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**Title: Regional differences in ST-segment-elevation myocardial infarction care and outcome: a call for multi-national cardiovascular registries**

**Authors:** Suleman Aktaa MD<sup>1</sup>, Chris P Gale PhD FRCP<sup>1</sup>

**Affiliations:**

<sup>1</sup>Leeds Institute of Cardiovascular and Metabolic Medicine, University of Leeds, Leeds, UK; Leeds Institute for Data Analytics, University of Leeds, UK; Department of Cardiology, Leeds Teaching Hospitals NHS Trust, Leeds, UK

**Correspondence:**

Dr Suleman Aktaa  
Leeds Institute of Cardiovascular and Metabolic Medicine  
Faculty of Medicine and Health, University of Leeds,  
Leeds, LS2 9JT  
United Kingdom  
Email: s.aktaa@leeds.ac.uk  
Tel: 0044 (0)113 343 8916  
Twitter: @SulAktaa

Disparities in the management of ST-elevation myocardial infarction (STEMI) undermine the opportunity to reduce the global burden of cardiovascular disease<sup>1</sup>. Timely reperfusion therapy, preferably with primary percutaneous coronary intervention (PCI), as well as attainment to guideline-indicated care and secondary prevention measures reduce STEMI morbidity and mortality<sup>2</sup>. Clinical registries play an important role in identifying gaps in STEMI care, regional variations in practice, and opportunities for improvement<sup>3</sup>. Furthermore, registries enable the evaluation of the differences in STEMI management between countries, which may help improve the prognosis following STEMI<sup>4</sup>.

International comparisons research using registry data, however, is constrained by the heterogeneity between existing registries<sup>5</sup>. For instance, countries, such as Sweden and the UK, have established national STEMI registries, yet studies comparing STEMI care and outcomes between Sweden and the UK were not facilitated by the differences in their respective registries' design, completeness, and coverage<sup>4</sup>. Across the Asian-Pacific region, where population is diverse and both economic and healthcare systems are at different stages of development, greater variation in STEMI care may be observed<sup>6</sup>.

Tern et al<sup>7</sup>. used already published data from twenty STEMI registries in 5 Asia-Pacific countries to compare STEMI care and mortality between these countries. In total, 158420 patients from Australia, Japan, Korea, Singapore and Malaysia, whom data were collected after the year 2000, were included in this meta-analysis. The authors described patient baseline characteristics, in-hospital treatment, and pooled estimates of in-hospital, 30-day,

and 1-year mortality rates. The analysis was supplemented by public health data and clinician-report surveys to evaluate systems of care in each of the 5 countries.

Tern et al . found that whilst national STEMI registries were available in all countries apart from Australia, only Singapore's was compulsory and recorded 'all-comers' STEMI patients. In addition, both within and between country variability across the selected registries was observed, with differences in data variables definitions, registry methodology, and inclusion criteria. Such variability may have contributed to the differences in STEMI outcomes between countries. For instance, unlike other registries, the Singapore Myocardial Infarction Registry included patients who had died out-of-hospital or in the emergency department, which may explain why higher STEMI mortality rates were seen in Singapore.

Nonetheless, pooled estimates of data allowed the reviewers to conduct meaningful comparisons between the 5 countries. They reported that different countries had different STEMI patient demographics and co-morbidities. A finding that have been previously reported both within and outside the Asia-Pacific region<sup>6</sup>, and reflect the geographical differences in acute myocardial infarction (AMI) patient profile. In Europe in particular, substantial variation in patient characteristics has been observed between Central, Eastern, Western, and Northern countries<sup>1</sup>.

The authors concluded that, notwithstanding the 5 countries had similar development and public health indices, there were significant variations in STEMI management and mortality rates. One of the most striking variation in care delivery for STEMI patients was the reperfusion treatment. Primary percutaneous coronary intervention (PCI) rates varied from

over 90% to around 9% in Korea and Malaysia, respectively. The other 3 countries had primary PCI rates comparable to these observed in Europe<sup>1</sup>. These figures were matched with variations in thrombolysis rates across the 5 countries, with highest rates in Malaysia (72.6%) and lowest in Singapore (1.1%).

In addition to the variation in reperfusion treatment, different countries had variable adherence to secondary prevention medications following STEMI. The appropriate use of such medications has been shown to improve outcomes<sup>2</sup>, and is proposed as an indicator of care quality<sup>8</sup>. However, to assess the appropriateness of care, data that are both reliable and sufficient, including potential exceptions (e.g., contraindication)<sup>9</sup>, are needed. Thus, it is imperative for clinical registries to capture high-quality data about important processes of STEMI care to allow the distinction between good and poor practice.

The reviewers reported that Malaysia and Singapore had higher mortality rates from STEMI than the other 3 countries. They explained that this could be attributed to the wide inclusion criteria of the STEMI registry in Singapore, the lower use of primary PCI in Malaysia, and/or the greater ethnic diversities in these 2 countries. Although it is difficult to infer causation from observational data, similar association between high reliance on thrombolysis therapy for STEMI and increased mortality rates was observed in Eastern European countries<sup>1</sup>. However, when using an outcome measure for benchmarking, differences may be due to factors other than quality of care (e.g., case-mix)<sup>10</sup>, which need adjusting for.

Mapping the geographical differences in STEMI presentation, management, and outcomes is critical to address gaps in care delivery<sup>1</sup>. For the Asian-Pacific region and beyond, nationwide registries are integral to quality improvement initiatives<sup>11</sup>. As such, quality indicators that are developed methodologically<sup>9</sup>, can be implemented within registries to measure performance<sup>12</sup> and disparities in care provision<sup>13</sup>. Future registries, such as the European Unified Registries On Heart Care Evaluation and Randomized Trials (EuroHeart), will use harmonized data standards and provide a unified platform for continuous data collection, which can facilitate international comparisons of cardiovascular disease<sup>14</sup>.

**Conflict of Interest:** none declared

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