

Creating Evidence on Quality of Stroke Care using RES-Q Global platform

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Summary

Introduction: Global perspective on quality of stroke care is lacking, although country-to-country benchmarking can facilitate development of stroke services. To be able to provide such benchmarking, collection of data into the global RES-Q registry needs to be more structured.

Methods: All consecutive stroke patients should be collected in March 2022 by all stroke treating centers participating in RES-Q. Communication strategy will be in place in order to inform hospitals of the importance to comply with methodology and to provide them with feedback during data collection phase.

Results: Summary country-level data will present the essential metric related to stroke care quality such as percentage of patients: arriving through Emergency Service (EMS), Computed Tomography(CT) /Magnetic Resonance (MR) imaging time from admission, admitted to dedicated stroke unit or ICU, receiving thrombolysis, thrombectomy, undergoing

swallowing screening, DVT prophylaxis, discharge on antiplatelets for non-cardioembolic stroke and on anticoagulants with cardioembolic strokes, outcome by modified Rankin score. Also, data on acute stroke care logistics will be presented such as door-to-needle time for intravenous thrombolysis and door-to-groin times for mechanical thrombectomy and reasons for not offering thrombolysis or thrombectomy in ischemic stroke patients.

Conclusion: This study will provide objective patient level data representative of stroke care quality in different countries around the world.

Introduction:

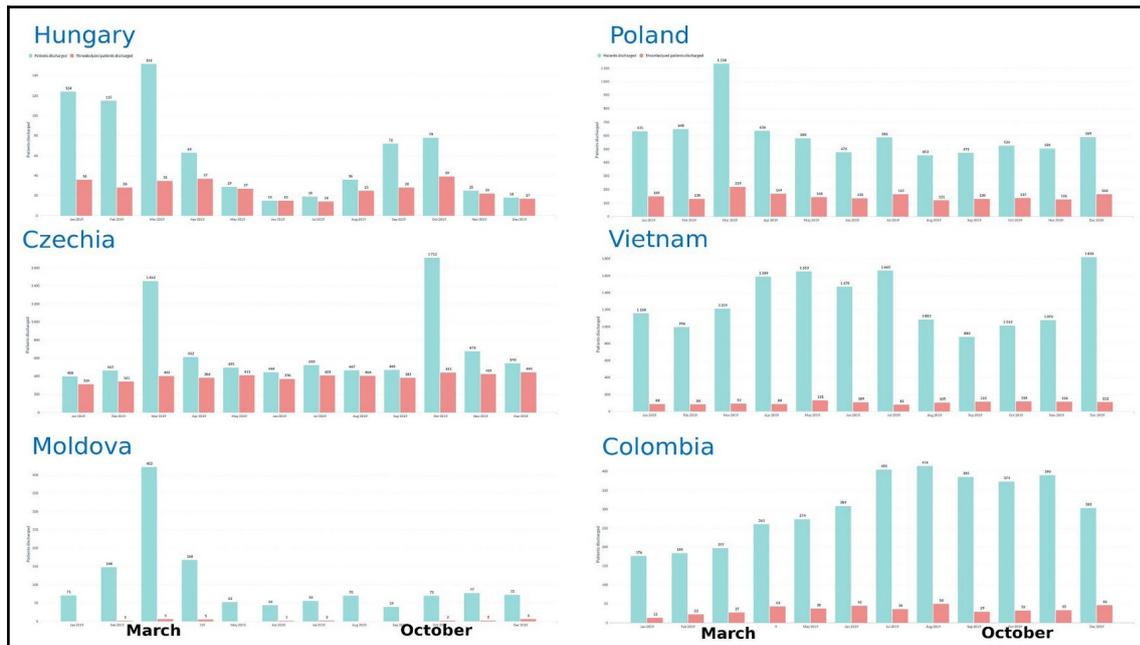
Knowledge of quality of stroke care is essential for identification of gaps and defining strategies to improve stroke care. Although many national registries provide national perspective on quality of stroke care, we still lack solid data allowing country to country comparisons. This is because data on stroke care quality is very fragmented in time and data content. The only multi-country data on stroke care quality comes from several surveys such as ESO survey or WSO surveys^{1,2}. Validity of survey data might differ depending on the source from which results are derived. Sometimes surveys present opinions about situations which may or may not be reflective of reality.

RES-Q is a global registry used for improving quality of stroke care. RES-Q was initiated in 2016 in Czech Republic and is currently used by > 1700 hospitals in 75 countries across continents³. Although RES-Q promoted a structured way of data collection, data collection is voluntary and not mandatory, potentially creating bias, particularly toward some stroke subgroups, e.g. those treated with recanalization therapies only. E.g. in Czech Republic, patients treated with intravenous thrombolysis and/or mechanical thrombectomy are collected systematically throughout the year for all consecutive patients; all other countries, data from a limited number of patients are collected via 'spot' audits conducted in March and October. The Czech Stroke Society requests that at least 30 consecutive patients are collected in March and October, but not all stroke centers always follow this. Moreover, in many countries around the world, such structured data collection is not promoted enough. In developing countries, data on the processes of care and associated patient outcomes are scarce.⁴

RES-Q is also used for the ESO/ WSO Angels Award program which requires some minimum data structure, i.e. capturing at least 30 stroke patients every quarter in RES-Q to participate. The ESO/ WSO Angels Award program acknowledges achievement and honours those teams and individuals from hospitals committed to quality improvement in stroke practice using Gold, Platinum or Diamond award status. There are > 2000 awards given over the past 4 years but there are many hospitals that do Quality Monitoring once in a while just to participate in the award program. Also because of such motivation, it is likely that only those hospitals that expect to meet a predefined set of 7 KPIs participate and hospitals that do not expect to meet such KPIs do not participate.

As a result, the structure of data collection differs from hospital-to-hospital and country-to-country. The figure below demonstrates the number of patients with stroke collected in six countries throughout 12 months (green are any patients and red are patients treated with IVT). Two important pieces of information can be seen: data structure and data volume: 1)

structure differs, e.g. in Czech Republic March & October distinct from other month for reasons mentioned above, in Hungary most patients are collected Jan-Mar, in Vietnam structure is most likely as expected in case all stroke cases are collected in all months. In terms of volume of data, 1452 patients were collected in March in Czechia (10.7 mil population) as compared to 152 patients collected in the same time period in Hungary (9.7 mil population).³ Given the incidence of stroke, roughly 2,000 patients should have a stroke in a month in Czechia & Hungary, meaning that in Czechia, 70% of patients are captured in March while only 8% in Hungary. Major issue of data quality is therefore data representativeness.



Currently, RES-Q attempts to evaluate the quality of data in three ways:

1. Representativeness of data at country level
2. Representativeness of data at hospital level
3. Data validity

1) **Representativeness of data at country/population level** is evaluated as a ratio of ischemic stroke cases collected in RES-Q of all ischemic stroke cases in a country. Number of all ischemic stroke cases in a country is adopted from the Global Burden of Diseases project. Table below provides such completeness of ischemic strokes per country in 2020. In some countries, RES-Q collected a considerable proportion from all ischemic strokes (Thailand, Czechia, Latvia, Bulgaria etc). There are 13 countries that capture more than 10% in RES-Q of all ischemic strokes in the population. But some countries are less active in data collection (India, Iraq, Guatemala, Uzbekistan etc). In many countries, the number of captured strokes in the RES-Q registry are minimal compared to the total number of strokes in the country.

Country	Completeness(%)	Country	Completeness(%)
Thailand	49.1	Saudi Arabia	1.6
Czech Republic	45.4	Armenia	1.4
Latvia	33.8	Turkey	1.4
Bulgaria	20.9	Iran	1.1
Portugal	19.7	Egypt	0.9
Bahrain	17.0	Italy	0.9
Croatia	15.5	Azerbaijan	0.8
Lithuania	14.1	Kazakhstan	0.7
Colombia	13.9	Australia	0.5
Vietnam	13.8	India	0.5
Estonia	12.6	Algeria	0.4
Poland	12.6	Indonesia	0.4
Serbia	10.6	Ecuador	0.3
Greece	5.7	Namibia	0.3
Chile	5.3	Jordan	0.1
Hungary	5.3	Kenya	0.1
Malaysia	5.3	Uzbekistan	0.1
Kyrgyzstan	5.2	Guatemala	0.0
South Korea	5.2	Iraq	0.0
Argentina	5.1		
Ukraine	4.7		
United Arab Emirates	3.6		
Romania	3.4		
Georgia	3.2		
Belarus	2.0		
North Macedonia	1.9		
Peru	1.7		
Philippines	1.7		
Mexico	1.6		

**Slovak republic is not included in the table but provides import to RES-Q from national registry which has high level of representativeness. Italy has nation-wide quality improvement program in place using SITS QR registry.*

2) Representativeness of RES-Q data at hospital level. It is difficult to estimate the proportion of strokes captured in each hospital because the volume of strokes per hospital is not available. As mentioned above, Czech Stroke Society requests that at least 30 consecutive patients are collected within one month. Thirty patients cut off was an arbitrary decision based on the assumption that even in small centers this number is achievable in one month or a bit longer. Also 30 was considered a minimum reasonable number for statistical analysis. In large volume hospitals, it is expected that (much) more than 30 patients are collected from one specific month.

Table below shows the number of hospitals from each country entering at least 30 patients in one month during 2021.¹

Country	Hosp registered in RES-Q	No of hosp capturing atleast 30 patients in RES-Q (%)
Thailand	102	68%
Romania	40	65%
Vietnam	47	60%
Czech Republic	53	51%
Estonia	6	50%
Serbia	4	50%
Ireland	6	33%
Korea	37	32%
Hungary	32	31%
Croatia	22	27%
Uzbekistan	11	27%
Lithuania	8	25%
Poland	87	23%
Russia	22	23%
Malaysia	23	22%
UAE	5	20%
Algeria	15	20%
Egypt	30	20%
Bulgaria	31	19%
Moldova	17	18%
Chile	18	17%
Portugal	40	15%
Belarus	7	14%
Philippines	29	14%
Turkey	20	10%
Ukraine	121	10%
Colombia	86	9%
South Africa	11	9%
Peru	23	9%
India	183	7%
Indonesia	44	7%
Argentina	52	6%
Kyrgyzstan	18	6%
Kazakhstan	18	6%
Italy	19	5%
Greece	20	5%
Mexico	184	1%

Currently the number of hospitals collecting at least 30 patients in at least one month in 2021 is limited compared to the overall number of hospitals participating in RES-Q. **Also, the**

number of countries with a reasonable number of hospitals (10 or more) is limited.

Reasons for such results would differ by country. In some countries, the reason is lack of data collection. In most countries however, large amounts of data are collected (i.e. resources to collect data exist), but data are not collected in a coordinated manner. Primary solution is therefore to establish communication with hospitals to achieve “**standardization**” of data collection. In some countries, more effort will be needed to initiate data collection first and then as the next goal to make data collection coordinated.

In order to create robust evidence of stroke care quality, we would need to work together to improve representativeness of data both at country and hospital level. Increasing the number of hospitals that would at least once a year collect data of all consecutive stroke patients in a selected time period would substantially improve data quality. Data collection creates additional workload but it is obvious that such workload is acceptable in many countries and hospitals around the world (even in big countries and busy hospitals). Proper communication of the importance of collection of consecutive patients is vital so a detailed communication plan needs to be in place.

Although representativeness should be aimed to be primarily achieved by “proper” data collection, representativeness could be improved post the data are collected. RES-Q uses some algorithms to identify “patterns supporting non-consecutivity” such as that centres collect patients with ischemic stroke only or those receiving thrombolysis only. Excluding such centers from analysis will improve representativeness. However, using such algorithms has disadvantage because it can be used only in retrospect once data are collected and less data are available for analysis.

3) **Validity of data** can be limited due to typing errors and mistakes. At least random check of data validity would be important but probably too resource intensive.

Below we present the outline of this global project aiming to provide Evidence on Stroke Care Quality.

Methods

This prospective study aims to provide information on quality of stroke care in different countries from different parts of the world. The most important objective will be to achieve representativeness of the data so results will be more likely be reflective of true quality of stroke care at national level.

RES-Q global platform will be used for data collection. Because RES-Q is already used in over 1700 hospitals in 75 countries, the most important change (as compared to current QI actions) will be to coordinate data collection in selected time periods and to ensure that collected samples are as representative as possible both at hospital and country/state level. The first data collection should happen in March 2022 and should be followed by data collection every March, i.e. March 2023, March 2024 etc. Countries/hospitals that have not participated yet in stroke care quality measurement through RES-Q, will be encouraged to join.

Representativeness of hospitals within a country

Representativeness of hospitals means that different types of hospitals (academic vs. non-academic, private vs. public, small vs. big) admitting strokes are represented. In smaller countries, even if only a few hospitals participate in RES-Q, usually they represent the majority of hospitals admitting strokes. Challenge is therefore especially in big countries, where even if a larger number of hospitals participates in RES-Q, such numbers might not represent the quality of stroke care in the country. Therefore, we propose a methodology defining the level of representativeness of data as a function of size of the country and number and characteristics of hospitals participating in RES-Q.

Depending on number of participating hospitals as compared to (known or estimated) number of all hospitals admitting stroke within the country/state, we propose that **countries/states will be categorised into 4 following categories:**

A) Countries with highly representative samples of hospitals due to broad participation: $>2/3$ of all stroke treating hospitals within the country/state who participate.

B) Countries with a reasonably representative sample of hospitals due to acceptable participation: $2/3$ of all stroke treating hospitals (easier to be achieved in smaller countries) or > 100 hospitals (easier to be achieved in bigger countries) within the country/state participate.

C) Representative sample of hospitals despite low participation: if only $1/3$ of hospitals participate, it would be possible to use methods such as maximum variation sampling.⁶ Maximum variation sampling would require participation of hospitals from different segments e.g. academic vs. non-academic, private vs. state-run, small vs. big. For analysis, data from at least 4 hospitals from each previously defined segment are used. Ways of hospital segmentations will be country specific and customised based on health care characteristics. E.g. in countries with strong involvement in stroke care of private hospitals, segmentation should include such factors, while in countries with social health care and no or little private hospitals, it would be better to segment hospitals based on the size or stroke footfall or academic status. Maximum variation sampling will include hospitals from different segments and should provide a representative sample based on previous research⁶.

D) Not representative sample of hospitals: countries with $1/3$ of hospitals participating and maximum variation sampling is not possible.

Country level results will be presented separately for categories A-C and D.

Representativeness of patients within a hospital

In order to achieve objective information on quality of stroke care, it is essential that all strokes admitted in a hospital within the selected period are captured. It will also provide sufficient volume of patients for statistical analysis. Therefore, hospitals are asked to collect ALL stroke patients admitted to the hospital in March 2022.

Once data are collected and before data are further analysed, “unrealistic patterns”, i.e. patterns that do not support consecutivity, will be applied.

Criteria used for unrealistic patterns are::

- a) percentage of ischemic strokes/TIA of all strokes is less than **65%** and not more than **95%** of all strokes. Justification: Ischemic strokes should present over 80-85% of all strokes.
- b) median door to needle time should not be less than **10 minutes**
- c) recanalization rate (thrombolysis and/or mechanical thrombectomy) for a hospital should not reach **over 55% out of AIS**

Hospitals with unrealistic patterns will be identified as soon as possible so they can be notified soon enough to provide additional data and/ or confirm consecutive patient collection.

Data to be collected

Process level data of all stroke patients arriving in a hospital will be collected in the RES-Q standard form, which is used in all participating sites. These data includes demographics, diagnosis, treatment, coordination of care, prevention of complications, initiation of treatment for secondary prevention, final outcomes during discharge.

Communication strategy

To drive effective implementation at a country by country level to achieve our goal, right and timely communication is important, whether it is through the RES-Q team, National Coordinators, Scientific Committee or Angels. RES-Q team will provide guidance of the study protocol, provide timely feedback/ status updates to the hospitals. RES-Q National Coordinators and Scientific committee would lead and encourage hospitals to be part of this study and capture data which will help hospitals identify gaps, improve processes/ SOPs and better patient outcomes. Angels team would help to communicate with the hospitals for capturing all stroke patients in RES-Q and why it is important to identify and bring process improvement in hospitals.

The message will be communicated in various steps and ways.

Deliverable	Target audience	Goal	Timeliness	Format	Responsible person
Kick off meeting (2 meetings based on time zone)	RES-Q National coordinators and RES-Q Scientific Committee	Introduce the study protocol to the stakeholders, set expectations	2 nd week of Feb 2022	Virtual	RES-Q team
Pre-launch	Hospital Local	Announce launch	2 nd week	Email	RES-Q

message	Coordinators	of the study and encourage hospitals to join/participate	of Feb 2022		team will draft the letter to be sent by NC to hospitals
Region wise launch (5 meetings region wise; 1. Europe 2. Russia, Ukraine & other Russian speaking countries 3. SouthEast Asia, South Korea & Australia 4. India, Middle east, Turkey & South Africa 5. South America & Brazil	Hospital Local coordinators, National coordinators, Angels consultants	Introduce study protocol, RES-Q 3.0 form, set expectations, address challenges for implementing	2 nd half of Feb 2022	Virtual	RES-Q team, Angels leads
WSO message	Hospital LC, National Coordinator	Reinforce importance of participating in the study	Mar 2022	Email	RES-Q team
Angels plan of action	Hospital LC	Reinforce to enrol patients in RES-Q to have more hospitals participate in the WSO/ ESO Angels award	Mar - July 2022	F2F /Virtual /Email	Angels project leads
Status report	National Coordinators, Scientific Committee, Angels	Communicate current status of hospital & patient enrolment	Every 10 days in March 2022	Email	RES-Q team

Status report	Hospital Local Coordinator	Communicate the status of completion and highlight hosp with unrealistic pattern in % Ischemic stroke and/ or % recanalisation rate in AIS	Every week in Mar 2022	Email	National Coordinator. Data to be provided by RES-Q
Data audit	Identified hospitals and their Local Coordinator	To review hospitals who have unrealistic patterns in data collection	Apr and May 2022	F2F/ Virtual	National Coordinator
Milestone review (for internal core team)	National Coordinators, Scientific Committee, Angels Project leads	Review status, gather feedback and decide next steps	End of Apr, May, Jun and July 2022	Virtual	RES-Q Team
Capturing 3 months follow up mRS	Hospital LC, National Coordinator	Communicate on capturing 3 months follow up mRS (Modified Rankin Scale)	Jun 2022	Email	RES-Q Team
Database lock	Hospital LC, National Coordinator, Scientific Committee, Angels	Communicate on the database lock	Mid July 2022	Email	RES-Q

Data analysis

Descriptive statistics will be used to analyse the data. Data will be presented as mean, median, percentages and 95% confidence intervals. Countries will be grouped into those with representative data (categories A-C see above) and non-representative data (category D)

Main results outputs:

- Total number of all stroke patients and as per stroke type per country
- Median number of admissions per hospital and country
- Mode of transport: EMS service, private transport or other hospital (%) *patients distributed by mode of transport from total cohort.*
- Patients admitted into dedicated stroke unit/ICU (%) *Calculated as: patients admitted to ICU/stroke unit from total cohort.*

- Total number of recanalized (IVT and/or MT) patients per country
- Recanalized patients per country v/s incidence of AIS (%) *Calculated as: patients receiving IVT and/or MT from all AIS cases.*
- Ischemic stroke patients receiving thrombolysis v/s incidence of AIS in the country (%) *Calculated as: patients receiving IVT from all AIS cases.*
- Ischemic stroke patients receiving thrombectomy v/s incidence of AIS in the country (%). *Calculated as: patients receiving MT from all AIS cases.*
- Median door to needle time (in minutes) per country & channel wise (public/ private)
- Median door to groin time (in minutes) per country & channel wise (public/ private)
- Median door to imaging time from admission (in minutes)
- Stroke patients undergoing swallow screening (%) *Calculated as: patients receiving swallowing screening from patients hospitalized for more than 24 hours.*
- DVT prophylaxis (type and %)
- Ischemic stroke patients/TIA without atrial fibrillation discharged with antiplatelets (%) *Calculated as: AIS/TIA patients w/o atrial fibrillation discharged alive/home with antiplatelet prescribed from those same-type patients.*
- Ischemic stroke patients/TIA with atrial fibrillation discharged with anticoagulants (%) *Calculated as: AIS/TIA patients with atrial fibrillation discharged alive/home with anticoagulant from those same-type patients.*
- Patients prescribed antihypertensive on discharge (%) *Calculated as: patients prescribed antihypertensive from patients discharged alive.*
- Patients prescribed statin on discharge (%) *Calculated as: patients prescribed statin from all AIS/TIA patients discharged alive.*
- Median 3-months mRS score (values 0 to 6)
- Patients with mRS 0-1 at 3 months (%) *Calculated as: patients discharged alive and having 3m-mRS with values 0-1 from all such patients with 3m-mRS filled.*
- Patients with mRS 0-2 at 3 months (%) *Calculated as: patients discharged alive and having 3m-mRS with values 0-2 from all such patients with 3m-mRS filled.*

Database lock will be 31 July 2022.

Ethics: data collection in most of the countries are being collected as part of routine clinical practice and quality assurance and therefore will not require special approval from local Ethical Committees. Protocol of this study will be approved by the Ethical Committee of St. Anne's University Hospital, Czech Republic.

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