Out-of-Hospital ST-segment Elevation Myocardial Infarction Registry

Aotearoa New Zealand, National Report 2020/21

Contents

List of figures

List of tables

Introduction
Whakatakinga

Ischaemic heart disease (IHD) in Aotearoa New Zealand carries a large burden of disease.

In 2019 IHD was the second leading cause of death for all New Zealanders, with 47 deaths per 100,000 population. The risk of death from IHD is higher for Māori, who have a rate of 84.8 deaths per 100,000 population (Ministry of Health).

ST-segment Elevation Myocardial Infarction (STEMI) is the most life-threatening manifestation of IHD and requires urgent revascularisation. This is achieved with either intravenous fibrinolysis and/or percutaneous coronary intervention (PCI). Intravenous fibrinolysis can be performed by paramedics in an out-of-hospital setting, whereas PCI must be performed in a PCI-capable hospital (Table 1).

PCI-capable hospitals

- North Shore Hospital (restricted times)
- Auckland City Hospital
- Middlemore Hospital (restricted times)
- Waikato Hospital
- Wellington Hospital
- Nelson Hospital (restricted times)
- Christchurch Hospital
- Dunedin Hospital

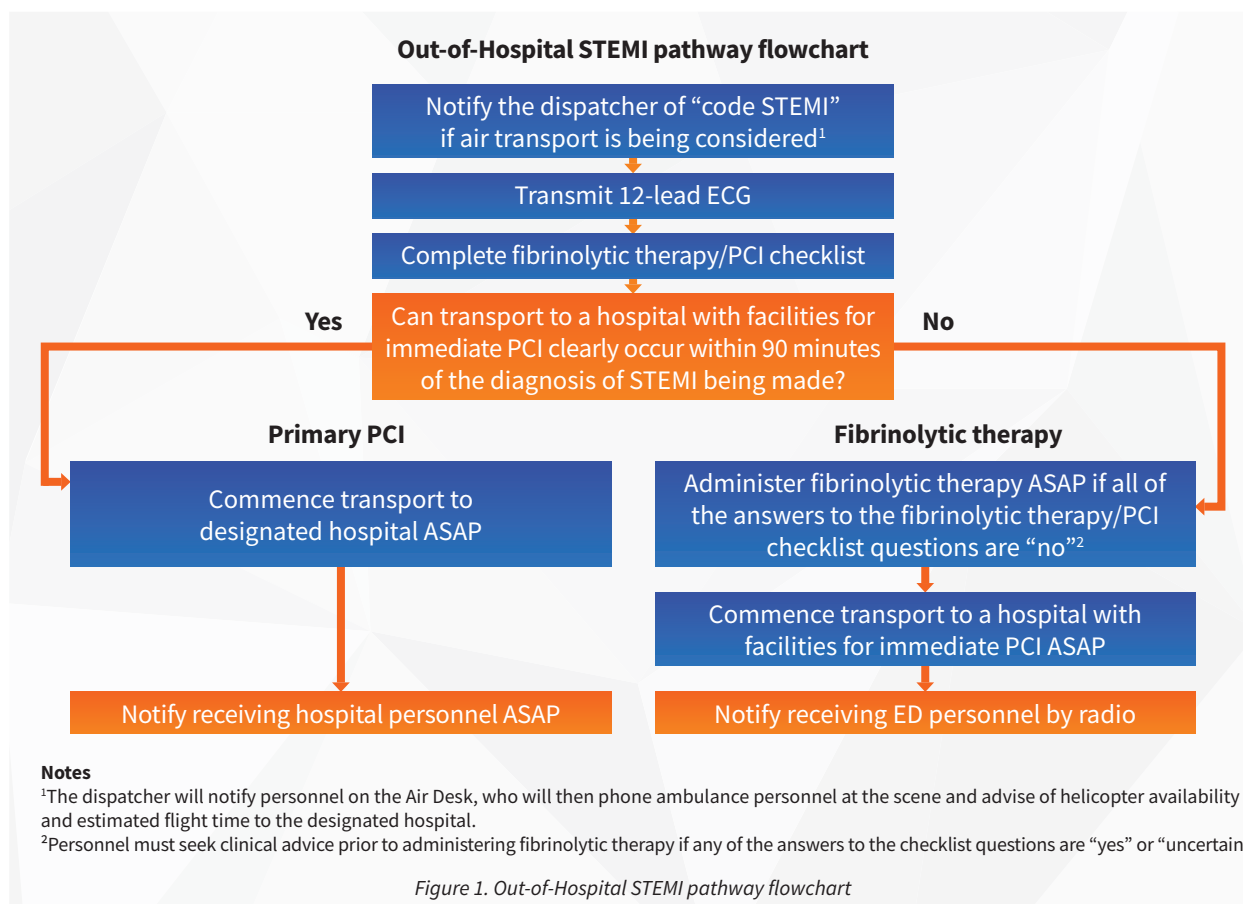*Table 1: List of PCI-capable hospitals*

Overview of the New Zealand Out-of-Hospital STEMI Pathway

The New Zealand Out-of-Hospital STEMI Pathway (STEMI pathway) aims to expediate reperfusion therapy for patients experiencing out-of-hospital STEMI.

The STEMI pathway guides paramedics' decision making between the two reperfusion strategies. If the patient can be transported to a PCI-capable hospital within 90 minutes of a STEMI diagnosis being made, then the Primary PCI reperfusion strategy is followed. If transport is expected to take longer than 90 minutes, fibrinolytic therapy is the reperfusion strategy.

In New Zealand, paramedics can autonomously administer fibrinolytic therapy when STEMI criteria is met, and the patient has no clinical contraindications. If relative contraindications are present or the STEMI diagnosis is unclear, consultation with an on-call doctor is required. Following out-of-hospital fibrinolysis, patients are transported to a hospital capable of providing rescue PCI.

Out-of-Hospital STEMI pathway flowchart

Notify the dispatcher of "code STEMI" if air transport is being considered[1]

Transmit 12-lead ECG

Complete fibrinolytic therapy/PCI checklist

Can transport to a hospital with facilities for immediate PCI clearly occur within 90 minutes of the diagnosis of STEMI being made?

Yes → **Primary PCI**

Commence transport to designated hospital ASAP

Notify receiving hospital personnel ASAP

No → **Fibrinolytic therapy**

Administer fibrinolytic therapy ASAP if all of the answers to the fibrinolytic therapy/PCI checklist questions are "no"[2]

Commence transport to a hospital with facilities for immediate PCI ASAP

Notify receiving ED personnel by radio

Notes
[1]The dispatcher will notify personnel on the Air Desk, who will then phone ambulance personnel at the scene and advise of helicopter availability and estimated flight time to the designated hospital.
[2]Personnel must seek clinical advice prior to administering fibrinolytic therapy if any of the answers to the checklist questions are "yes" or "uncertain".

Figure 1. Out-of-Hospital STEMI pathway flowchart

The wider rollout of the STEMI pathway started in March 2019 and it was incrementally introduced across District Health Boards (DHBs) through to its completion in September 2020. The impact of this on our results is unknown.

About this report
Mō tēnei pūrongorongo

This is New Zealand's first annual Out-of-Hospital ST-Elevation Myocardial Infarction (STEMI) report.

The data presented in this report is for all STEMI incidents attended by the St John and Wellington Free Ambulance services in the period from 1 July 2020 to 30 June 2021.

Data was retrieved retrospectively from ambulance electronic Patient Report Forms (ePRFs). Case selection required both a diagnostic 12-lead ECG and a selected clinical impression (Table 2).

Cases which progressed to cardiac arrest were excluded from analysis. Where possible cases were excluded if fibrinolysis was administered by a non-EAS provider.

Where a patient was transported to a hospital that had PCI capability only during restricted hours, we have assumed that PCI was available at the time of transport.

In this report, patients were allocated to the primary PCI reperfusion strategy if they were transported to a PCI capable hospital and prehospital fibrinolysis did not occur.

This report encompasses some of the COVID-19 pandemic period. However, in New Zealand we were fortunate that during this reporting period we had lockdowns of short duration and that were geographically isolated to select parts of New Zealand (https://covid19.govt.nz/about-our-covid-19-response/history-of-the-covid-19-alert-system/).

Inclusion criteria
Documented STEMI location on ECG
and
a primary or secondary clinical impression from the list below:
• ST- elevation myocardial infarction
• Cardiac chest pain
• Myocardial ischaemia

Table 2: Out-of-Hospital STEMI patient inclusion criteria

Executive summary
Tuhinga whakarāpopoto nui

1,511 STEMI patients attended by emergency ambulance in the 12 month period

The median age was **67** years

31% female
69% male

STEMI diagnosis

35% of patients waited more than two hours from onset to calling 111

7 minutes Median time from EAS arrival to 12-lead ECG

65% of patients had first 12-lead ECG within 10 minutes

Primary PCI strategy

46 minutes Median time from EAS arrival to PCI Hospital

93% of patients arrived at a PCI capable hospital within 90 minutes of EAS arrival

Fibrinolysis strategy

35 minutes Median time from EAS arrival to fibrinolysis
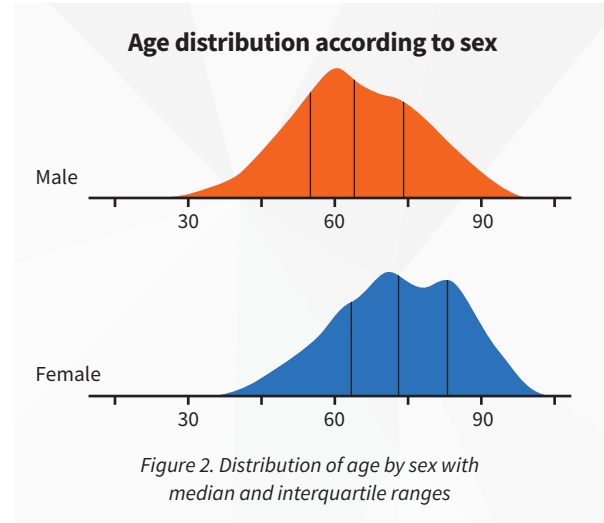
39% of patients received fibrinolysis within 30 minutes of EAS arrival
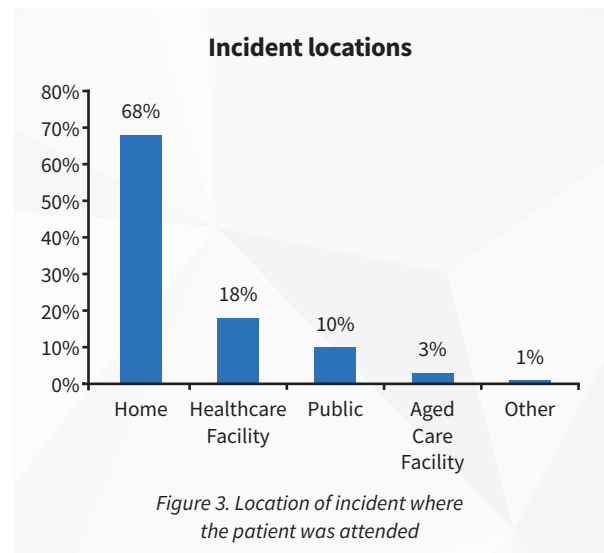
Incidence and Patient Demographics

During the inclusion period, ambulance officers attended 1,511 patients experiencing a STEMI. Sixty-nine percent of the patients were male. The median age for all genders was 67 years. The median age for males was 64 (55,74 IQR) while median age for females was 73 (63,83 IQR).

Māori experience STEMI at a younger age. The median age for all Māori experiencing STEMI was 60 years. For Māori females the median age was 63 and 57 was the median age for Māori males.

Age distribution according to sex

Male

Female

Figure 2. Distribution of age by sex with median and interquartile ranges

Location

Sixty-eight percent of the STEMI incidents occurred at the patient's home. In 18% of cases the patient was located at a healthcare facility, indicating that they were assessed by another health professional prior to ambulance attendance.

Incident locations

Location	Percentage
Home	68%
Healthcare Facility	18%
Public	10%
Aged Care Facility	3%
Other	1%

Figure 3. Location of incident where the patient was attended

Reperfusion strategies

Primary PCI is the preferred reperfusion strategy for patients experiencing STEMI. Nationwide, 68% of out-of-hospital STEMI followed the primary PCI reperfusion strategy while 16% underwent fibrinolysis. The remaining 16% did not meet the criteria of either strategy.

Reperfusion strategies and hospital destinations

PCI

Urban

Fibrinolysis

Rural

Neither

PCI Hospitals

Auckland City Hospital
Christchurch Hospital
Wellington Hospital
Waikato Hospital
Middlemore Hospital
North Shore Hospital
Dunedin Hospital
Nelson Hospital

Non-PCI Hospitals

Taranaki Hospital
Ashburton Hospital
Gisborne Hospital
Gore Hospital
Rotorua Hospital
Hawera Hospital
Taupo Hospital
Hawkes Bay Hospital
Timaru Hospital
Hutt Hospital
Wairau Hospital
Kaitaia Hospital
Southland Hospital
Lakes District Hospital
Taranaki Hospital
Bay of Islands Hospital
Tauranga Hospital
Te Nikau Grey Hospital
Thames Hospital
Whakatane Hospital
Tokoroa Hospital
Whanganui Hospital
Wairarapa Hospital
 Invercargill Hospital
Dunstan Hospital
Clutha Health First
Palmerston North Hospital
Whangarei Hospital
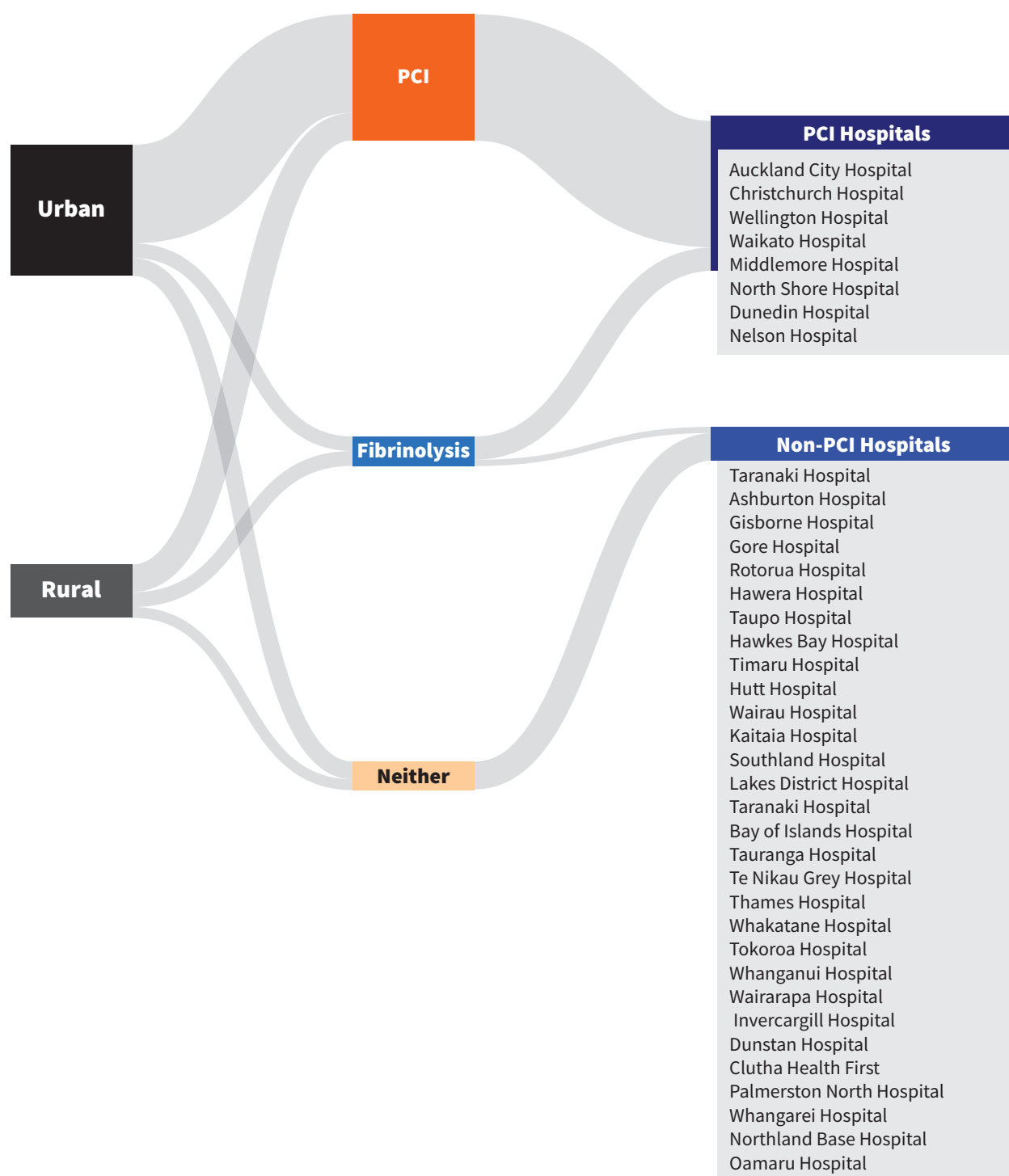Northland Base Hospital
Oamaru Hospital

Figure 4. Sankey diagram of STEMI reperfusion strategies and hospital destinations according to rurality

Median time from ambulance arrival to arrival at hospital for patients following the Primary PCI reperfusion strategy was 46 minutes. The median time from ambulance arrival to tenecteplase administration for patients following the fibrinolysis reperfusion strategy was 35 minutes.

Rurality

Longer distances to a PCI capable hospital meant that incidents that occurred in rural locations had a lower proportion of patients following the Primary-PCI strategy.

Even in urban areas, fibrinolysis is the primary reperfusion strategy for 11% of cases. This may be partly attributed to the restricted operating hours of some PCI capable hospitals.

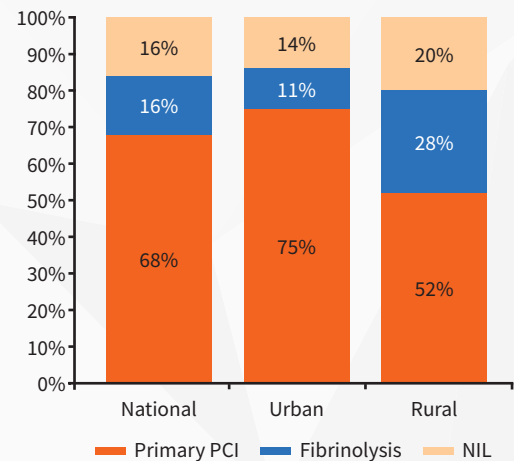**Reperfusion strategy according to rurality**

Figure 5. Reperfusion strategy according to rural and urban areas

Ethnicity

Europeans accounted for the majority of patients experiencing a STEMI (76%) followed by Māori (10%), Asian (8%) and Pacific People (6%). The remaining 3% were Middle Eastern, Latin American, African, and other ethnicities. Numbers of Māori, Asian & Pacific were small.

When compared with other ethnicities, a higher proportion of Māori patients followed neither reperfusion strategy (Figure 6).

In New Zealand, the majority of the Asian and Pacific Peoples populations reside in urban areas. This most likely accounts for the high level of access to Primary PCI in these ethnic groups.

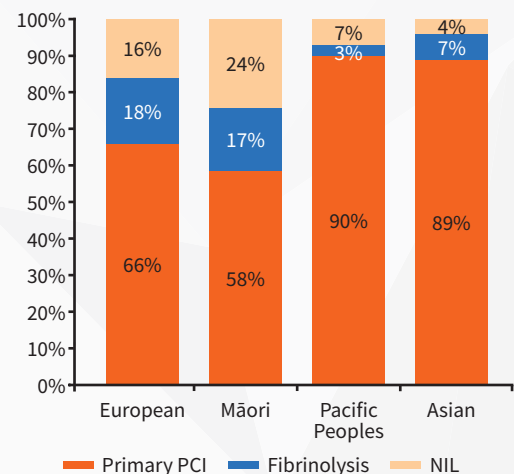**Reperfusion strategy according to ethnicity**

Figure 6. Reperfusion strategy according to ethnicity. (other ethnicities not shown made up less than 5% of patients)

	European	38 per 100,000 persons
	Māori	20 per 100,000 persons
	Pacific Peoples	35 per 100,000 persons
	Asian	12 per 100,000 persons

Figure 7. Ethnicity-specific incidence of STEMI per 100,000 persons based on Primary Health Organization (PHO) Enrolment Demographics 2021

Timeline

The flowchart shows the timeline of events for a typical out-of-hospital STEMI patient.

There is often a considerable delay in patients seeking care after the onset of their symptoms. The median time calculation of 63 minutes from onset of symptoms to 111 call includes patients who are assessed at other healthcare facilities prior to ambulance attendance.

Median time from onset of symptoms to 111 call

63 mins

Median time from 111 call to ambulance arrival

13 mins

(urban 12 minutes, rural 20 minutes)

Median time from ambulance arrival to first 12-lead ECG

7 mins

Median time from STEMI diagnosis to arrival at a PCI capable hospital

36 mins

(urban 34 minutes, rural 55 minutes)

Median time from STEMI diagnosis to prehospital fibrinolysis

25 mins

Patient journey

━━ Median scene time　　■ Median transport time

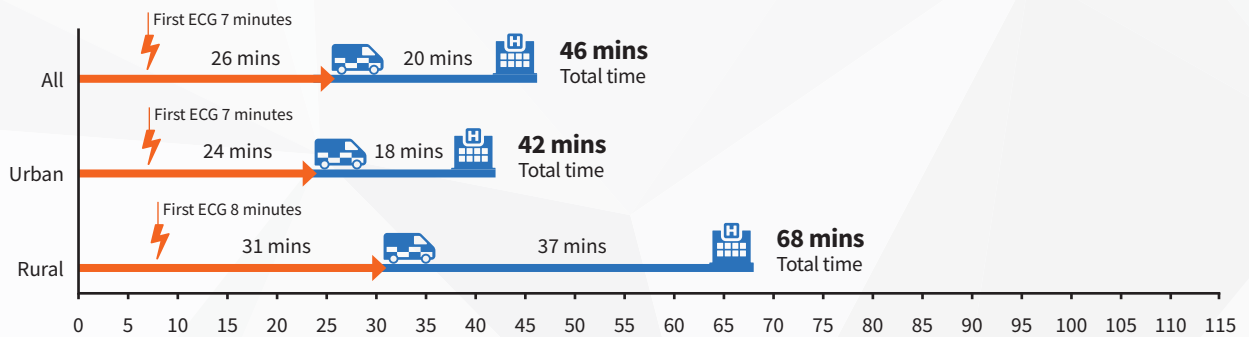## Median times for patients following the Primary PCI strategy

Figure 8. Median times for patients following the Primary PCI strategy

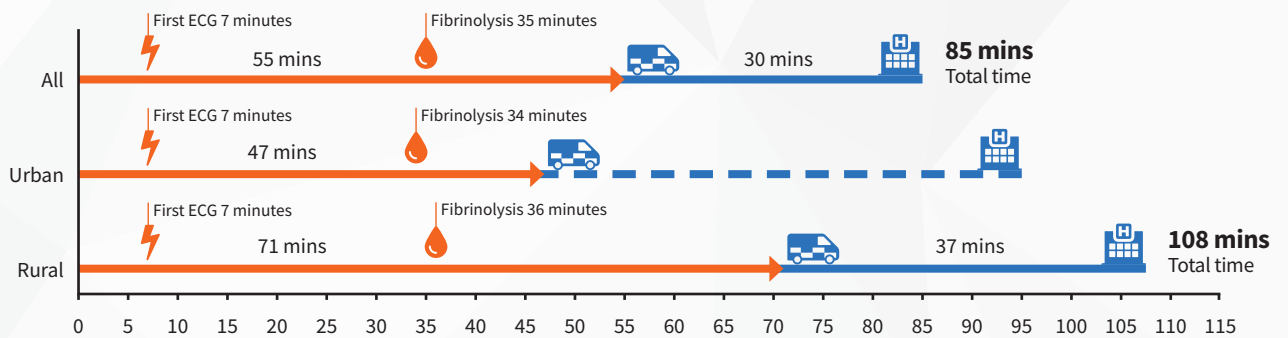## Median times for patients following the Fibrinolysis strategy

Figure 9. Median times for patients following the Fibrinolysis strategy
*Transport times for urban fibrinolysis strategy unable to be calculated due to data unavailability.

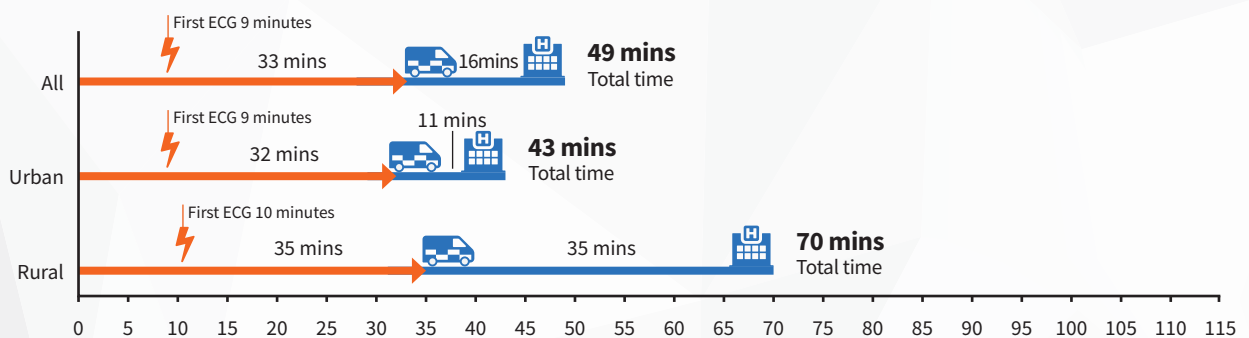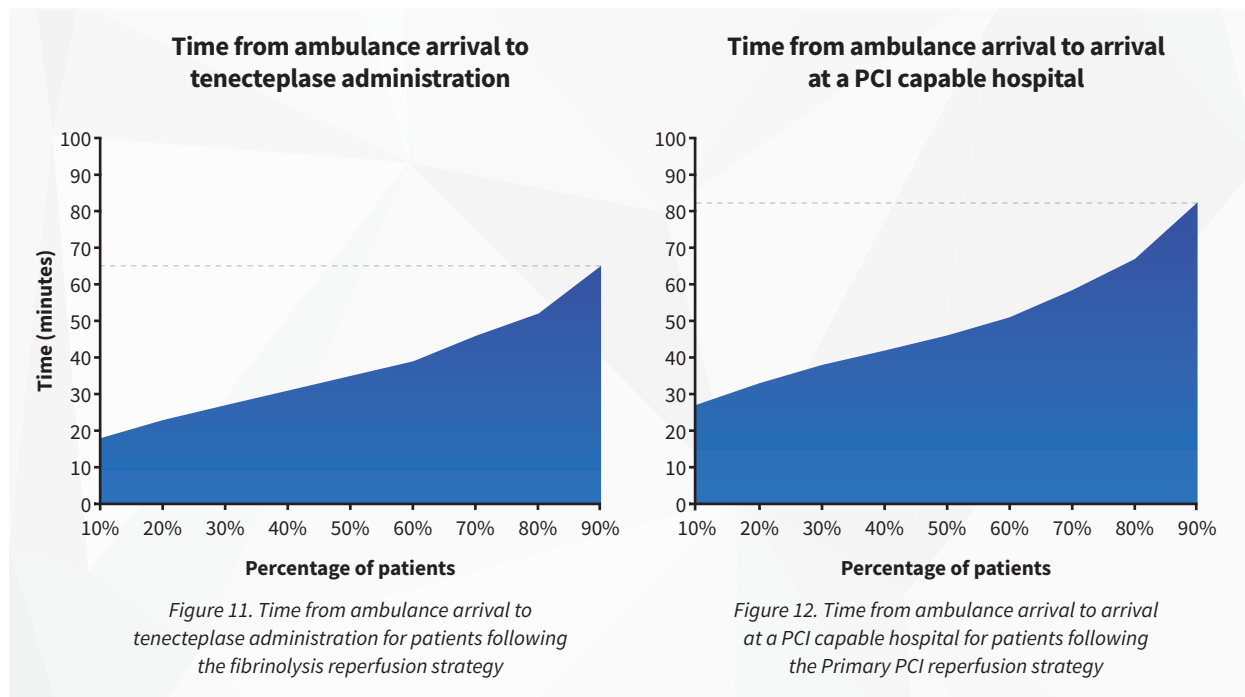## Median times for patients following neither strategy

Figure 10. Median times for patients following neither strategy

While paramedics can provide fibrinolytic therapy without consultation, sometimes when STEMI diagnosis is unclear or cautions exist, consultation with on an call doctor is required. Consultation is likely to delay fibrinolytic therapy. However, this delay was unable to be quantified as we currently cannot distinguish between autonomous and consulted fibrinolytic therapy.

Time from ambulance arrival to tenecteplase administration

Time from ambulance arrival to arrival at a PCI capable hospital

Figure 11. Time from ambulance arrival to tenecteplase administration for patients following the fibrinolysis reperfusion strategy

Figure 12. Time from ambulance arrival to arrival at a PCI capable hospital for patients following the Primary PCI reperfusion strategy
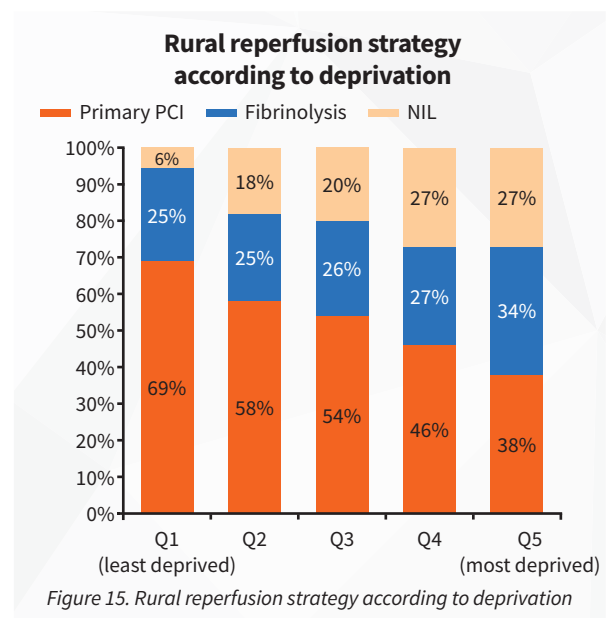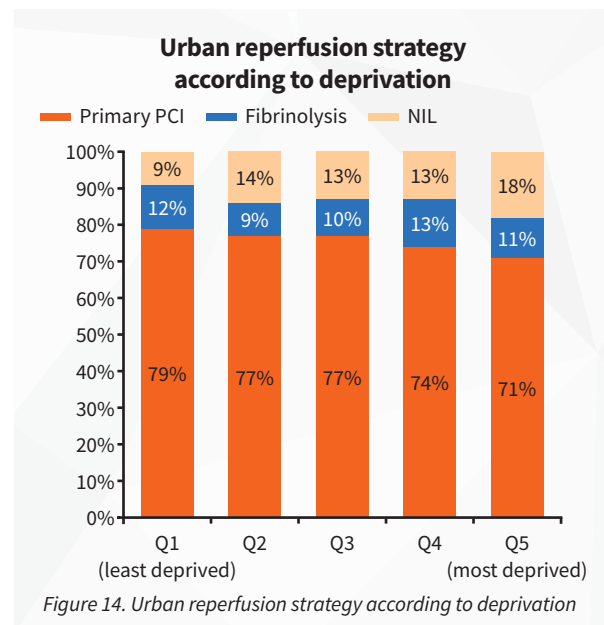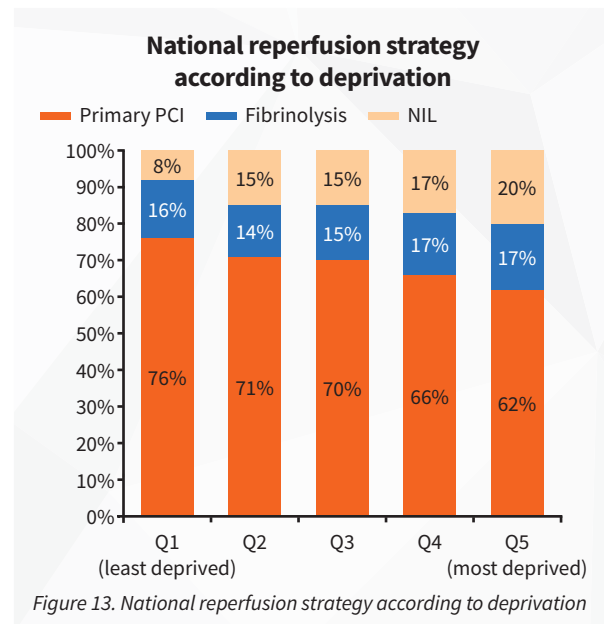
Deprivation Index

There is a recognised association between socioeconomic status and health outcomes. The 2018 New Zealand Index of Deprivation was used to categorise the data into deprivation quintiles based on the incident location.

Quintile 1 (Q1) represents the least deprived (wealthiest) regions, and Quintile 5 (Q5) is the most deprived.

The most deprived quintiles had a higher proportion of patients following neither reperfusion strategy.

Figure 13. National reperfusion strategy according to deprivation

Figure 14. Urban reperfusion strategy according to deprivation

Figure 15. Rural reperfusion strategy according to deprivation

Conclusion
Mutunga

This is the inaugural Aotearoa New Zealand Out-of-Hospital STEMI report and follows the rollout of the Aotearoa New Zealand Out-of-Hospital STEMI pathway. The data presented in this report reveals New Zealand paramedics successfully integrated reperfusion strategies into their practices and will provide a valuable baseline for year-on-year improvements in patient care.

Glossary of terms

Adult	Patients aged 15 years or older.
EAS	Emergency ambulance service
ECG	12 lead electrocardiogram
ED	Emergency department
PCI	Percutaneous intervention
Rural and remote service area	Assigned according to SA2_2021 Urban Rural coding of incident location. Rural includes: Small urban area, Rural settlement, Rural other.
STEMI	ST-elevation myocardial infarction
Urban area	Assigned according to SA2_2021 Urban Rural coding of incident location. Urban includes: Medium urban area, Major urban area, Large urban area.