DANSKE KRÆFTFORSKNINGSDAGE 2023

Earlier palliative care using AI: A national implementation

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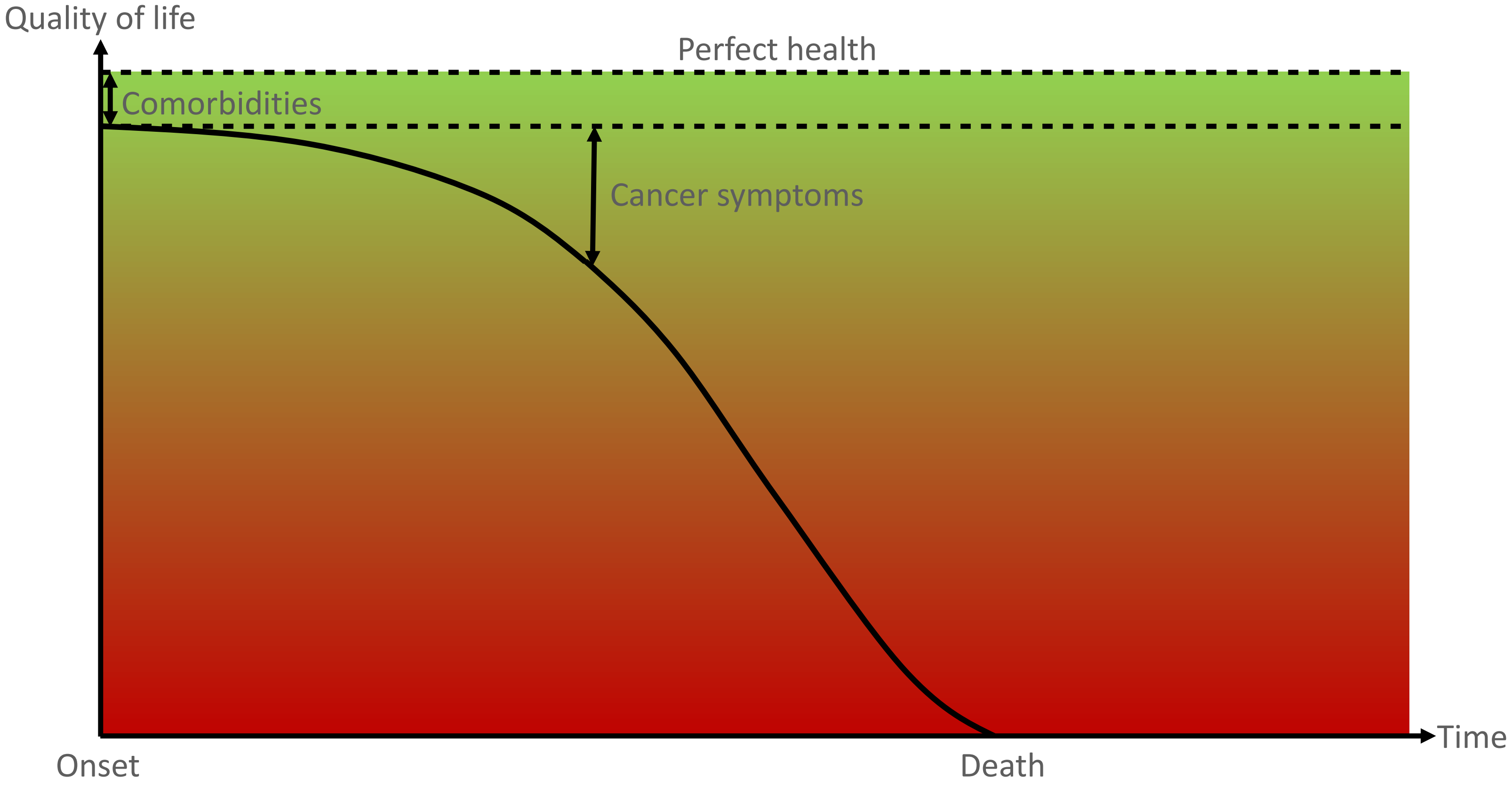
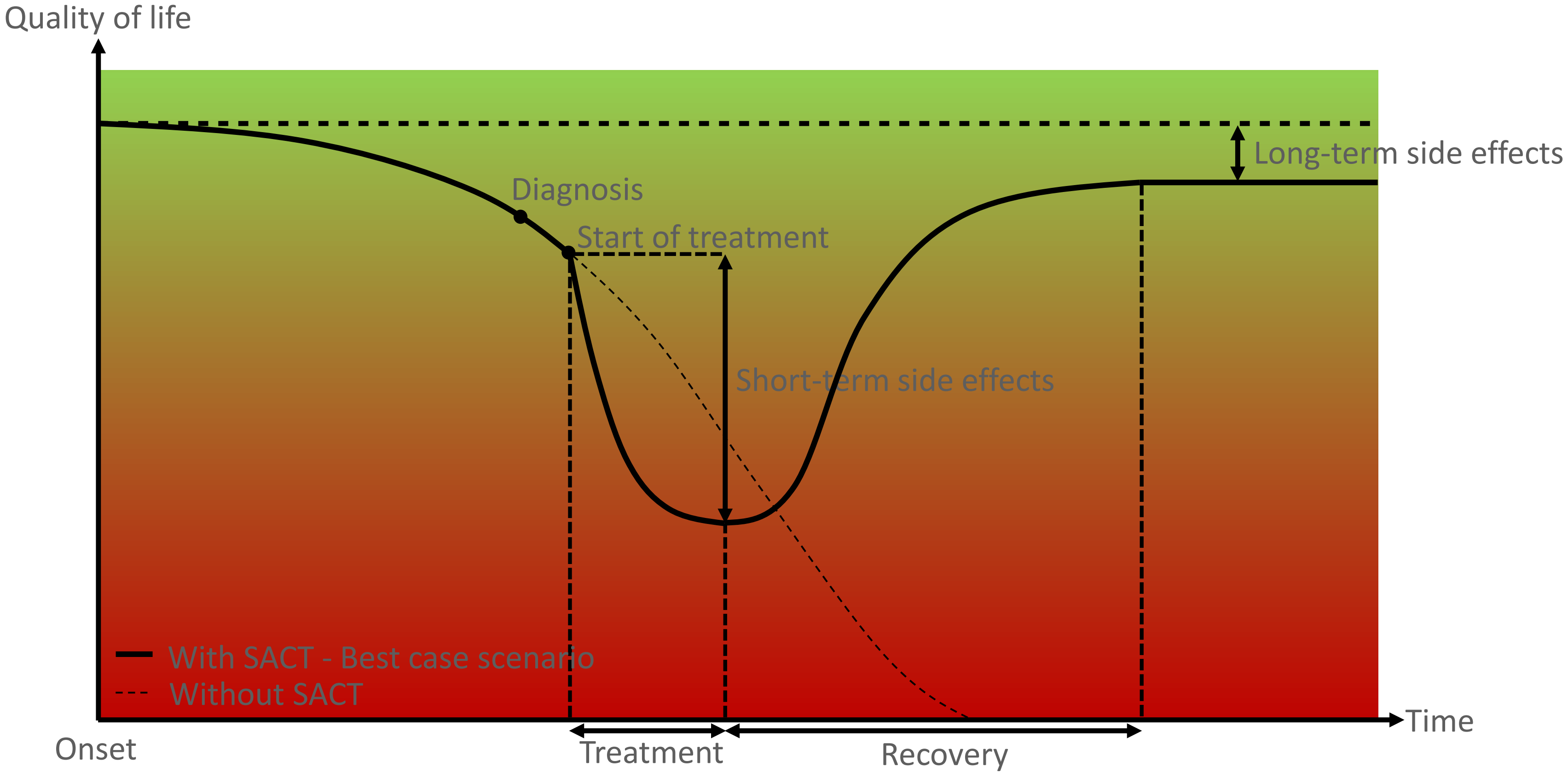
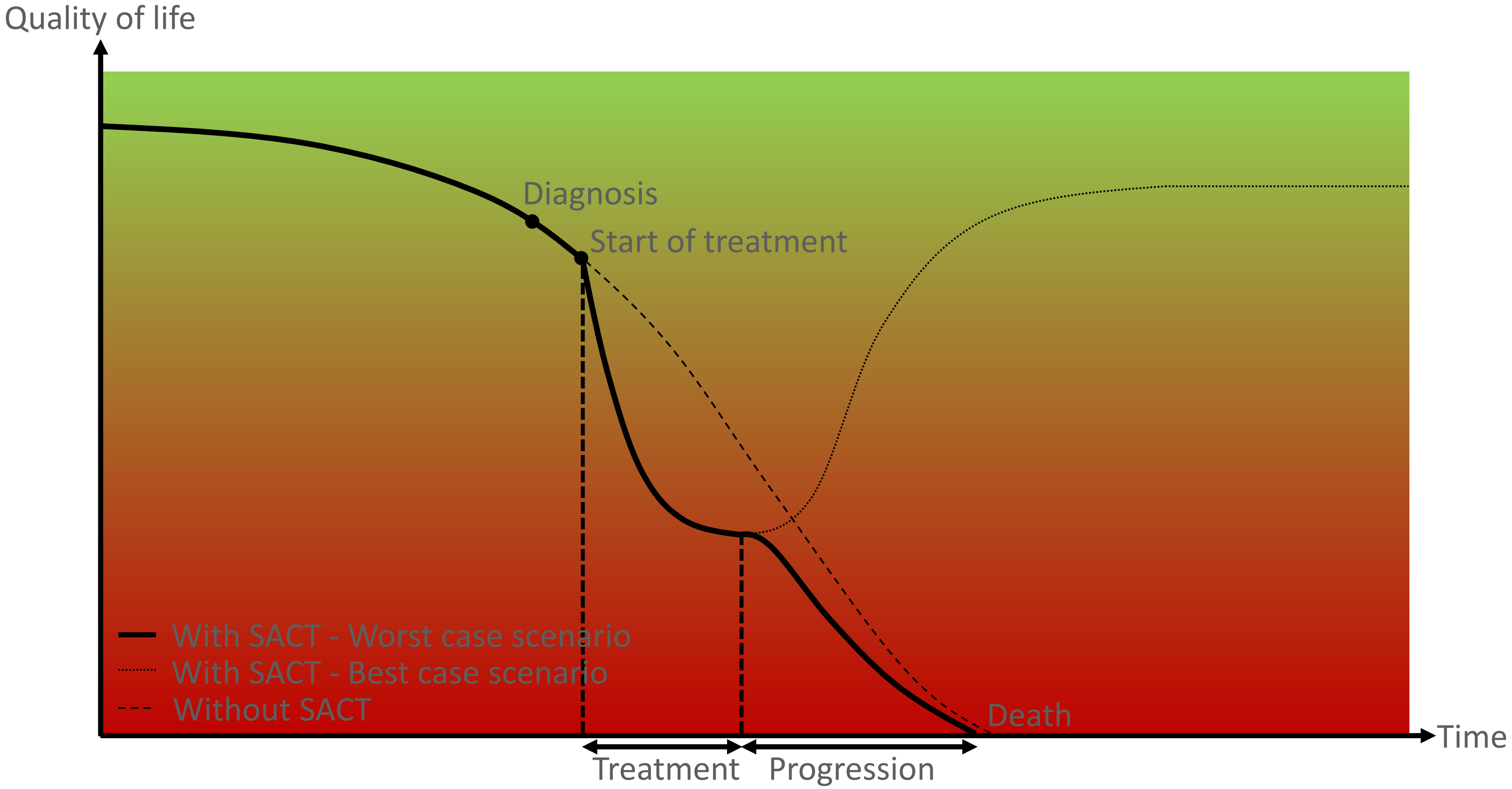
Motivation


Quality of life
Perfect health
Comorbidities
Cancer symptoms
Time
Onset
Death

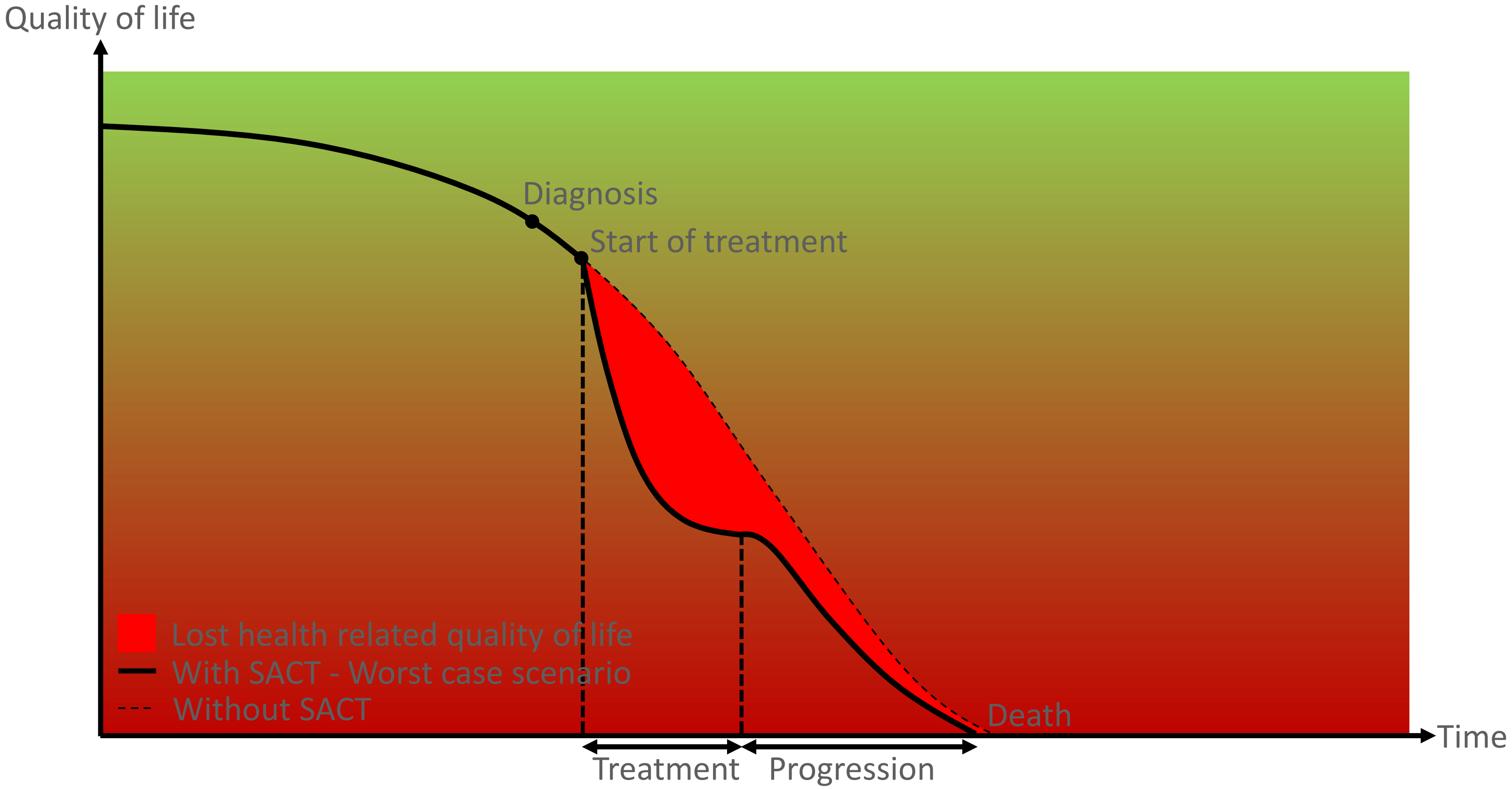
Motivation


Quality of life
Long-term side effects
Diagnosis
Start of treatment
Short-term side effects
With SACT - Best case scenario
Without SACT
Time
Onset
Treatment
Recovery

Motivation

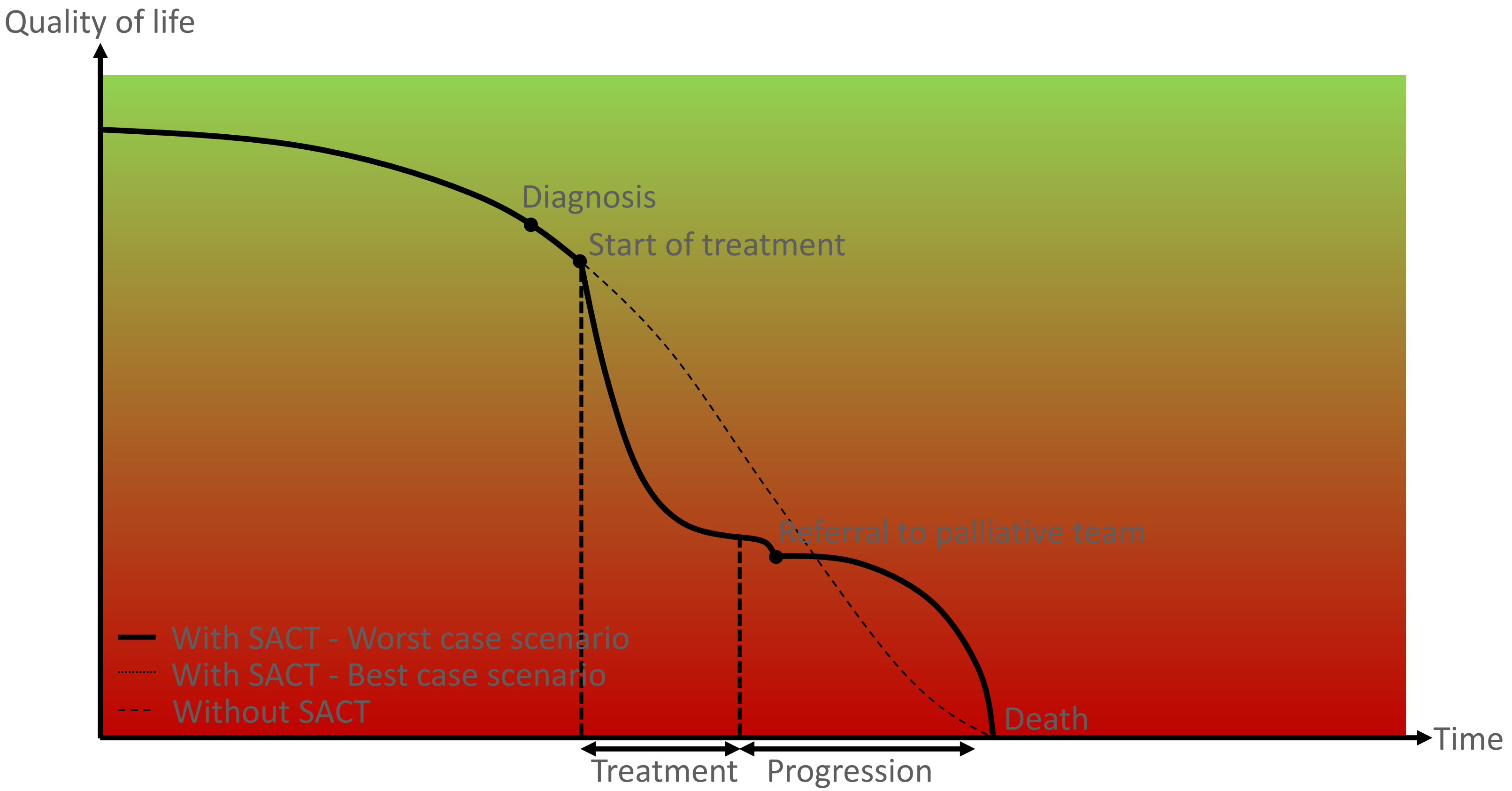

Quality of life
Diagnosis
Start of treatment
With SACT - Worst case scenario
With SACT - Best case scenario
Without SACT
Death
Time
Treatment
Progression

Motivation

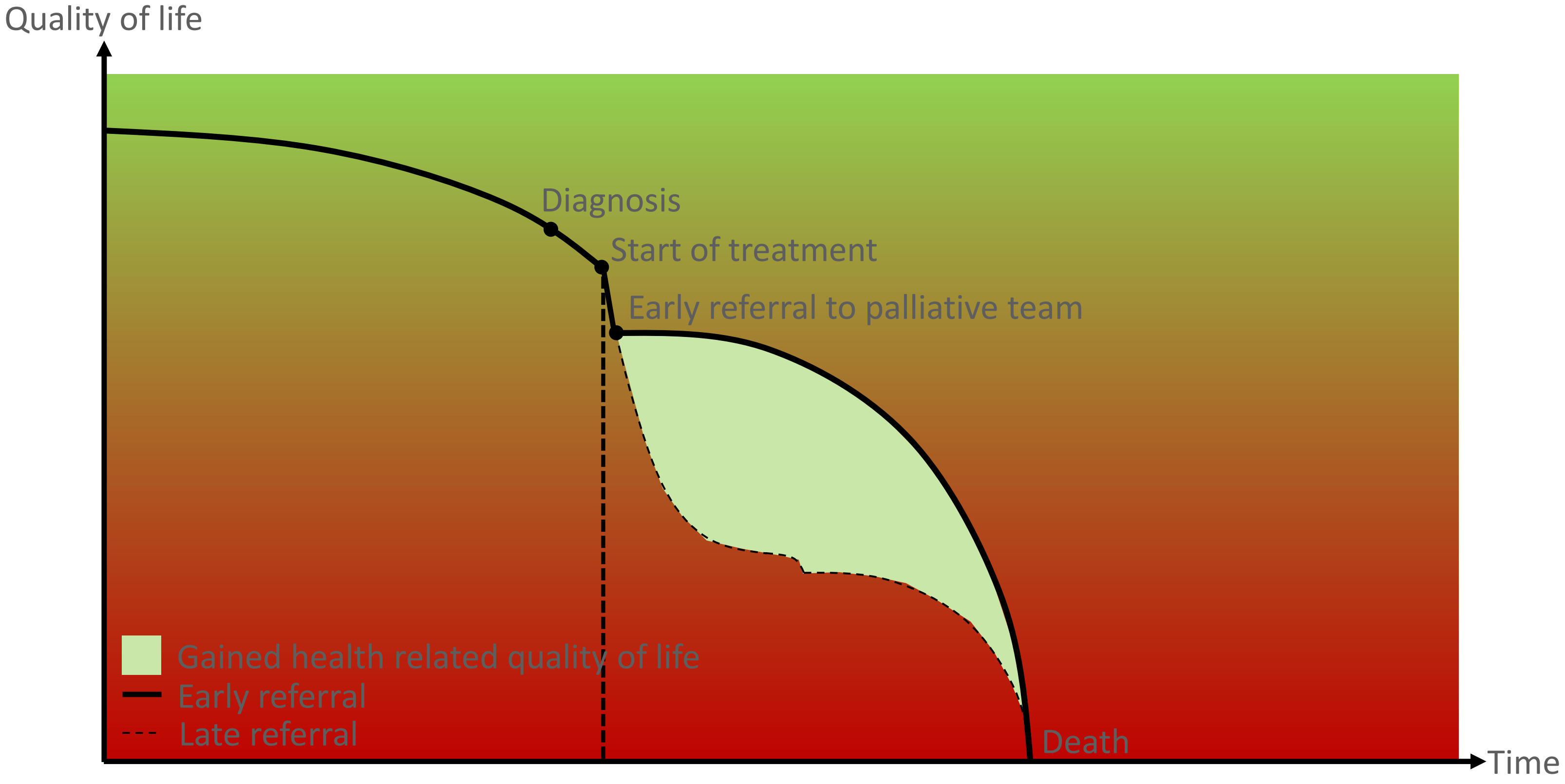


Quality of life
Diagnosis
Start of treatment
Lost health related quality of life
With SACT - Worst case scenario
Without SACT
Death
Time
Treatment
Progression

Motivation


Quality of life
Diagnosis
Start of treatment
Referral to palliative team
With SACT - Worst case scenario
With SACT - Best case scenario
Without SACT
Death
Time
Treatment
Progression

Motivation


Quality of life
Diagnosis
Start of treatment
Early referral to palliative team
Gained health related quality of life
Early referral
Late referral
Death
Time

Current situation

- **Guidelines (ESMO 2023)**
  - Clinician Prediction of Survival
  - Clinically validated metrics
    - Univariate: Performance Status
    - Multivariate: Glasgow Prognostic Score
- **Challenges**
  - Requires personal experience
  - Based on subjective criteria
  - Many parameters could play a role

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SPECIAL ARTICLE

Prognostic evaluation in patients with advanced cancer in the last months of life: ESMO Clinical Practice Guideline☆

P. Stone[1,2], P. Buckle[3], R. Dolan[4], J. Feliu[5], D. Hui[6,7], B. J. A. Laird[8,9], M. Maltoni[10,11], S. Moine[12], T. Morita[13], M. Nabal[14], V. Vickerstaff[15], N. White[1], D. Santini[16] & C. I. Ripamonti[17], on behalf of the ESMO Guidelines Committee*

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Available online 11 April 2023

Key words: advanced cancer, ESMO Clinical Practice Guideline, palliative care, prognostic factors, risk prediction models

INTRODUCTION

Patients with cancer may have potentially curable disease or may live for many years despite incurable cancer. However, these guidelines specifically relate to patients with advanced incurable cancer who are expected to live for a few months or less. Distinction is made between patients with a few months to live, who may or may not be receiving anticancer therapies, and those thought to be imminently dying (i.e. within days or weeks). This guideline focuses on the prediction of death or length of survival and not other clinically-important outcomes such as response to treatment, preferred place of death or length of inpatient stay. Recommendations are provided to health care professionals (HCPs) who care for patients with advanced cancer in the last months of life regarding the best way to prognosticate and to communicate prognoses to patients and their families or caregivers. A proposed algorithm for prognostication and communication is shown in Figure 1.

Importance of prognosis

Prognostic information is important to patients, their families and HCPs. Prognoses help to inform future care and provide opportunities for patients and their families to focus on the things that are most important to them when time is short. Prognostic information can also facilitate access to services and benefits. At an organisational level, prognoses can be helpful for describing the case mix of services or for summarising the health status of patients in different arms of a clinical trial. At an individual level, prognoses can provide information about when a particular patient is likely to die.

Prognostic research methodology

The PROGnosis RESearch Strategy (PROGRESS) partnership describes a four-stage hierarchy of prognostic research.[1] In the context of cancer care, fundamental prognosis research employs epidemiological methods to understand the natural history of cancers under different conditions. Prognostic factor research identifies specific factors associated with length of survival. Statistical models use a combination of prognostic factors to predict an individual's survival risk and such models need to undergo development, validation and assessment for impact. Finally, stratified medicine research uses prognostic information to tailor treatments to individuals or groups with specific prognostic features. Most research in cancer palliative care has been at the level of identifying and validating individual prognostic factors or developing and validating multivariable prognostic models. There have not yet been any studies to evaluate the impact of prognostic models on clinical care. Prognostication in advanced cancer is also somewhat unusual in that, in

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☆Note: Approved by the ESMO Guidelines Committee: February 2023.

AI to optimize referral

- **Better prediction**
  - Big data approach
  - Can handle complex interactions
- **But …**
  - Technical and organisational challenges
  - Lack of clinical validation

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original reports

ARTIFICIAL INTELLIGENCE

Dynamic Risk Prediction of 30-Day Mortality in Patients With Advanced Lung Cancer: Comparing Five Machine Learning Approaches

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abstract

PURPOSE Administering systemic anticancer treatment (SACT) to patients near death can negatively affect their health-related quality of life. Late SACT administrations should be avoided in these cases. Machine learning techniques could be used to build decision support tools leveraging registry data for clinicians to limit late SACT administration.

MATERIALS AND METHODS Patients with advanced lung cancer who were treated at the Department of Oncology, Aalborg University Hospital and died between 2010 and 2019 were included (N = 2,368). Diagnoses, treatments, biochemical data, and histopathologic results were used to train predictive models of 30-day mortality using logistic regression with elastic net penalty, random forest, gradient tree boosting, multilayer perceptron, and long short-term memory network. The importance of the variables and the clinical utility of the models were evaluated.

RESULTS The random forest and gradient tree boosting models outperformed other models, whereas the artificial neural network–based models underperformed. Adding summary variables had a modest effect on performance with an increase in average precision from 0.500 to 0.505 and from 0.498 to 0.509 for the gradient tree boosting and random forest models, respectively. Biochemical results alone contained most of the information with a limited degradation of the performances when fitting models with only these variables. The utility analysis showed that by applying a simple threshold to the predicted risk of 30-day mortality, 40% of late SACT administrations could have been prevented at the cost of 2% of patients stopping their treatment 90 days before death.

CONCLUSION This study demonstrates the potential of a decision support tool to limit late SACT administration in patients with cancer. Further work is warranted to refine the model, build an easy-to-use prototype, and conduct a prospective validation study.

JCO Clin Cancer Inform 6:e2200054.

ASSOCIATED CONTENT
Data Supplement
Author affiliations and support information (if applicable) appear at the end of this article.
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PURPOSE

Systemic anticancer treatments (SACTs) includes chemotherapy, targeted therapy, immunotherapy, and hormonal therapy treatments. A SACT should only be considered in patients with an adequate benefit from the treatment since SACTs often have a short-term negative impact on health-related quality of life.[1-7] An accepted threshold for late SACT administration is 30 days before death.[8] However, clinicians' experience in predicting the remaining lifetime of patients may be inadequate,[9] leading to prescription of SACT too late to achieve a clinical benefit.[8] Furthermore, death from advanced cancer often has a multifactorial background where acute complications could lead to patient death.

Lung cancer is a frequently occurring cancer type with poor prognosis and high mortality, particularly in advanced stages. Thus, patients with lung cancer are at higher risk of receiving SACT close to death than other cancer types with a better prognosis.

There is a need for decision support tools to assist the work of clinicians to minimize the risk of decreasing health-related quality of life because of SACT of patients with lung cancer receiving palliative treatment in advanced stages. Patient health might promptly deteriorate during treatment, requiring frequent use of dynamic predictive tools to assess their situation. To the best of our knowledge, existing studies addressing this issue (1) are based on a limited number of clinical variables; (2) do not consider artificial neural network–based models; (3) are based on different end points, for example, 6-month mortality; or (4) are not suitable for dynamic risk prediction.[10-17]

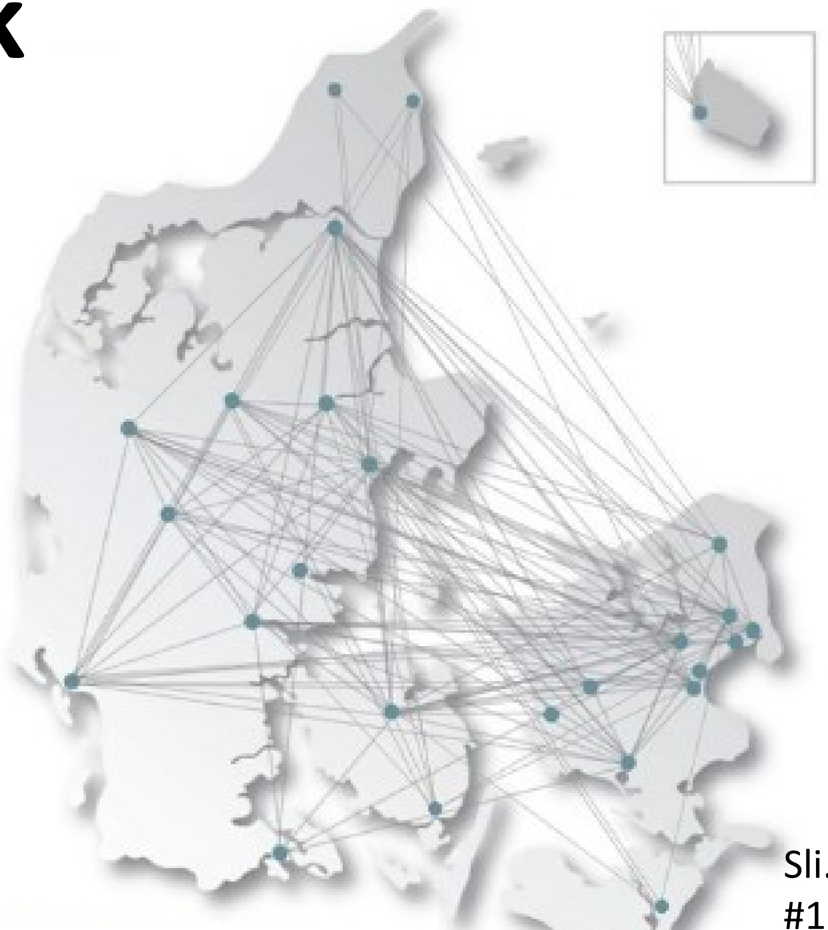
The aim of this study was to investigate the potential use of machine learning approaches on electronic

National implementation

- National network
- Technical implementation
- Prospective validation
- Regulatory aspects

National network

- **Departments of Oncology**
- **Region IT Departments**
- **Palliative Teams & Hospices**



https://www.dccc.dk

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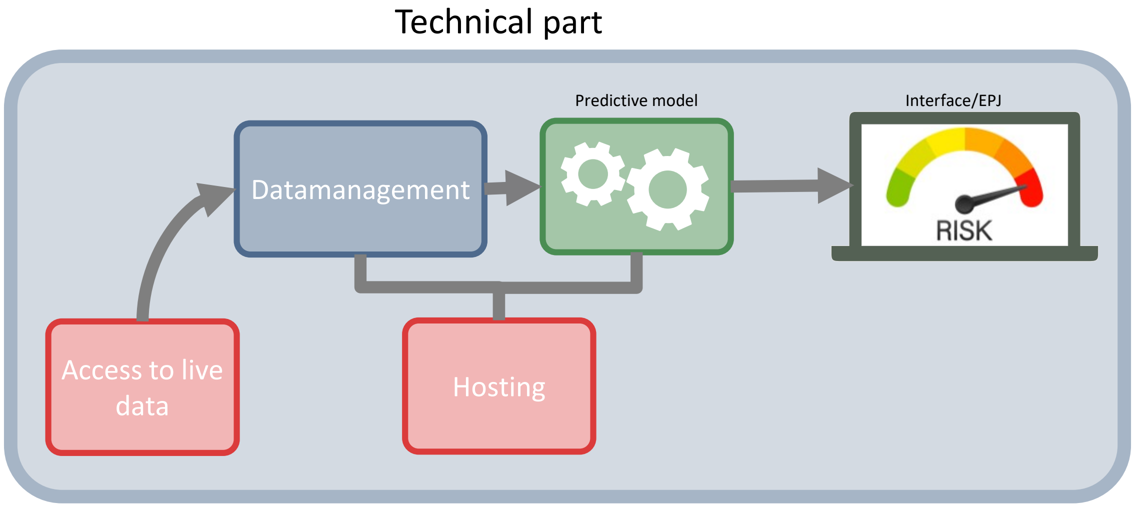
Technical implementation



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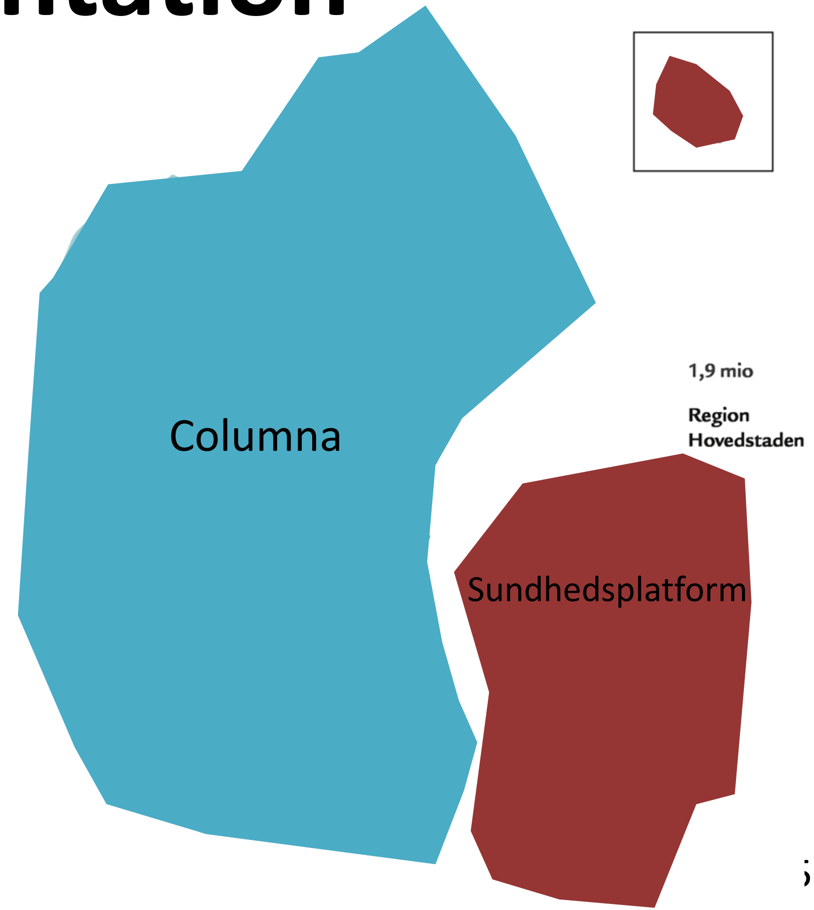
Technical implementation

- **Access to live data:**
  - 5 independent regions
  - 2 journal systems



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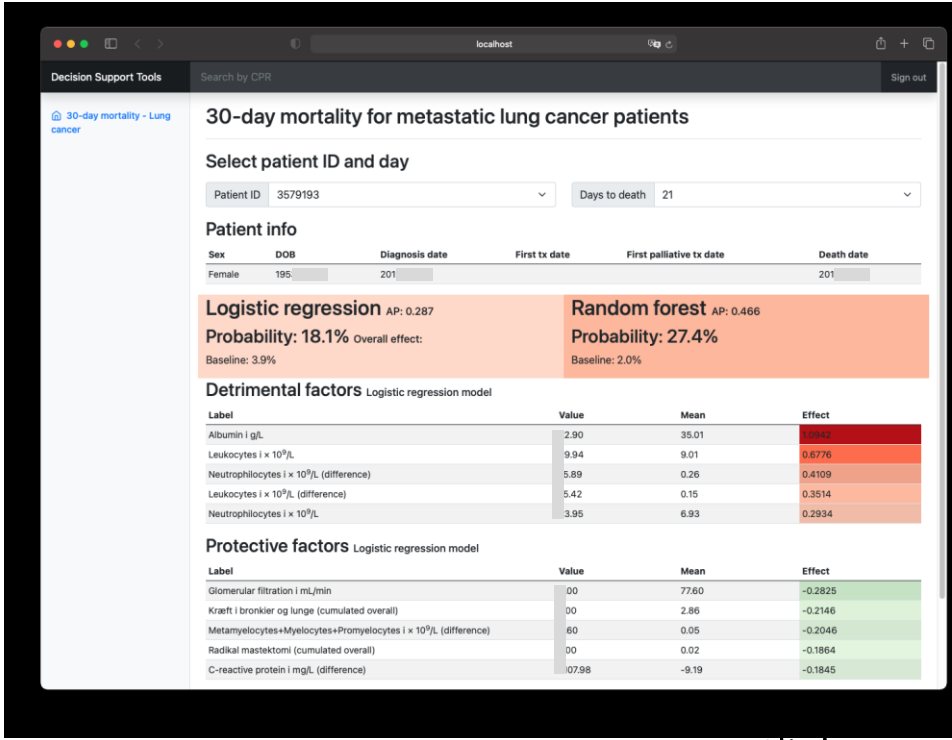
Technical implementation

- **Interface:**
  - Decision support tool for oncologists
  - Design best practices
  - Integration with patient journals



Prospective validation

- **To ensure the performance**
- **Challenges with protocol:**
  - Randomisation
  - How to measure success

Regulatory aspects

- Ethical approval
- Data processing agreements
- EU Medical Device Regulation

Take home message

- **AI can help improve patient care**
- **Implementation is challenging**
- **We are looking for collaborations across Denmark to make it happen**

Contact us
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