Closing emergency treatment centers in Sweden: Impact on travel distance and time-to-treatment

Kenneth Carling[a], Ebba Henrekson[b], Vijay Paidi[a] and Niklas Rudholm[c,*], Eliel Stenström[d]

[a]Dalarna University, Borlänge, Sweden.
[b]Marie Cederschiöld University, Stockholm, Sweden and Stockholm School of Economics, Stockholm, Sweden.
[c]Institute of Retail Economics, Stockholm, Sweden.
[d]University of Oxford, Oxford, United Kingdom.

**Corresponding author: niklas.rudholm@hfi.se.*

Keywords: Emergency treatment center locations, time-to-treatment, golden hour, p-median modeling, eCOmpass.

JEL-codes: I11, I14, R41, C63, C88.

Abstract: One of the things that characterizes remote areas in Sweden is the considerable distances and resulting time delays involved in the management and treatment of trauma patients. Such delays may have a notable influence on mortality outcomes (Nilsbakken et al., 2024), and faster means of transportation in recent years have been shown to be a major driving force in decreasing mortality following an incident (Maurya et al., 2022). As such, having a dense network of emergency treatment centers (ETCs) located in a manner that minimizes travel distance and time-to-treatment seems prudent.

Despite the importance of time-to-treatment for trauma patients, there have been several closures of emergency treatment centers (ETC) in Sweden in recent years. In Västra Götaland, a region in the south of Sweden, the emergency treatment center in Lidköping with a population of approximately 40 000 in the local municipality, closed in 2023. In the regions of Kalmar and Västmanland, the full scale ETCs in Oskarshamn (27 000 inhabitants) and Köping (26 000) have been reduced to a form of treatment centers that does not treat severe trauma including life-threatening conditions anymore. Finally, in the region of Västernorrland, a decision is likely to be taken on the 11th of March to restructure the existing ETC in Sollefteå (19 000 inhabitants), no longer providing any form of surgery at that facility.

Despite these decisions, a key priority for policymakers worldwide is often said to be to provide accessible and equitable health care to their populations (Higgs, 2004; Neutens, 2015; Shanmathi Rekha et al., 2017). A recent agreement between the Swedish Government and the Swedish Association of Local Authorities and Regions also states that the health care system should ensure that all patients have access to equitable and high-quality care (Socialdepartementet, 2023). As closures of ETCs are decided locally by the regions, we have investigated how these closures affected travel distances and time-to-treatment both for the general population in the region, but also for the population in the affected cities.

The analysis has been done in a web-accessible tool called eCOmpass (https://ecompass.se/), originally developed to investigate travel distances in retailing and to suggest optimal locations for retailers wanting to minimize travel distances and the associated CO_2 emissions for their consumers (Carling et al., 2024). The tool is set up so that the user can supply either addresses or coordinates in the format supplied by Google/Google Maps as input into the system. Analysis can be made on either the national, regional, or municipal level, and as stated above, we have chosen to do this on the regional level where decisions regarding closures or the restructuring of ETCs are being made. The tool also allows the user to analyze distances and travel times using either known facility locations as in our case (we know all locations, including the locations of the ETCs being closed or restructured), or to find the optimal locations from a travel distance and time-to-treatment perspective. The mode used when the user knows the address or coordinates of the facilities is called

“EXPLOIT”, while the mode where the tool identifies optimal locations in the sense that they minimize travel distances is called “EXPLORE”. When using the tool, an important assumption is that the emergency vehicle personnel will opt for the shortest route to the nearest ETC. Based on information regarding the Swedish road network and where the population resides (in 1km squares), the tool then calculates average distances with and without the closed ETC, and also how much of the population that will be served by each ETC under the “shortest route to the nearest ETC” assumption with and without the closed ETC. Results from the tool are being presented both in text and in the form of a map with the facilities analyzed marked. If using the “EXPLORE” option, existing facilities are marked in blue, while new ones that are optimal in the sense that they minimize travel distances given the location of the existing network of facilities are marked in red.

Our results show that the average distance to the nearest ETC in the region usually does not increase that much due to the closures. In Västra Götaland, the closure in Lidköping increased the average distance to the nearest ETC in the region from 22.07 kilometers (km) to 23.20, i.e., by 1,13 km. The closure in Oskarshamn increased the average distance to the nearest ETC in the region from 32.73 km to 47.87 km, i.e., by 15.14 km, while the closure in Köping increased it from 17.73 km to 25.80 km, i.e., by 8.07 km. The most rural closure, the one proposed in Sollefteå, would change the average distance to the nearest ETC from 21.47 km to 29.67, i.e., by 8.20 km. That it is Köping, rather than Sollefteå, that has the largest increase in average travel distance for the population in the region to the nearest ETC is due to the share of the population affected. In the case of Köping, 39% of the inhabitants in the region had that as the nearest ETC, while for Sollefteå only 24% has. Note also that even in bad traffic conditions, this likely will not increase travel time by more than 20 minutes as an average speed of 45 km per hour should be possible to maintain in most cases for an emergency vehicle. However, also including the time to prepare the trauma victim for transport, it could be that in some cases the time-to-treatment will now exceed the so-called golden hour (Cowley, 1975; 1976).

However, for the inhabitants of Lidköping, Oskarshamn, Köping and Sollefteå ,the direct consequences of the closures on time-to-treatment are much more dire. After the closure in Lidköping, the nearest ETC is in Skövde, 48.20 km away with an estimated travel time of 48 minutes. For the inhabitants of Oskarshamn, the nearest fully equipped ETC is in Västervik which is 70.30 km away (67 minutes), while for the inhabitants of Köping the distance to the nearest fully equipped ETC in the region (in Västerås) is 40.60 km away (35 minutes). The proposed restructuring of the ETC in Sollefteå would nevertheless have the largest impact regarding distance and time-to-treatment. All patients requiring surgery would after such a restructuring be transported to either Sundsvall or Örnsköldsvik, journeys of roughly 100 kilometers and with transportation times of approximately 90 minutes in good conditions. In this case, the time-to-treatment would always considerably exceed the so-called golden hour (Cowley, 1975; 1976).

So, how are these closures politically feasible? From the regional analysis using eCOmpass, we know that these closures only affect clear minorities in the regions where they are decided. The largest share of the population affected is for the closure in Köping, where 39% of the inhabitants in the region are affected. There is, however, only one other ETC in the region, so not even in this case does the affected population reach the level needed to stop the closure. For all other closures, the shares are considerably lower, making it even more difficult to affect the political process through voting. We therefore find it likely that it is the considerable differences in the average impact on time-to-treatment and associated health outcomes in the regions versus the local impact in the affected cities that explain both why these types of closures are politically viable, but also the local outrage toward the deciding politicians in the regions when such closures are announced.