this thesis, we aimed to provide more insight into the journey of patients with a severe infection through the Dutch acute care chain, or, in other words, from home to hospital. In these studies, we focused on optimising care. Below is a summary of the scientific and social impact of this thesis. After that, we will reflect on our experiences with conducting research in acute care.

Scientific impact

The scientific impact of this thesis lies mainly in the identification of possible ways to optimise the care for patients with an infection in the already well-functioning Dutch acute care system. Topics include insight into the prehospital trajectory of patients with an infection in the Emergency Department (ED), reliability of vital sign measurements, and interprofessional communication.

Prehospital trajectory of ED patients with an infection

Prior to this thesis, most research on severe infections and sepsis focused on the hospital environment. However, patients do not become ill the moment they enter the hospital. We therefore investigated the trajectory prior to ED visit and found that most ED patients with an infection already had contact with a general practitioner (GP) and emergency medical services (EMS, ambulance service). In addition, their symptoms had been present for a median of 3 days. These findings suggest that this phase may offer a window of opportunity that allows for a good start of treatment, and that future research should focus on this phase as well. An example could be qualitative research to evaluate individual patient trajectories, both from a physician perspective (e.g. consensus meetings), and from a patient perspective.

Reliability of vital sign measurements

Throughout several chapters, we described the frequency and quality of vital sign measurements, which are essential in the suspicion/diagnosis of sepsis. The finding that vital signs are not consistently measured suggests that there is room for improvement in daily practice, although we did not investigate the effect of measuring vital signs.

Special attention should be paid to the respiratory rate; a vital sign which has been known to reflect severe illness, but is measured least frequently. Both of these characteristics

were confirmed once again in our studies, and in addition, we showed that manual measurements of the respiratory rate are often inaccurate. This can affect clinical rule scores, especially when these rules use strict cut-off values. In our opinion, it would be wise to investigate the added value of reliable non-invasive methods to measure the respiratory rate throughout the entire acute care chain.

Finally, many studies use routinely gathered vital sign measurements in their datasets. This strategy has drawbacks, specifically when it is unknown whether a patient already received therapy prior to the measurements, and if so, what therapy. These drawbacks should be taken into account when interpreting the results from these studies. The finding that vital signs are not measured consistently, and some (e.g. respiratory rate) not accurately, affects the reliability of studies that use vital sign measurements. Especially in case of – manually measured – respiratory rate values, one should realise that some of these values will be inaccurate. Future studies performed in the acute care chain should at a minimum document when vital signs were measured, in order to make interpretation of findings possible.

Interprofessional communication

Due to the lack of a diagnostic test for serious illness, sepsis, or the need for referral, and the caveats regarding vital sign measurements, it is indispensable that healthcare providers have relevant and accurate information at their disposal. Our findings suggest that there is room for improvement in the documentation of sepsis and of a sense of urgency. Future – preferably qualitative – studies should focus on why sepsis and a sense of urgency are so poorly documented in medical records, and how this can be improved. It should then be measured whether better documentation indeed leads to better care, taking into account the administrative workload.

Social impact

Relevance for healthcare providers

Several of the research findings described in this thesis are important for healthcare providers working in acute care every day. By providing additional insight in the population of patients with an infection in the Dutch acute care system, we hope to contribute to the knowledge of this population of patients and identify potential targets for optimisation of care. An important finding is that, prior to their ED visit, patients have

already been having symptoms for several days. Healthcare providers should realise this and acknowledge that vital signs measured at arrival in the ED are not the first, nor are they the last measurements. This is especially relevant as vital signs vary over time. In our case this happened during patients' ED stay, but it is likely that this also happens in the prehospital setting. Healthcare providers should realise that – even if measurements are 100% accurate – variation in vital signs can influence healthcare providers' perception of severity of illness. These vital signs are also not the only factor that decides whether a patient should be referred or not. As such, it is important for referring healthcare providers to hand over all relevant considerations, but also for receiving healthcare providers to actively ask relevant questions. Collaboration between healthcare providers, using each other's specific knowledge and skills, is likely the best way to further optimise care for patients.

Relevance for patients, caregivers and society

This thesis provides insight in the trajectory of patients with a severe infection through the acute care chain. Luckily, most infections are self-limiting or resolve with oral antibiotics, but sometimes referral to the ED is necessary. In this thesis, we provided insight in the Dutch approach to patients with serious infections and defined possible targets for optimisation of care. The major challenge that healthcare providers are faced with is identifying who is at risk of deterioration and who is likely to recover without complications. In the absence of a definite diagnostic test for sepsis/serious infection, healthcare providers need to base their decision on information shared by the patient and/or his or her caregivers and a physical examination of the patient. Society should realise that – even though we live in 2022 – healthcare providers often need to make estimations, especially in case of infections, and cannot always truly diagnose a disease. Variation in vital sign values and inaccuracy of vital sign measurements complicate this estimation, making it impossible for healthcare providers to provide patients with a 100% accurate prediction for the future. We do feel, however, that systematic measurement of vital signs and the development of diagnostic aids could improve accuracy, and subsequently the efficacy of the acute care system.

A logical question after reading this thesis would be what the impact of the COVID-19 pandemic on the findings in this thesis has been. Based on experience from the field, we know that patients with a COVID-19 infection often stayed at home as long as possible, possibly changing the duration of symptoms prior to ED visit. In addition, we have found that the COVID-19 pandemic has expanded the development and implementation of remote monitoring enormously, making it possible to gather more vital signs than

previously possible. It is likely that this progress will continue in the future, for instance through the recording of data by patients themselves by wearing intelligent monitoring devices. Whatever the effects of these developments, the primary aim should always be to provide high quality care.

Personal insights, likely to be relevant for acute care researchers

In addition to its scientific and social impact, this thesis has provided myself insight in how to carry out clinical research in acute care settings. In my opinion, it is valuable for readers to share my experiences, as this might make future colleagues' work easier.

First, inclusion of patients in acute care settings can be difficult. Every day in the ED is different and reliable planning of inclusions is nearly impossible. At quiet times, there are little patients eligible for inclusion, while at busy times, professionals can be so occupied that research projects are – understandably – not given priority. A great solution for us was the use of dedicated research students. Advantages of this approach included relieving bedside professionals of the burden of research administration, a continuous flow of inclusions (independent of the situation in the ED) and likely more time for informed consent procedures. Feedback from students showed that they particularly enjoyed the opportunity to peek inside the world of acute care, which – to them – can feel like 'uncharted territory'. I would therefore wholeheartedly recommend this approach for future projects.

Second, it is important to note that patients can be hesitant to participate in acute care research projects, even for non-interventional studies. When patients were asked why they did not want to participate, explanations included 'not feeling like it', 'not having time to answer all questions', or the feeling that it was inappropriate of researchers to ask for study participation in 'such an acute situation'. While this can be disappointing for researchers, a personal experience with acute care reminded me to put effort in the informed consent approach. Taking time and acknowledging the fact that patients are likely occupied with quite different things than research makes a huge difference. The organisation of future research projects should take this into account.

The importance of adequate communication in acute care research does not only apply to patients, but to healthcare professionals as well. As illustrated in this thesis, the acute care chain consists of several stations, which are in turn manned by several professionals, who often work in shifts. The absolute number of GPCs and EDs in the Netherlands keeps decreasing, creating larger organisations with complex infrastructures. As a result, the

number of potential colleagues involved in one's research project can be massive. In addition to having a pivotal role in acute care, I have come to believe that emergency physicians are also indispensable for acute care research. By working as a staff member in the ED every day and fully understanding the acute care chain, we are able to make small adjustments in research-related processes. In addition, we often personally know colleagues inside and outside the hospital, whose participation in research projects is crucial.

As a physician, I believe that it is up to us as professionals to guide ill patients through the acute care chain. I would like to apply that same statement to research as well, once again underlining the importance of a dedicated team of staff members working in the ED.

Implementation in daily practice

The results of this thesis will be shared with others in several ways. First, all chapters have already been published in peer-reviewed medical journals, most of which are openly accessible online. Secondly, this thesis will be published online, in order to make it readable for everyone interested. Finally, we will present the results of this thesis at scientific meetings, congresses or webinars. By sharing this information with others, new collaborations can be created.