

## **A Bridge Too Far: Geographic Information Systems and regionalized STEMI care models**

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Open Medicine has published a study by Patel *et al* that describes the acceptable travel times by ground transportation between residential locations and large urban hospitals with capacity to undertake angioplasty (“PCI facilities”) using geographic centre of census dissemination areas (centroids)[1]. This distance was used to estimate the proportion of the Canadian population currently having timely access to percutaneous coronary intervention (PCI) for persons suffering ST-segment elevated myocardial infarction (STEMI). The rationale provided is that randomized trials have confirmed the superiority of PCI over fibrinolysis with evidence growing that “the sooner the better” for PCI. The authors then estimate the additional proportion of the population that would be covered if other facilities capable of undertaking angioplasty were created in additional medium-size cities (Kelowna, Lethbridge, St Catharines and Trois Rivières) as part of “regionalized STEMI care models”.

Geographic information system (GIS) analyses have an important and growing role in health services research. They provide useful tools to document inequality and inequity in access to services across communities and neighborhoods. They can also be used to assess the at-risk population for environmental exposures, to optimize human resource allocation, and to identify effective and convenient means of transportation to facilities and services for users. Investigators are now moving beyond the technical implementation by using GIS to develop meaningful knowledge about person, place and time. For example, an earlier study by some of the same authors analyzed population and geographical coverage by different modes of transporting patients for PCI. [2]. They found that wheeled ambulances covers more population than air ambulances and, in some areas, greater distances, within the critical 90 minute-window. They arrived at the useful conclusion that, in Alberta, air ambulances were not an effective means of transporting patients to a PCI facility.

In the current study, Patel *et al* show an interesting and straightforward application of GIS analysis. They found, as expected, that “The hypothetical addition of a new PCI facility in each of the four most populated provinces would increase the proportion of the population with timely access.” The road network analysis using GIS is beneficial in incorporating a temporal component of geographical access.

On the other hand, the interpretation and implications of Patel *et al* overreach the mark. The authors seem to be advocating for new PCI facilities. However, there are many other issues needing to be addressed to adequately “inform the development of regionalized STEMI care models”. First, serious concerns have been voiced [3;4] about the assertion that PCI is superior to fibrinolysis, including potential biases and confounding that threaten the internal validity (eg, operator effects) and, selection effects that limit the

external validity, of the pivotal randomized trials. Also, given the smaller population base for the four hypothetical hospitals, the number of emergent PCIs that would be done annually may be low enough that the poorer outcomes seen in United States PCI facilities with lower volumes may become an issue in Canada. Second, the authors estimated that (annually), “about 17 short-term deaths and 34 recurrent nonfatal myocardial infarctions or strokes could be avoided through the addition of these 4 hypothetical facilities.” This weak “back-of-the-envelope” type of calculation belies the complexity of developing credible estimates of this nature and would require much more robust methodology that included estimates of dispersion and of the degree of confidence in the results. In the worst case, those numbers could be quoted inappropriately. Third, even if correct, basing the case for new PCI facilities on a relatively small number of short-term deaths avoided – amounting to 0.008% of the 201,488 deaths in those four provinces in 2008 – might be used as evidence to argue against those facilities.

In terms of allocating resources, it bears asking whether other investments would reduce the burden of STEMI more than new PCI facilities? Thus, policies to reduce travel times to existing facilities may be more effective or less costly for achieving the same outcomes. For example, studies done in Calgary and in Ottawa have shown that pre-hospital assessment and direct transfer (bypassing the emergency room) to the appropriate facility can speed access to PCI[6;7]. While these strategies are not applicable to Canadians living in areas without a nearby PCI facility, organizational strategies such as those could be more effective in shortening the mean temporal delay to PCI as much as new facilities, be less expensive and be more straightforward to implement.

Underlying the authors’ GIS-based approach to the “regionalized STEMI care models” is the question “how can the highest proportion of the Canadian population be provided with rapid access to PCI?”. That question, which views access to PCI in isolation, is not useful for decision-makers. More relevant questions are “How much PCI should the health care system provide?” “How quickly?” and, “To which patients?” [5]. Regionalized STEMI care models must also include all alternative therapies including fibrinolysis. From an economic point of view even if, on balance, PCI is considered cost-effective relative to fibrinolysis for treating STEMI in Canada, the country’s large geographic size necessitates a mix of services between the two therapeutic modalities because fibrinolysis is easier to administer and requires less specialized equipment. Even then, the incremental cost-effectiveness of PCI will vary according to many factors, among them distance to the PCI facility, volume, and organization of STEMI treatment.

More generally, tertiary care cardiology services must be viewed in the context of delivering all health services and other societal goods [8]. The line of reasoning which seeks the most efficient ways of delivering health care is consistent with the ethical stance arising from a single public payer constrained by a fixed health care budget. Of course, other ethical stances must be considered, including the rights of all Canadians to timely access to treatment for STEMI[9].

A modern approach to studying health services delivery must go beyond studying isolated tertiary care services such as PCI. While Patel *et al* provide information on population coverage that would be required for establishing hypothetical new PCI facilities, their “regionalized STEMI care models” views PCI in isolation, does not examine the return on investment, and is predicated on building additional services around the historic ways providers are structured. In the face of increasing expectations from the public and greater fiscal constraints, real improvements in efficiency, sustainability, quality, appropriateness of health care require new methods of delivering services that go beyond growth of the existing system. Health services researchers must take the lead in developing a modern approach to health care delivery by identifying and testing new policies that are designed to equitably meet the health needs of the entire population. Without doing so, a reasoned and cohesive plan for developing a sustainable, responsive, transparent, and just, health care system will remain elusive.

## Reference List

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