ACR IMPROVE - Benchmarking Quality of Cardiovascular Care

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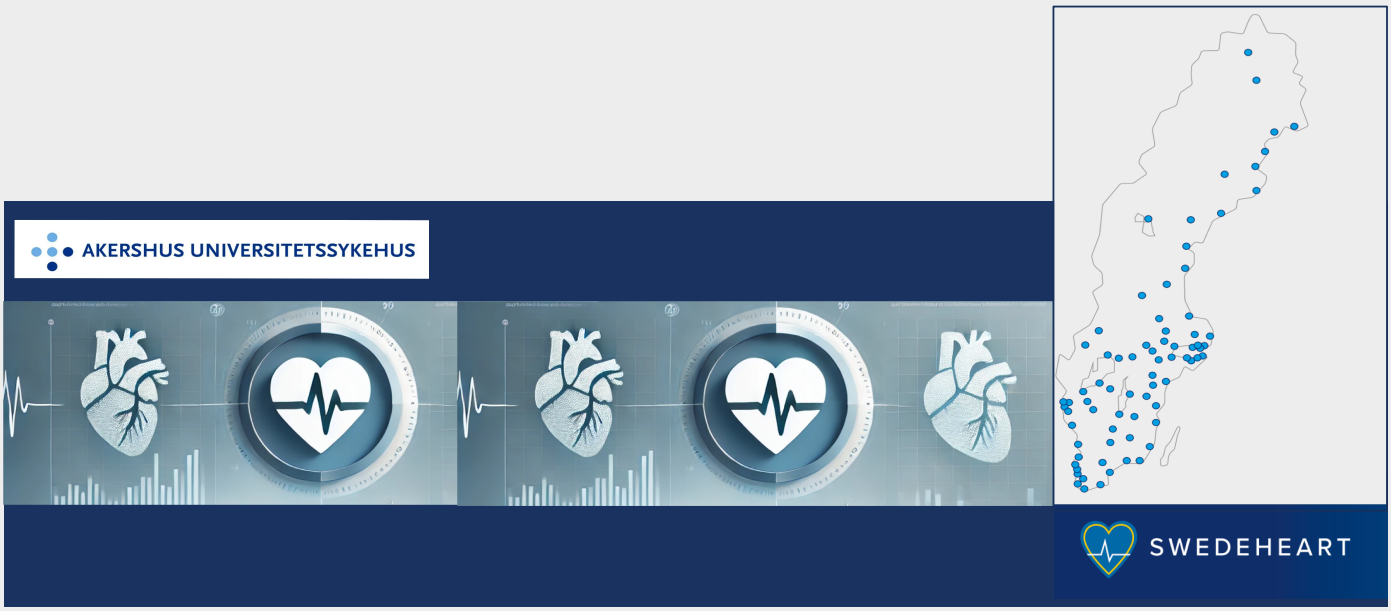

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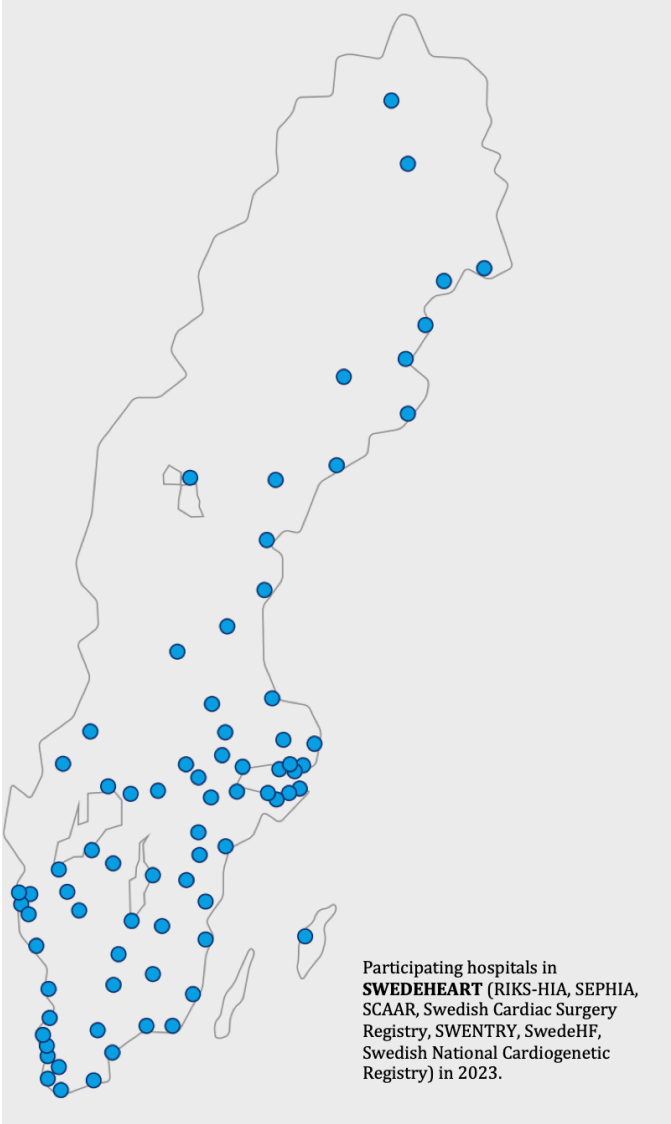
1.2. Background

1.2.1. The SWEDEHEART registry

Launched in 2009, SWEDEHEART (the Swedish Web-System for Enhancement and Development of Evidence-based Care in Heart Disease Evaluated According to Recommended Therapies) prospectively collects data from multiple previously independent nationwide Swedish registries that focus on different aspects of cardiovascular care. The primary purpose of SWEDEHEART is to support the implementation of evidence-based treatments for myocardial infarction, coronary artery disease, heart valve disorders, heart failure, and hereditary heart diseases. The registry and regular publication of SWEDEHEART data provide ongoing information on disease severity, patient risk profiles, medical and device-based treatments, outcomes, and complications from all procedures and surgical interventions. SWEDEHEART also aims to track changes in the quality and content of patient care over time, both within individual hospitals and in comparison with other hospitals across Sweden, to support continuous improvement efforts across all participating clinics.

In the SWEDEHEART registry, data is collected from all hospitals caring for patients with chronic and acute cardiac disease, including all patients undergoing coronary angiography, catheter-based interventions, or cardiac surgery, thus reflecting an unselected population. The ability to link the SWEDEHEART database with other national registries also allows for comprehensive follow-up on myocardial infarction, mortality, and other diseases.

SWEDEHEART contains a set of key quality indicators (Quality Indexes) designed to reflect the quality of the entire chain of patient care in Sweden.



These Quality Indexes are periodically analyzed and reported at the hospital level to support continuous improvement and standardization of cardiovascular

care across the country. In 2022, SWEDEHEART joined the European collaborative effort EuroHeart, a network of quality registries aimed at advancing cardiac care in Europe and enhancing the global approach to managing cardiac diseases.

1.2.2. ACR-IMPROVE Pilot Project

Benchmarking the quality of local hospital care against established performance standards is essential to identify any gaps in quality that may expose patients to suboptimal treatments, potentially affecting their prognosis. Against this backdrop, a pilot project was launched in June 2024 to analyze the performance of Akershus University Hospital in Norway relative to SWEDEHEART standards. Following agreement, key quality metrics and outcomes were identified within SWEDEHEART, and corresponding data from Akershus University Hospital were collected. This report is primarily descriptive; as the data are unadjusted for case mix, no direct comparisons between Akershus University Hospital and SWEDEHEART data or outcomes have been conducted.

1.3. Methodology

1.3.1. Organization

The Department of Cardiology at Akershus University Hospital has collaborated with Akershus Clinical Research Center (ACR), Lørenskog, Norway, and Uppsala Clinical Research Center (UCR), Uppsala, Sweden, to assess the status for cardiac coronary care at Akershus University Hospital. UCR is a leading academic research organization in Sweden, which is owned 50% by the University of Uppsala and 50% by Region Uppsala (UCR - Uppsala Clinical Research Center - Start (uu.se). UCR has established and is currently responsible for the Swedish national quality registries for cardiac care organized under the SWEDEHEART platform (Start - SWEDEHEART (uu.se).

1.3.2. Aim

The aim of the work was to compare the performance of Akershus University Hospital for 15 selected quality indexes to all Swedish centers in SWEDEHEART.

1.3.3. Project methodology

The project was considered an internal benchmarking project and the local Norwegian Registry of Invasive Cardiology (NORIC) contact at the Department of Cardiology, Akershus University Hospital extracted all data from NORIC. The Department of Analysis, Akershus University Hospital extracted the data from the data warehouse of Akershus University Hospital.

First, the group decided on 15 quality indexes from SWEDEHEART annual reports from the RIKS-HIA group and the SCAAR working group. (1, 2) An overview of the illustrations is provided in Table 1. To obtain identical definitions prior to data extraction at Akershus University Hospital, UCR provided detailed definition to ACR of each quality index and the SQL-code for data extraction from SWEDEHEART. This information was used to extract equivalent data from NORIC, collected from Akershus University Hospital in 2022 and 2023, as well as the data warehouse at Akershus University Hospital.
ACR performed statistical analysis according to the same statistical metrics used in SWEDEHEART for the selected quality indexes. Only aggregated, anonymized data were distributed between the partners and UCR have produced the illustrations in the report. UCR is solely responsible for the interpretation of the results for Akershus University Hospital, including the summary. We present data for all *a priori*-decided quality indexes in this report.

Table 1: Figure number and text from the SWEDEHEART annual reports from 2020, authored by the RIKS-HIA group, and 2023, authored by SCAAR working group, which we used to identify and later select key quality indexes. *IMPORTANT: the results in this report are from 2022 and 2023, both for Akershus University Hospital and the Swedish centers.*

Number	Text
Benchmarking against SCAAR-SWEDEHEART	
2	Number of coronary angiographies per hospital, 2022 and 2023.
5	Proportion of patients with suspected coronary artery disease but without angiographically significant coronary stenosis, per sex and age group, 2023 (total number of patients above the bar).
7	Number of PCIs per type and hospital, 2022 and 2023.
13	Thirty-day mortality after PCI in STEMI patients, per hospital, 2014–2023 (mean value and 95 % CI).
18	Proportion of PCIs using IVUS or OCT, per hospital, 2023.
20	Proportion of coronary angiography in stable coronary artery disease where FFR/iFR was used, per hospital, 2023.
50	Thirty-day mortality per indication for PCI, 2023.
52	Distribution of waiting time (days from admission to coronary angiography) for NSTEMI patients, per hospitals with > 10 patients, 2023.
53	Thirty-day mortality for coronary angiography in NSTEMI patients, from hospital admission to day of coronary angiogram, 2023.

58	Proportion of PCI performed (excluding STEMI) in the left main stem where invasive imaging (IVUS or OCT) has been used, 2023.
59	Proportion of completed complication registrations, from the department after performing coronary angiography or PCI, 2023.
81	Number of CT coronary angiographies, per hospital, 2022 and 2023.

Benchmarking against Riks-HIA-Swedeheart

24	Delay time in minutes (median) from ECG to primary PCI in STEMI patients, all ages, per hospital, 2020
106	Thirty-day mortality in MI patients, < 80 years, per hospital, 2019–2020 (mean, 95 % CI). The observed rates are not adjusted for differences in case mix and the CIs are wide. Therefore, the observed differences must be interpreted with great caution
107	One-year mortality in MI patients, < 80 years, per hospital, 2018–2019 (mean, 95 % CI). The observed rates are not adjusted for differences in case mix and the CIs are wide. Therefore, the observed differences must be interpreted with great caution

1.4. Summary of results

In 2022 and 2023, Akershus performed over 2,000 coronary angiographies (Figure 2), exceeding the median number of coronary angiographies in SWEDEHEART, which was 1,302 and 1,273 for those years, respectively. The number of coronary CT angiographies at Akershus was also very high, surpassing 1,000 in 2023 (Figure 81).

A similar trend was observed in the proportion of patients with suspected coronary artery disease but without angiographically significant coronary stenosis in both SWEDEHEART and Akershus (Figure 5). The number of diagnostic (invasive imaging and/or physiology) and therapeutic PCIs (balloon or stent) at Akershus was substantial, exceeding 1,000 in both 2022 and 2023 (Figure 7). This figure also exceeded the SWEDEHEART median of 805 and 871 PCIs in 2022 and 2023, respectively. The proportion of intravascular imaging during PCI (IVUS, OCT, or combined) was over 15% at Akershus, aligning with SWEDEHEART data (Figure 18). Similarly, the use of FFR/iFR in stable coronary artery disease patients was over 30%, meeting the SWEDEHEART quality threshold (Figure 20). IVUS/OCT use in non-urgent left main PCIs at Akershus was also high, exceeding the SWEDEHEART quality indicator threshold of 60% in both 2022 and 2023 (Figure 58). The proportion of fully reported complications at Akershus was 95%, though it fell slightly below the SWEDEHEART recommendation of 99% (Figure 59).

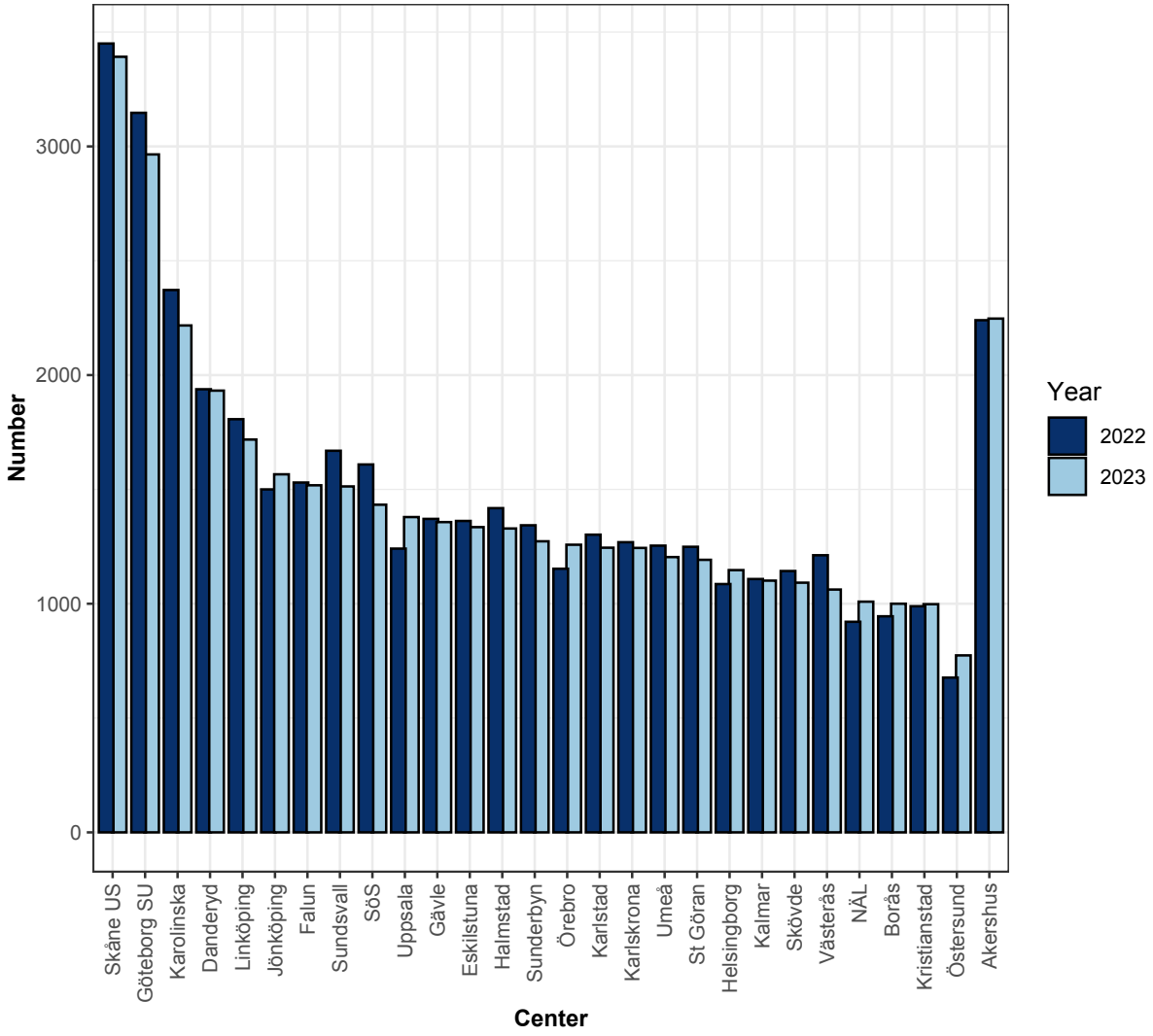
In terms of outcomes, all-cause mortality in STEMI patients undergoing PCI was close to 6% in 2023 at Akershus, comparable to the hospital-based mortality estimates in SWEDEHEART from 2014 to 2023 (4.4%-7.9% range, Figure 13). Similar mortality trends at 30 days post-PCI by clinical indication were observed in both SWEDEHEART and

Akershus, with higher mortality rates in STEMI patients (Figure 50). Most NSTEMI patients (over 75%) in Akershus underwent angiography within 0-1 day, and the 30-day mortality according to waiting time in this group was in line with SWEDEHEART estimates (Figures 52 and 53).

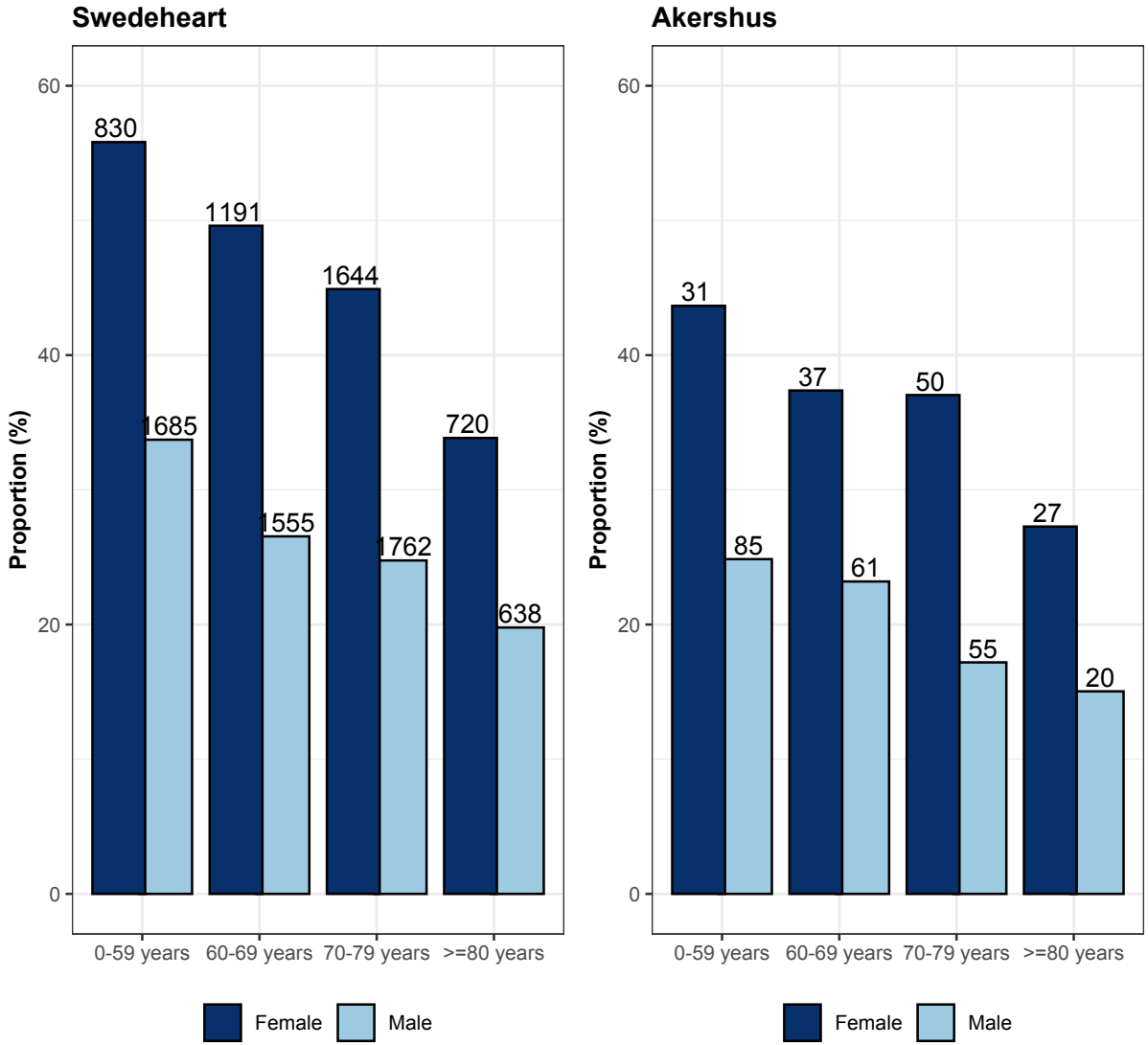
The time delay to angiography for STEMI patients at Akershus was low and below the SWEDEHEART median of 73 minutes (Figure 24). Thirty-day and one-year mortality rates in MI patients aged ≤80 years were low in Akershus (Figures 106 and 107).

1.5. Figures

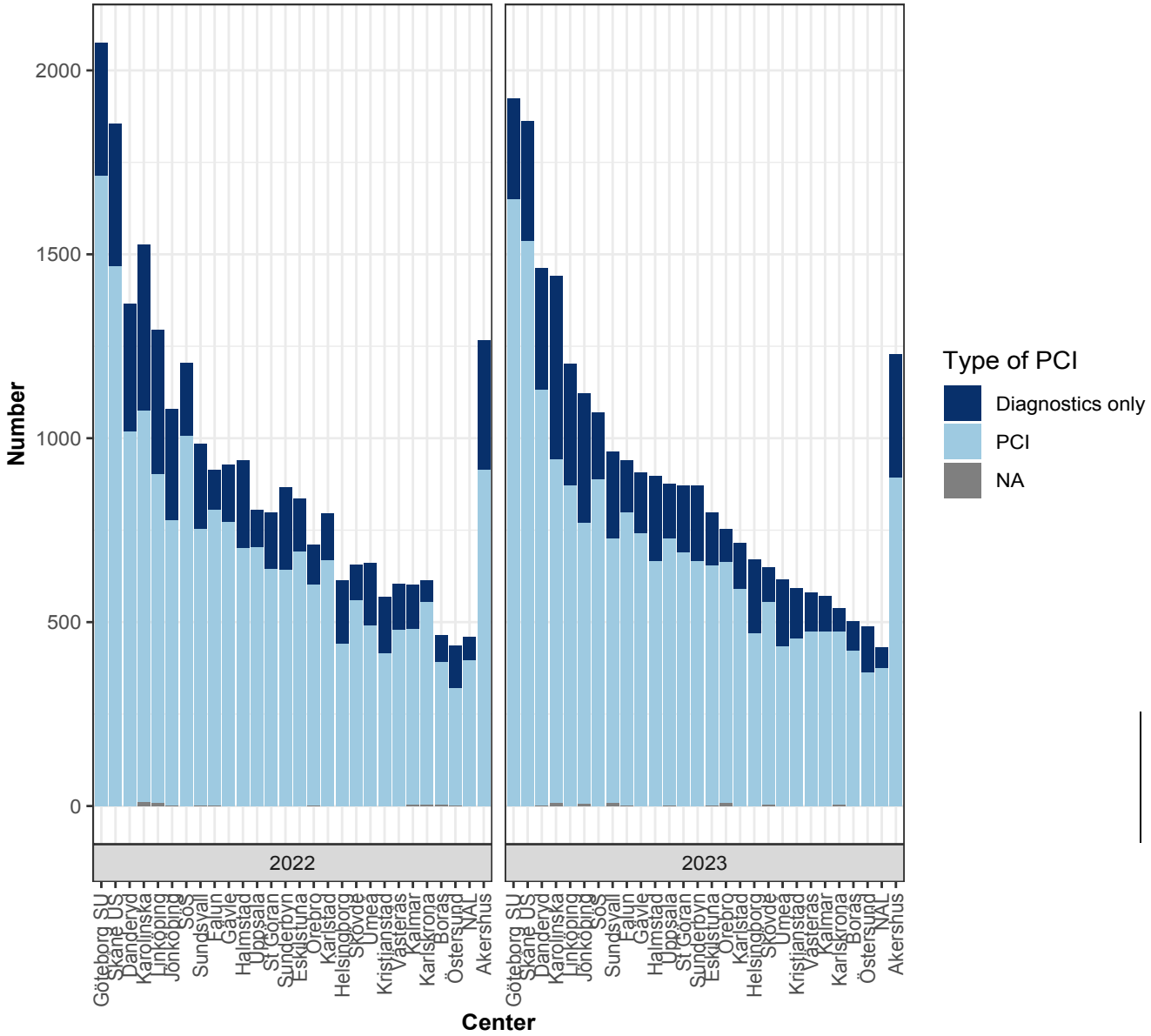
1.5.1. **Figure 2** Number of coronary angiographies per hospital, 2022 and 2023.



1.5.2. **Figure 5** Proportion of patients with suspected coronary artery disease but without angiographically significant coronary stenosis, per sex and age group, 2023.

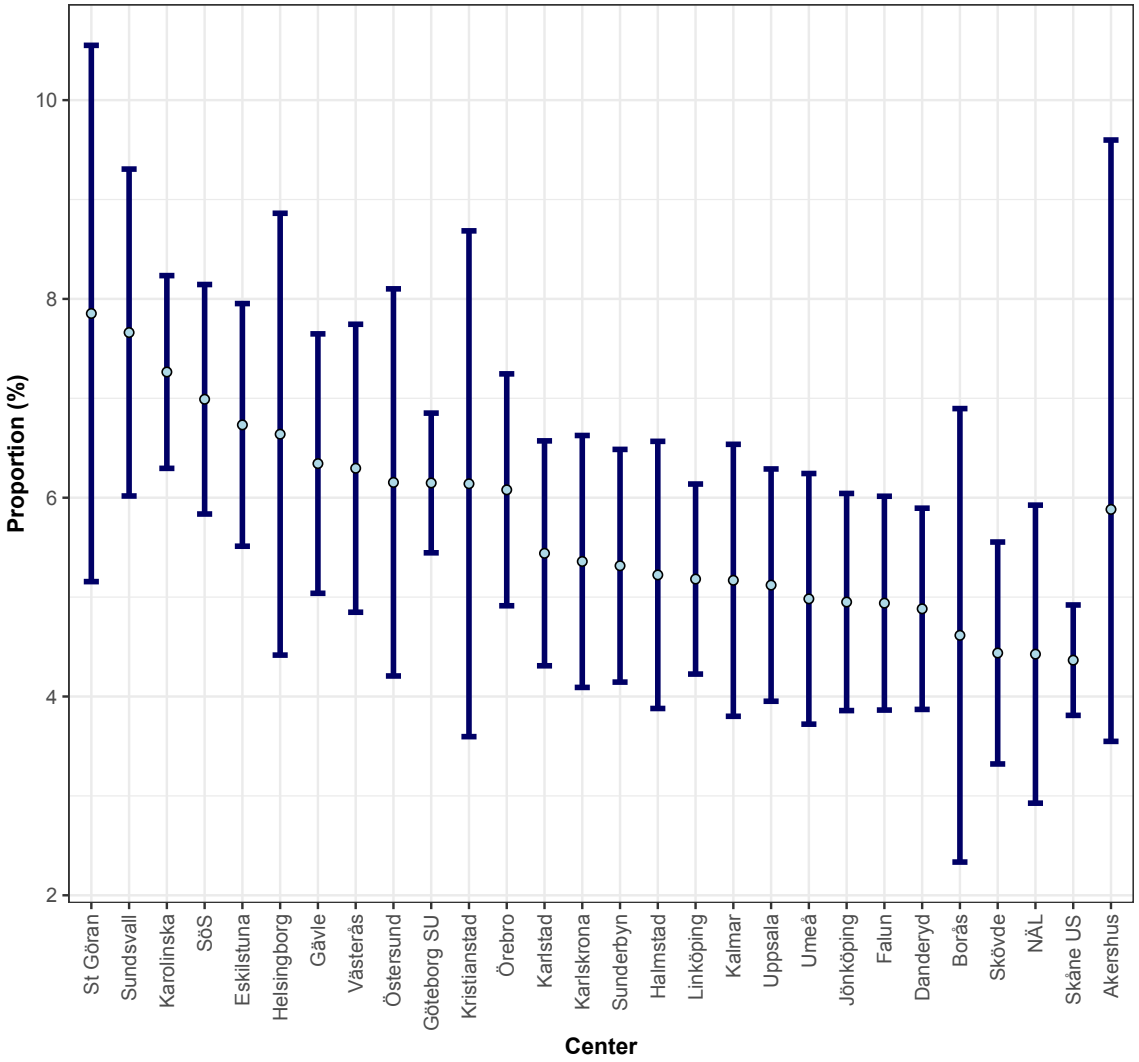


1.5.3. **Figure 7** Number of PCIs per type and hospital 2022 and 2023.



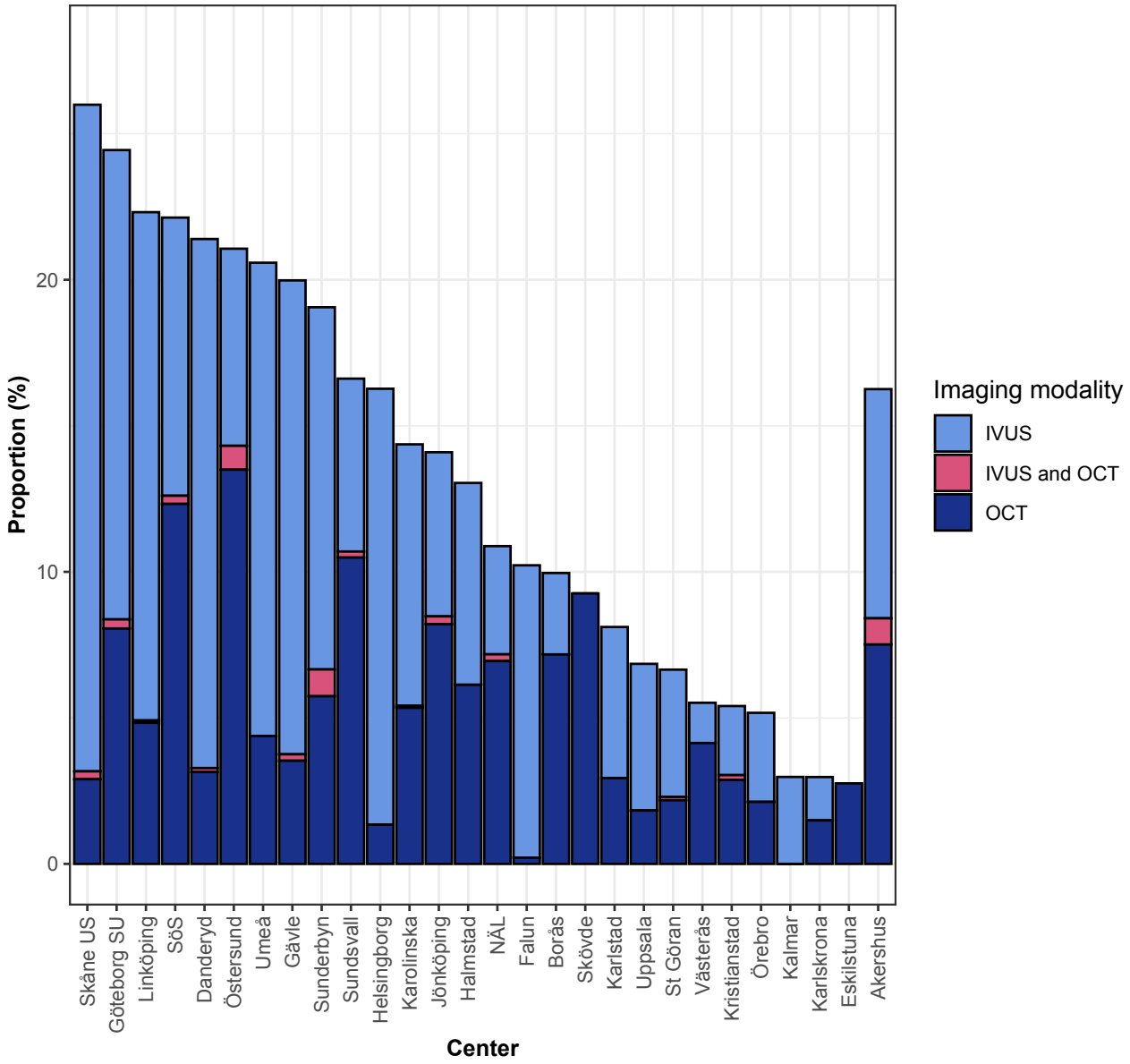
Diagnostic PCI is defined as any coronary wire advanced in the vessels with a diagnostic purpose (i.e., FFR/iFR or intravascular imaging).

1.5.4. **Figure 13** Thirty-day mortality after PCI in STEMI patients per hospital 2014-2023.

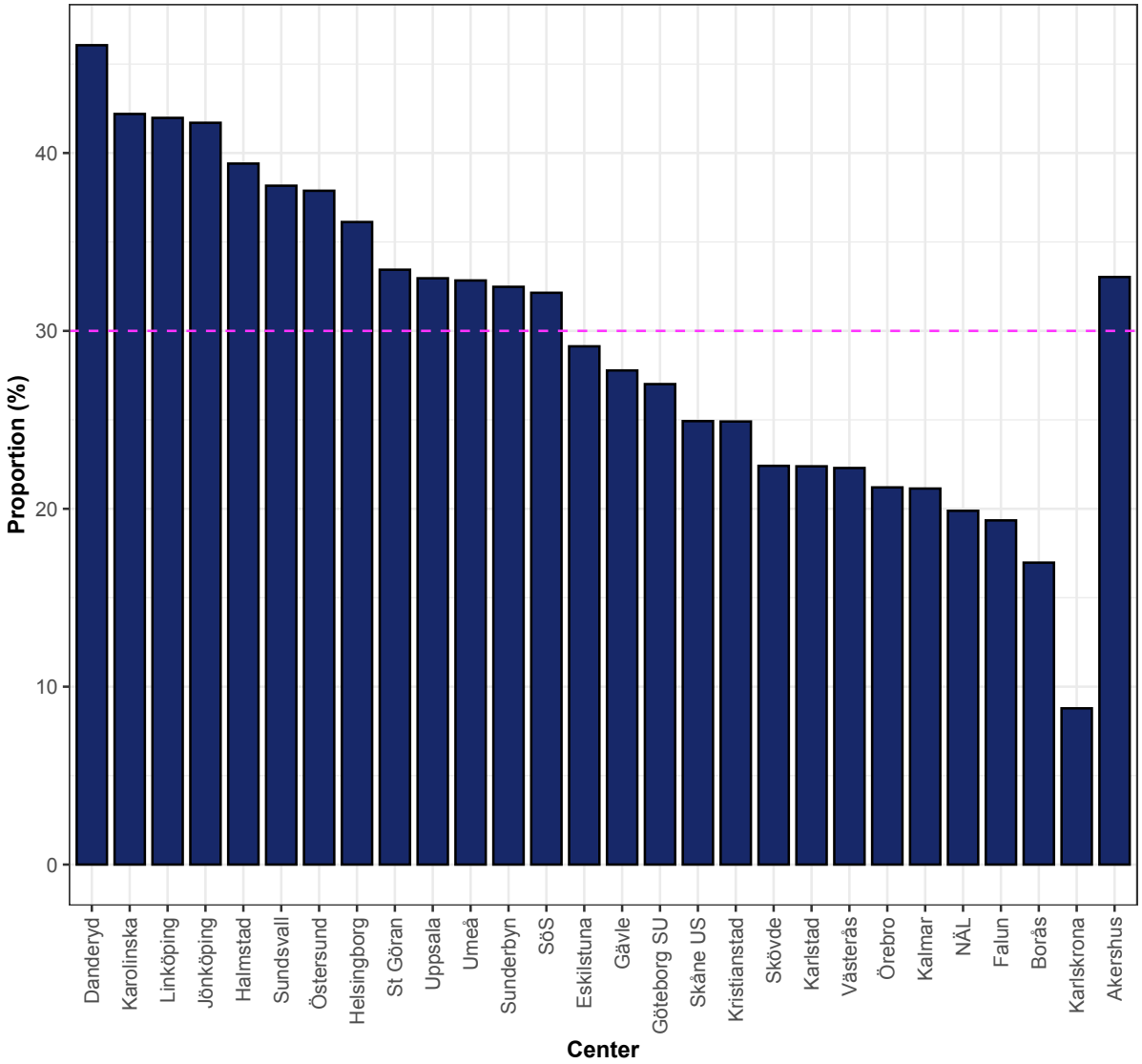


Mortality data in Akershus were obtained only for 2023. This explains the larger confidence interval as compared to other hospitals in SWEDEHEART.

1.5.5. Figure 18 Proportion of PCIs using IVUS or OCT per hospital 2023.

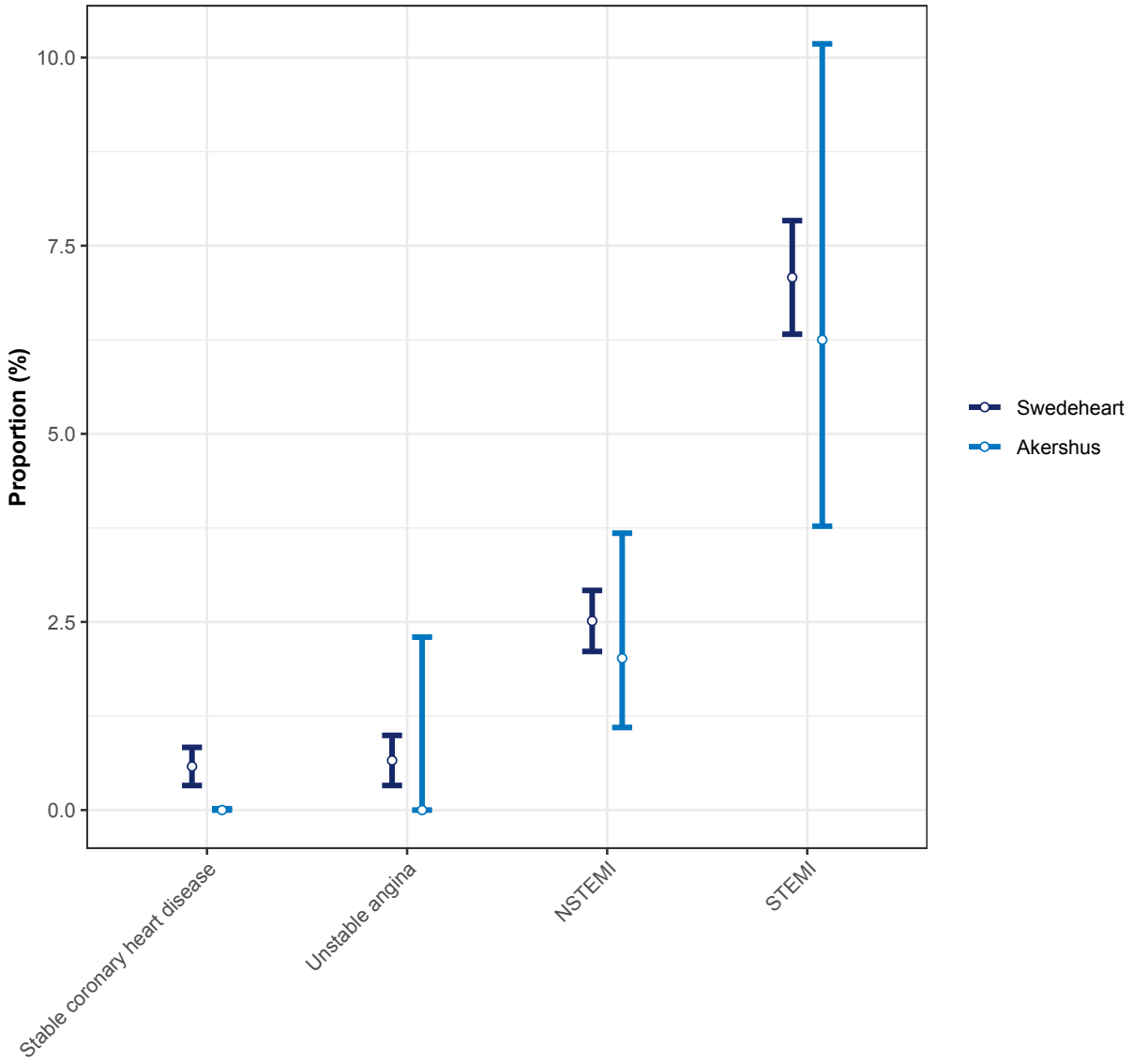


1.5.6. **Figure 20** Proportion of coronary angiography in stable coronary artery disease using FFR/iFR in 2023.

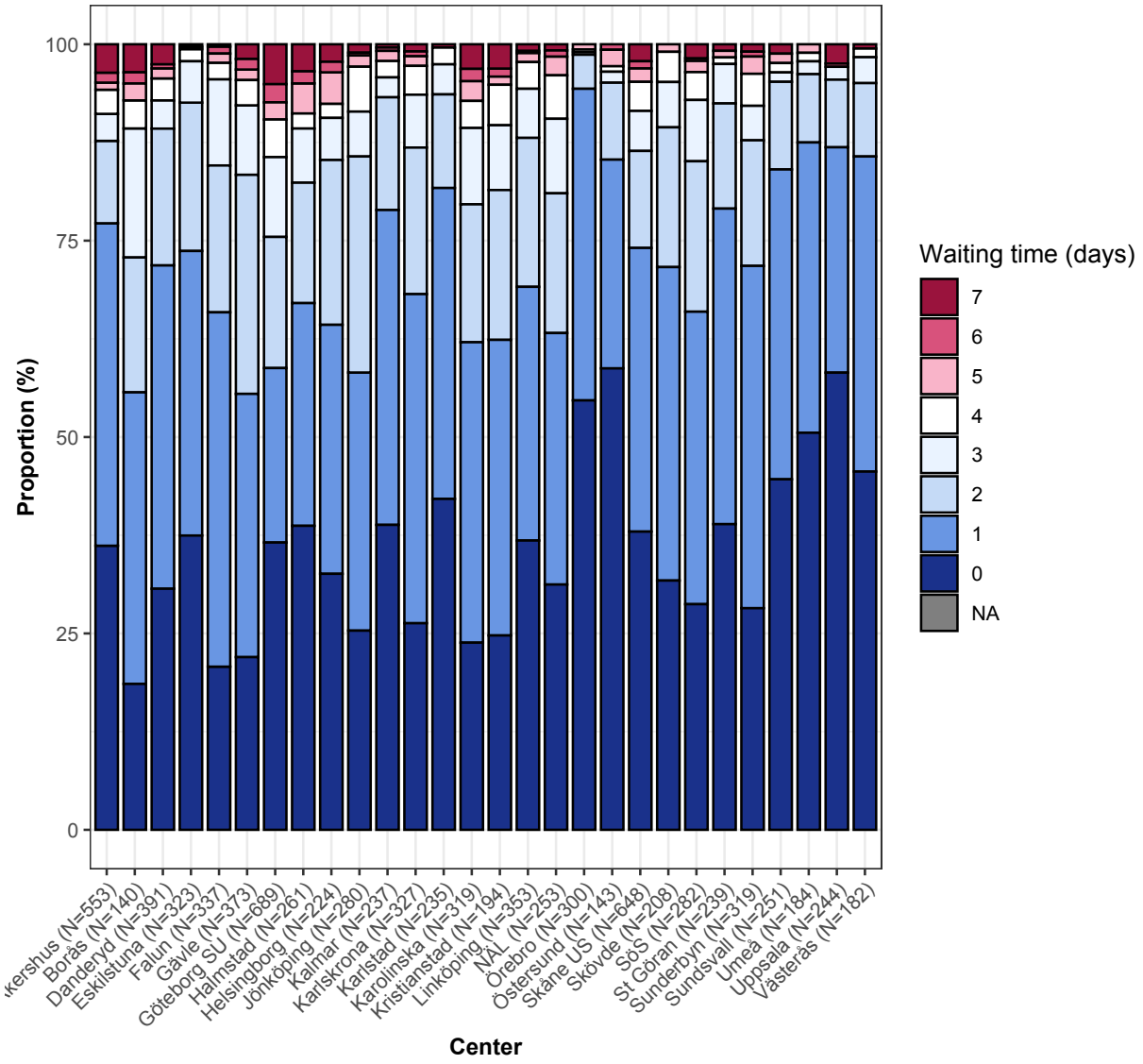


A proportion of 30% (purple line) is considered as quality index in SWEDEHEART.

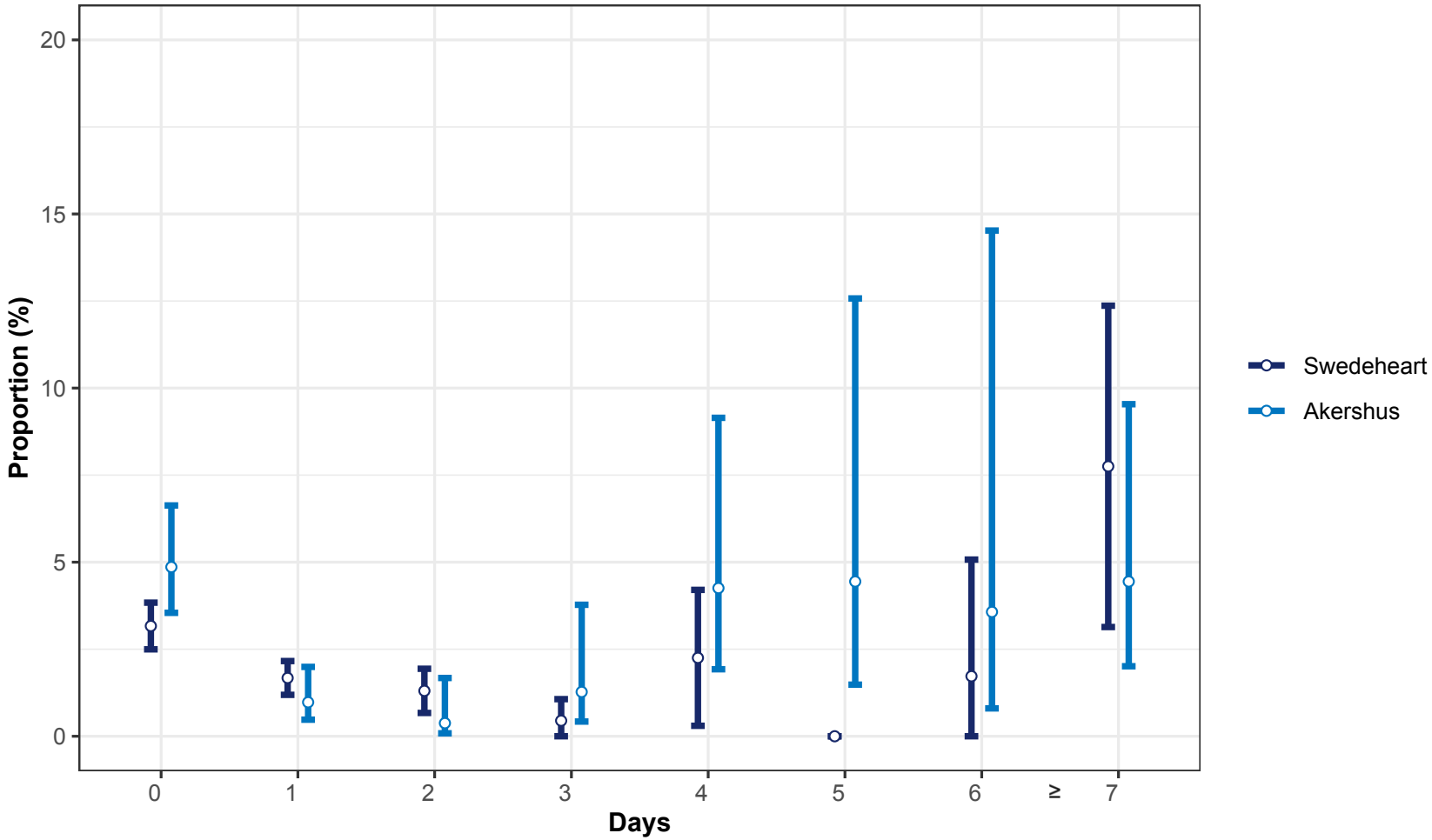
1.5.7. **Figure 50** Thirty-day mortality per indication for PCI in 2023.



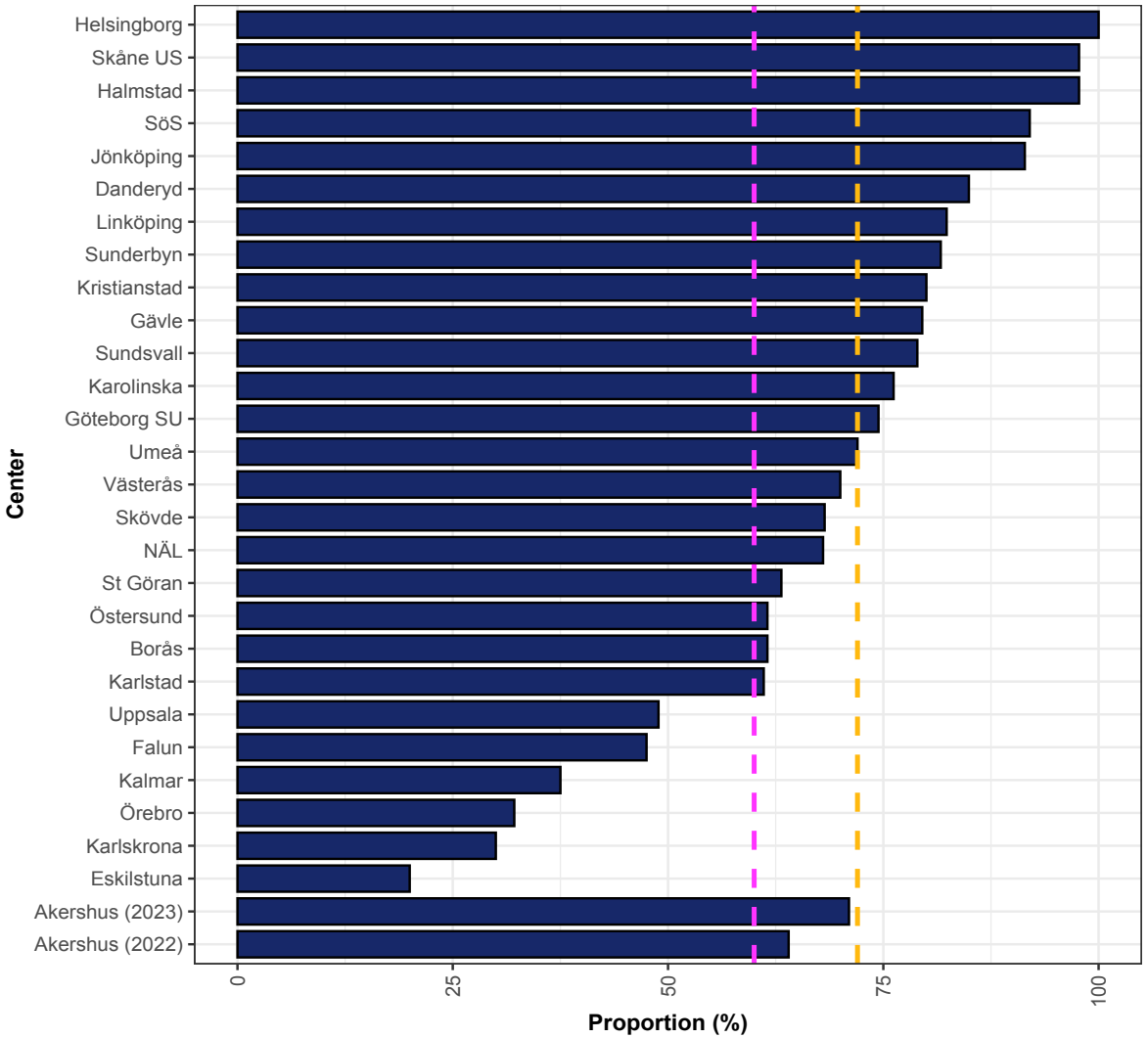
1.5.8. **Figure 52** Distribution of waiting time (days from admission to coronary angiography) for NSTEMI patients per hospitals 2023



1.5.9. Figure 53 Thirty-day mortality for coronary angiography in NSTEMI patients from hospital admission to day of coronary angiogram.

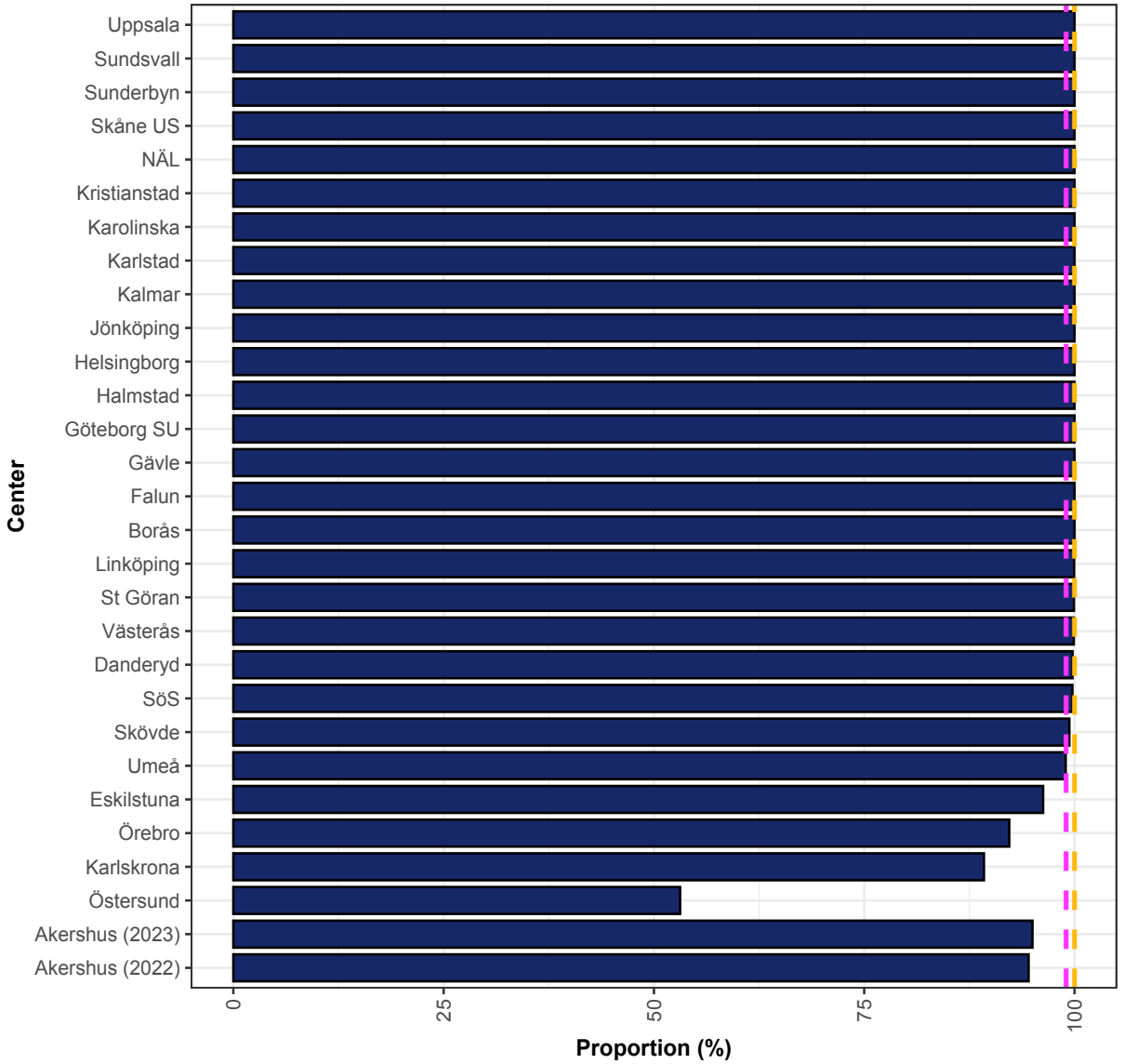


1.5.10. Figure 58 Proportion of PCI performed (excluding STEMI) in the left main stem where invasive imaging (IVUS or OCT) has been used.



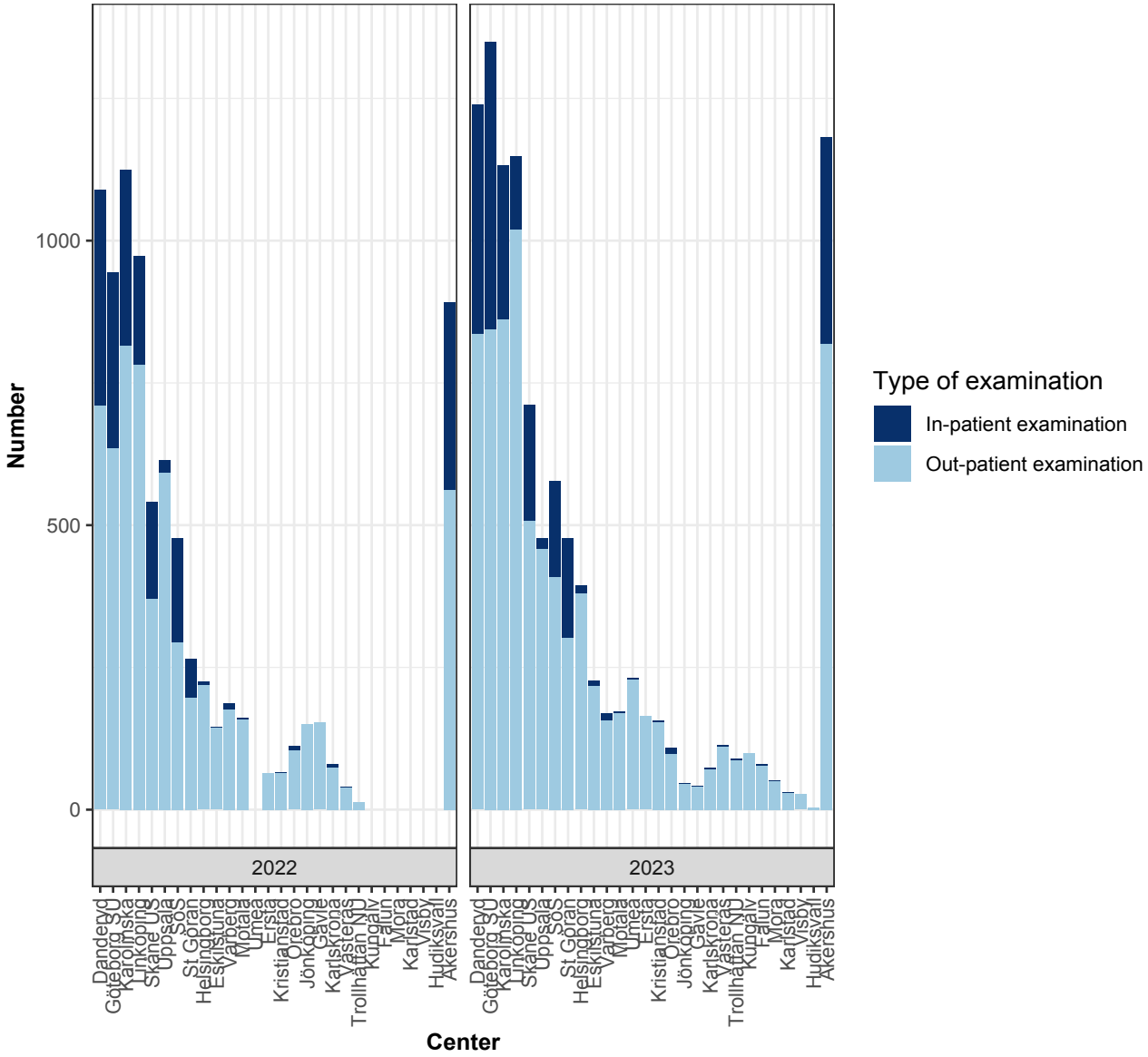
A proportion of 60% (purple line) is considered as quality index in SWEDEHEART. The median use of IVUS in SWEDEHEART (yellow line) is 73%.

1.5.11. Figure 59 Proportion of completed complication registrations from the department after performing coronary angiography or PCI.

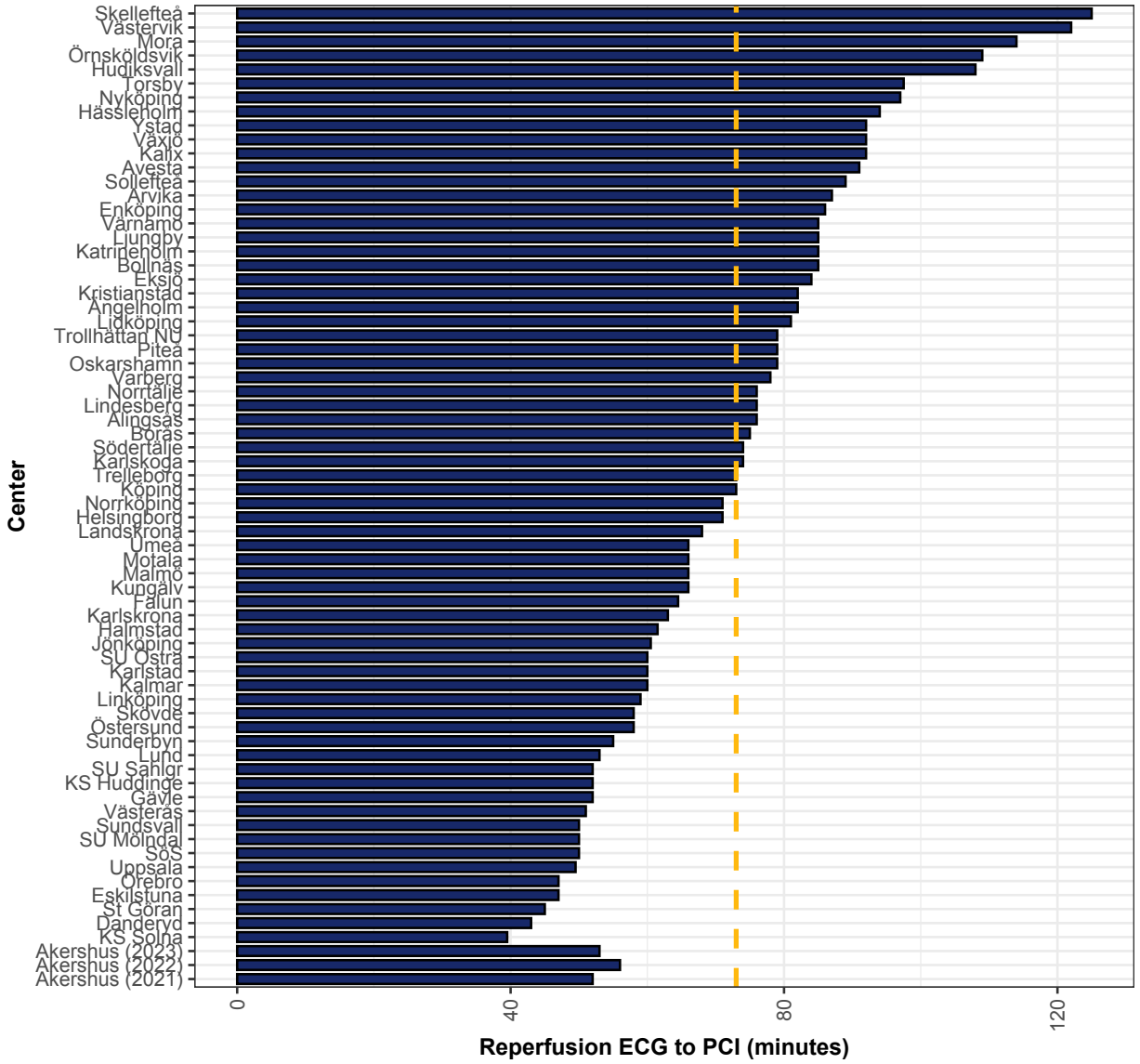


A proportion of 99% (purple line) is considered as quality index in SWEDEHEART. The median SWEDEHEART proportion of reported complication (yellow line) is >99%.

1.5.12. Figure 81 Number of CT coronary angiographies per hospital.

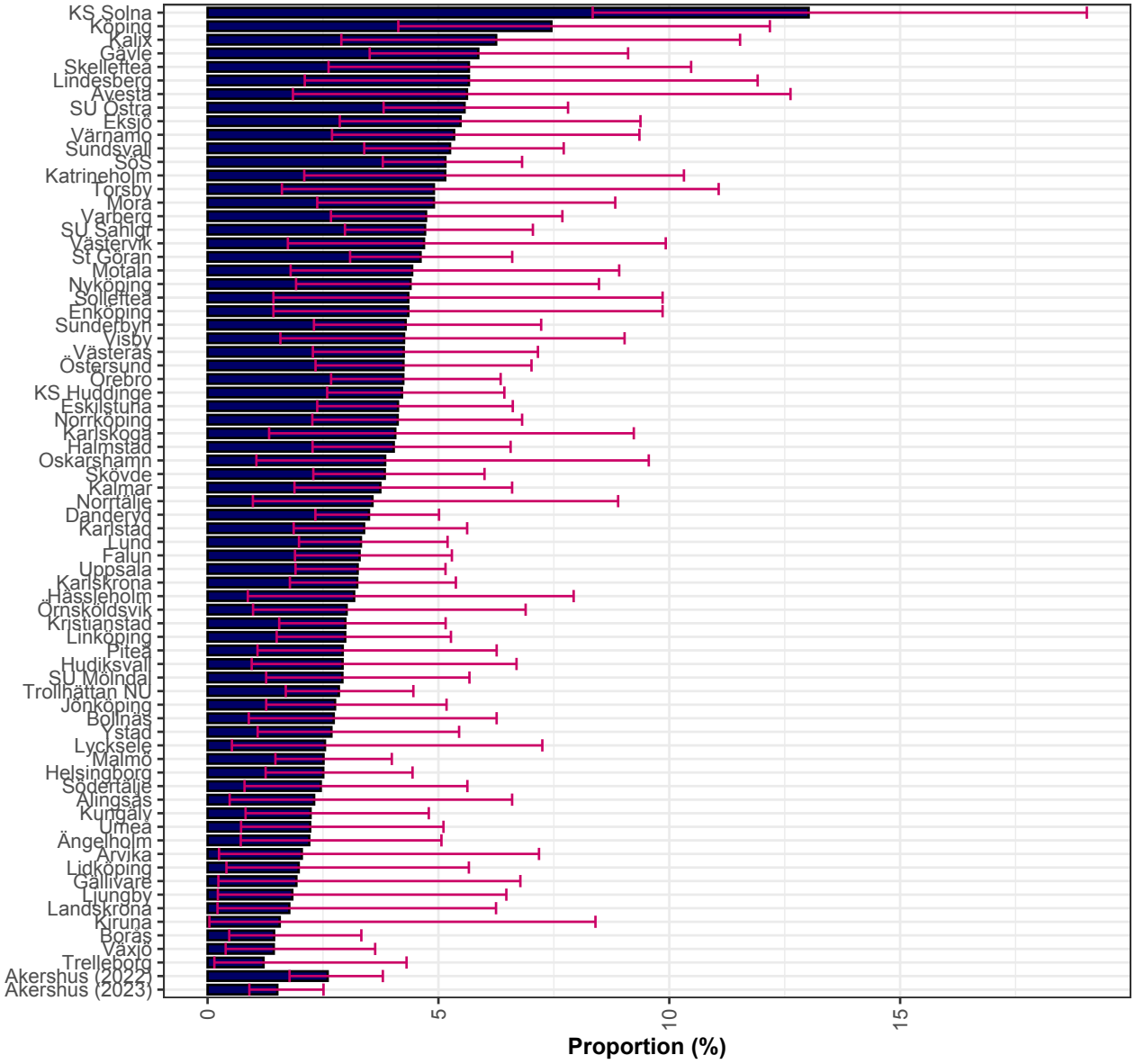


1.5.13. Figure 24 Delay time in minutes (median) from ECG to primary PCI in STEMI patients all ages per hospital 2023.

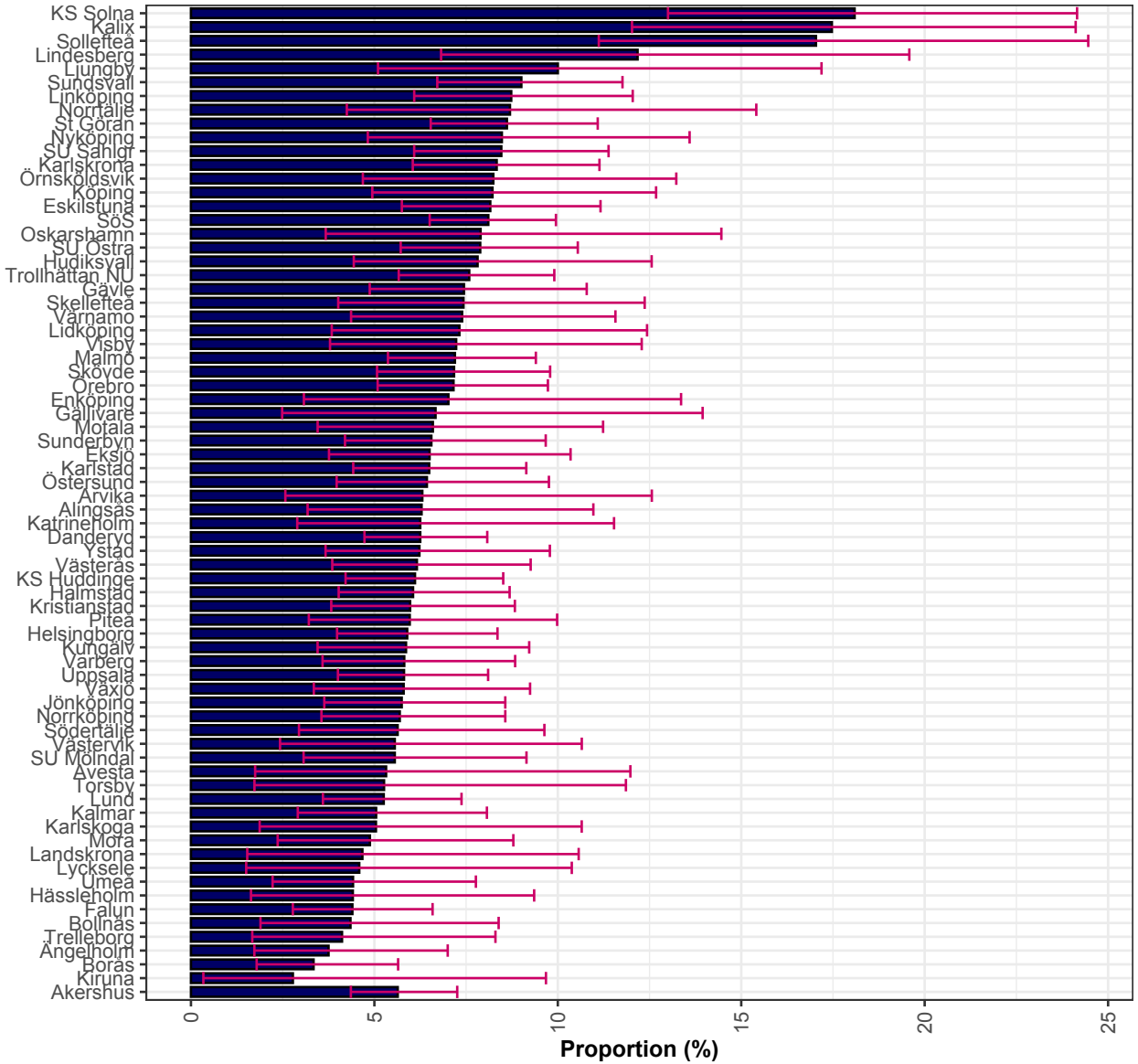


The median time delay in SWEDEHEART (yellow line) is 73 minutes.

1.5.14. Figure 106 Thirty-day mortality in MI patients <= 80 years per hospital 2022-2023.



1.5.15. **Figure 107** One-year mortality in MI patients <= 80 years per hospital 2021-2022.



1.6. Concluding remarks

The ACR IMPROVE pilot project demonstrated the feasibility of benchmarking the quality of cardiovascular care of non-Swedish centers against SWEDEHEART data. The findings indicate that Akershus University Hospital is a high-volume center with quality standards and outcomes comparable to those observed in SWEDEHEART.

1.7. References

1. Vasko P, Alfredsson J, Back M, et al. SWEDEHEART annual report 2020. annual report. Uppsala, Sweden Uppsala Clinical Research Center (UCR); 2021
2. Vasko P, Alfredsson J, Back M, et al. SWEDEHEART annual report 2023. annual report. Uppsala, Sweden Uppsala Clinical Research Center (UCR); 2024