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Discrepancies between current and ideal endovascular stroke treatment practice in Europe and North America: Results from UNMASK EVT, a multidisciplinary survey

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Abstract

Background: Since 2015, endovascular therapy has been established as a standard of care for acute stroke. This has caused major challenges regarding the organization of systems of care, which have to meet the increasing demand for thrombectomies. This study aims to evaluate how endovascular therapy decisions made by European and North American physicians under their current local resources differ from those made under assumed ideal conditions.

Methods: In an international, multidisciplinary survey, physicians involved in acute stroke care were asked to give their treatment decisions to 10 out of 22 randomly assigned stroke case-scenarios. Participants stated (a) their treatment approach under assumed ideal conditions (without any external limitations) and (b) the treatment they would pursue under their current local resources. Resources gaps (ideal minus current endovascular therapy rates) were calculated for different countries/states/provinces and correlated to economic and healthcare key metrics (gross domestic product-per-capita, public or private health insurance coverage, etc.).

Results: A total of 607 physicians, among them 218 from North America and 136 from 25 European countries, responded to the survey. Resources gaps in the majority of North American states/provinces and European countries were small (<5%). The highest gaps were observed among few European countries, namely Poland (30%) and the United Kingdom (33%). The magnitude of the resources gap did not correlate to national economic or healthcare metrics.

Discussion and conclusion: In the majority of North American states/provinces and European countries covered in this study, the discrepancy between endovascular therapy decisions under current local resources and assumed ideal conditions seems to be small, even in countries with a limited economic status and healthcare infrastructure.

Keywords

Endovascular therapy, ischemic stroke, stroke, systems of care, thrombectomy

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Introduction

In 2015, five major randomized controlled trials proved the safety and efficacy of endovascular therapy (EVT) in acute ischemic stroke (AIS) compared to medical treatment alone.¹ This has dramatically changed the treatment paradigm in acute ischemic stroke: EVT is recommended and considered standard of care in AIS patients with large vessel occlusions.² In order to establish a nationwide network of comprehensive stroke centers providing EVT, existing systems of care, including pre-hospital transport algorithms and hospital infrastructure, had to be reorganized. Different regions of the world have faced various unique challenges in their

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efforts to establish this resource-intensive, highly specialized treatment nationwide. Although EVT per se is cost-effective,³ there are initial costs for implementing and maintaining a nationwide network of endovascular treatment facilities which may vary substantially depending on the type of pre-existing resources, population density and distribution and geographic factors. We sought to evaluate whether and to which extent EVT decisions of European and North American physicians under their current local resources differ from the EVT decisions they would pursue under assumed ideal conditions, and whether this “resources gap” correlates to national economic and healthcare metrics.

Methods

An international cross-sectional web-based survey (UNMASK-EVT) among physicians directly involved in acute stroke treatment was conducted to understand their approach to endovascular decision-making in acute stroke.⁴ Enrolment of the survey participants was based on institutional networks and academic collaborations. We enrolled physicians actively involved in acute stroke care in their clinical routine. No other restrictions (e.g. caseload, subspecialty or region of practice) were applied. Twenty-two case scenarios were designed to assess participants’ treatment practice and endovascular decision-making in acute stroke: Eight of them with level A evidence, 11 with level B evidence and 3 that were not covered by current guidelines.⁵ Participants were asked how they would treat the patient (a) under assumed ideal conditions, i.e. assuming there were no external (monetary or infrastructural) constraints, and (b) given their local working conditions. Response options were (a) EVT, (b) tPA, (c) EVT and tPA or (d) antiplatelets/anticoagulation. For detailed descriptions of the case scenarios see supplementary Table 1. Response data were obtained from 26 November 2017 to 27 March 2018. Approval by the local research ethics board was obtained. Prior to accessing the case scenarios, the physicians were asked to provide some personal demographic and practice-related data (country of practice, subspecialty, and hospital setting). Economic and general health system key metrics (gross domestic product per capita in US dollars, percentage of the population covered by public or private health insurance, percentage of employment in the health and social services sector, number of hospitals per million residents and number of CT scanners per million residents) were obtained from the Organization for Economic Cooperation and Development (OECD) database.⁶

Statistical analysis

Decision rates in favor of EVT under current local resources and under assumed ideal conditions were determined for different countries and country-specific resources gaps (ideal minus current decision rates).

Differences among subgroups were assessed with chi square tests, and differences in the distribution of continuous measures between groups were compared with Wilcoxon rank sum tests. Spearman rank correlation was used to assess the relationship between continuous variables. Multivariable logistic regression clustered by respondent was performed to provide adjusted measures of effect size. All tests were two-sided and conventional levels of significance ($\alpha = 0.05$) were used for interpretation. Data analyses were performed in Stata 15.1. Figures were created with Microsoft Power BI desktop 2016 and the Mapbox Visual Plugin.

Results

A total of 607 participants completed the study (response rate 45.6%). Participants were affiliated to several subspecialties, located in 38 countries, among them 145 from the United States, 73 from Canada and 136 from 25 European countries. Baseline demographic characteristics of the participants overall and for the European and North American participants separately are shown in Table 1.

Table 2 provides an overview about current and ideal decision rates overall and for European and North American participants separately.

With respect to responding physicians, resource gap analysis showed that resources gaps (ideal minus current decision rates in favor of EVT) were small (<5%) in the majority of European countries and North American states/provinces (green colored countries/states or provinces in Figure 1). The number of responses, current and ideal EVT decision rates can be found in the supplementary material.

The resources gap in Norway, Austria, the Czech Republic, Romania and Estonia, as well as in the Canadian provinces of Saskatchewan, Nova Scotia, and the US states of Wyoming, Colorado, Texas, Louisiana, Indiana, Alabama and Vermont ranged between 5 and 20% (yellow colored countries in Figure 1). In Poland and the United Kingdom, the reported resources gap exceeded 20% (Poland: 30%, United Kingdom: 33%).

Correlation of the reported resources gaps with the gross domestic product (GDP) per capita, the percentage of the population covered by public or private health insurance, the percentage of employment in the health and social services sector, the number of hospitals per million residents, and the CT scanner per million residents, was not significant. There was, however, a significant positive correlation between the GDP per capita and the number of CT scanners ($r_s = 0.509$, $P = 0.031$) per million residents.

Discussion

In the majority of North American states/provinces and European countries, the resources gap was small: this suggests that most countries and states/provinces have successfully reorganized their systems of care and

Table 1. Demographic baseline characteristics of the survey participants.

Variable	Participants overall (N = 607)	Europe (N = 139)	North America (N = 218)
Specialty - n (%)			
Neurology	326 (53.7)	81 (59.6)	115 (52.8)
Interventional Neuroradiology	173 (28.5)	43 (31.6)	60 (27.5)
Neurosurgery	81 (13.3)	2 (1.5)	32 (14.7)
Others	27 (4.2)	10 (7.4)	11 (5.1)
Hospital setting - n (%)			
Academic	551 (90.8)	130 (95.6)	196 (89.9)
Non-academic	56 (9.2)	6 (4.4)	22 (10.1)
Age - median (IQR)	44 (39-50)	45 (39-53)	44 (39-49)
Experience in years - median (IQR)	13 (8-20)	15 (10-22)	10 (6-17)
Annual personal stroke volume - median (IQR)	100 (50-250)	122.5 (50-400)	75 (40-200)
Annual personal EVT volume - median (IQR)	30 (15-50)	50 (20-80)	30 (16-50)
Annual center tPA volume - median (IQR)	100 (50-170)	131 (99-230)	120 (80-200)
Annual center EVT volume - median (IQR)	65 (30-120)	120 (60-200)	90 (60-130)

IQR: interquartile range; tPA = intravenous alteplase; EVT: endovascular therapy.

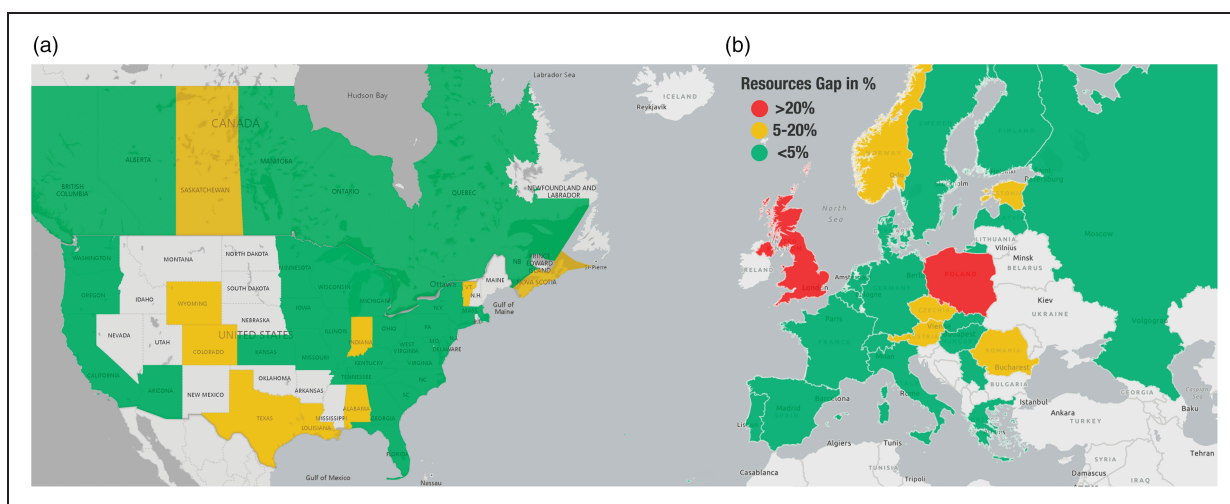


Figure 1. Resources gap in different North American states/provinces (a) and European countries (b) in percent. White colored countries: no data available.

are able to meet the demand for EVT in most instances. In two European countries, namely Poland and the United Kingdom, physicians reported severe deficits in endovascular treatment availability: in 30% (Poland) and 33% (UK) of cases, they would have wanted to offer EVT, but their current environment did not allow them to do so. The resources gap captured in this survey could reflect local restraints on a hospital level (e.g. suboptimal call-schedules, etc.), insufficiencies on a regional or national level (i.e. insufficient network of comprehensive stroke centers in general) or a combination of both. Since the specific nature of the constraints was not captured in this study, we are not able to determine, which of the above-mentioned possibilities apply in each country. Interestingly, there seems to be no association between the magnitude of a

country's or state's resources gap and its overall economic status: the GDP per capita of the United Kingdom, for instance, vastly exceeds the GDP of Latvia or Serbia,⁶ but the resources gap of the latter two countries ranged well below 5%, whereas it was 33% for the United Kingdom. Furthermore, the resources gap correlated neither with the GDP per capita nor with healthcare metrics. This could potentially indicate that the overall financial situation and healthcare macro-infrastructure of a country or state might not be the determining factor for the resources gap; it seems that institutional and individual factors (such as the call schedule and hospital-specific policies) and physician reimbursement, which was not captured in this survey but is an important factor that influences whether and to what extent EVT is provided, may play

Table 2. EVT decision rates under current local resources and assumed ideal conditions.

EVT decision rate (%)	Participants		
	overall (N = 607)	Europe (N = 139)	North America (N = 218)
All case scenarios			
Current local resources	75.6	79.5	76.2
Assumed ideal conditions	79.0	83.2	76.4
Level 1A scenarios			
Current local resources	86.8	88.7	89.0
Assumed ideal conditions	90.6	91.8	89.5
Level 2B scenarios			
Current local resources	66.3	71.4	65.7
Assumed ideal conditions	69.7	76.2	66.0

EVT: endovascular therapy.

an important role as well. Our findings also indicate that sufficient delivery of endovascular stroke treatment seems to be possible even in countries with a relatively low economic status and limited healthcare infrastructure. Somewhat counterintuitively, a recent European survey among stroke professionals found relatively low proportions of AIS patients receiving EVT in several countries with a small resources gap in our study (e.g. Russia, Hungary and Greece).⁷ The reasons for these apparently contradictory findings are possibly the result of the different methodologies used in both surveys and the non-systematic participant enrolment in our study. Furthermore, the resources gap in our survey captured not only nationwide limitations but also participants' restraints on a local level. Since these can vary between regions within a country, the resources gaps reported by physicians might not be representative for the whole country. We observed negative resources gaps in some countries (for example, Russia: -25% resources gap, supplementary Table 2), i.e. countries in which physicians would want to perform EVT less often than they currently do. It is possible that EVT is very frequently performed in these countries, and this approach might be perceived as overly aggressive by the local physicians. Another reason could be unfamiliarity of individual survey participants with EVT: physicians with little endovascular stroke treatment exposure/caseload might not want to offer EVT as often as they currently do because they do not feel sufficiently experienced. Lastly, the number of responses from certain countries was low (n = 20 for Russia, supplementary Table 2). In such cases, the negative resources gaps might not be generalizable. Interestingly, only 90.6% of physicians overall decided to offer EVT under assumed ideal conditions despite level 1A evidence (Table 2). One potential explanation for this is lack of guideline awareness, another one would be that the physicians do not personally agree with guideline recommendations and therefore do not adhere to them. The specific reasons why EVT was not offered were

not captured in this survey, but they should be made subject to further research.

Limitations

Our study has several limitations: the overall response rate of physicians was modest with 45.6%. The number of respondents varied vastly between countries and geographic regions, and some North American states/provinces and European countries were not represented in this survey at all. This is most likely due to the fact that participant enrollment was voluntary and based on institutional networks and co-operations, which constitutes a potential source for selection bias, particularly since the majority of the participants worked in academic centers. This might have led to underestimation of resources gaps. The variability in the number of respondents per country, and the fact that some countries were not covered at all, constitutes another limitation of our study. We did not ask participants to state the specific nature of the constraints, and hence could not determine whether and to what extent the reported resources gaps were caused by local vs. nationwide limitations. Furthermore, EVT decision rates were <100% even under assumed ideal conditions, and the reasons for this remain unclear as well. They could be related to a lack of knowledge (i.e. physicians are not aware of the guidelines) or personal disagreement (i.e. physicians might perceive current guideline recommendations as too aggressive and deliberately decide not to follow them). Evidence levels were defined using North American guideline recommendations,⁵ which are very similar to current European guidelines⁸ but might differ from local, institution-specific policies. Lastly, survey data can only approach but never accurately depict decision making in clinical routine, in which decisions are ideally made by a multidisciplinary team rather than an individual physician alone, and the generalizability of the results may therefore be limited. Despite these limitations, this study provides useful information about discrepancies between current and ideal EVT practice in different European countries and North American states/provinces, thereby offering starting points for future efforts to improve national stroke care systems.

Conclusion

In the majority of North American states/provinces and European countries that were covered in this survey, the difference between EVT practice under current local resources and assumed ideal conditions seems to be small despite the limited economic budget and healthcare infrastructure in some countries.

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Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Since this study did not involve and human patients or animals, an ethics approval was not required. All survey respondents gave their informed consent and agreed to participate in the study.

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Supplemental material

Supplemental material for this article is available online.

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