World's Best Hospitals 2020 – Methodology

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1   Introduction

Patients are faced with the critical and difficult decision of choosing the right hospital for their medical needs, a choice that was often solely determined by word of mouth or the recommendation of a single physician (e.g. their general practitioner) in the past. Structural characteristics of a hospital such as its number of beds or number of medical staff are unreliable indicators for quality of care and therefore not suited as a basis for decision making. In the last decade, the number of web-based portals, websites and databases that aim to help with this decision by providing data about hospitals have increased, ranging from relatively short and superficial news articles to specific databases with multiple quality indicators per hospital within a specific country. However, none of the available resources to date have attempted a methodologically sound international ranking of hospitals based on a comprehensive score that gives an indication of where each hospital stands relative to its peers. Most available resources do not even feature a full overview of the major hospitals in one country, instead focusing on certain specialties or diseases, much less a ranking of these hospitals.

The World's Best Hospitals 2020 ranking is a project which aims to close this gap by **ranking the best hospitals across the world**. Its vision is to establish the ranking as the best and most comprehensive resource for global top lists in the hospital sector. A total of 21 countries are featured in the 2020 edition: USA, Canada, Germany, France, United Kingdom, Italy, Spain, Switzerland, Netherlands, Sweden, Denmark, Norway, Finland, Israel, South Korea, Japan, Singapore, India, Thailand, Australia and Brazil. The countries were mainly selected based on standard of living and life expectancy, population size, number of hospitals and data availability.

The current 2020 edition of the ranking is an extension and update of the World's Best Hospital 2019 ranking which was first published by Newsweek and Statista in March 2019 and featured the 1,000 best hospitals in 11 countries. In the 2020 ranking edition, **over 1,500 hospitals** are featured in total, marking an important milestone to the project and bringing it significantly closer to the goal of a global ranking. The amount of hospitals awarded in each country varies based on the number of existing hospitals, average hospital size (commonly approximated by number of inpatient beds) and data availability in the respective country. The length of the list varies, with 300 USA-based hospitals included, while Israel, Denmark, Norway, Finland and Singapore were rep-resented with 10 hospitals each.

Hospitals which are not accessible to the public and/or are very small were excluded from the ranking since they were very unlikely to receive enough recommendations to

make the final list (for most countries, the minimum requirement for consideration was a capacity of at least 100 inpatient beds[1]).

Every hospital in each country was rated by a score, which is based on three data sources:

- o **Recommendations from medical experts** (doctors, hospitals managers, health care professionals)

- o **Medical KPIs** regarding hospitals

- o Existing **Patient satisfaction** data

These Rankings are only comparable for hospitals within the same country, because different sources for patient experience and medical KPIs were examined in each country and given the complexity of the various data sources, it was not possible to harmonize this data. For the same reason, cross-country comparisons of the raw values of the scores are also not possible (example: A score of 90 in country A doesn't necessarily mean that this hospital is better than a hospital with a score of 87 in country B).

Nevertheless, one aim of this project was to create a **Global Top 100 ranking**, mainly based on international recommendations from peers who were not from the same country that the hospital is located in. To achieve this, the number of international recommendations and the national ranking were combined into a global rank, resulting in a Global Top 100 list (see chapter 2.5). This list includes a ranking of the 50 best global hospitals while ranks 51-100 are sorted alphabetically.

Hospitals which made the World's Best Hospitals ranking in the USA were also recognized with a Best-in-State award in their respective state. This distinction reflects the fact that these hospitals represent the best hospitals in the respective US state (see chapter 3.1).

The overall aim of this study is to provide the best possible data-based comparison of hospital reputation and performance across countries.
To this end, the World's Best Hospitals 2020 ranking is intended to be a resource to help patients make a more informed and data driven decision when choosing the right hospital for their medical needs, as well as to provide a composite benchmark for hospitals

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[1] Exceptions: United Kingdom, Sweden, Switzerland: at least 80 inpatient beds

which is indicative of their relative performance when compared to their national and international peers.

2 Study Design

The following sections provide an overview of the study design and the underlying methodology used to determine the various rankings. First, the general approach is outlined in chapter 2.1, followed by a description of the role of the Global Expert Board and the approach that was used to both a create specialized hospital list and the Global Top 100 list. These approaches differ from the overall study design and are therefore described separately in chapters 2.4 and 2.5. This section is followed by a more in-depth description of specific rankings in chapter 3.

2.1 General Methodology

The study design of the 2020 World's Best Hospital project is based upon three pillars:

Methodology overview
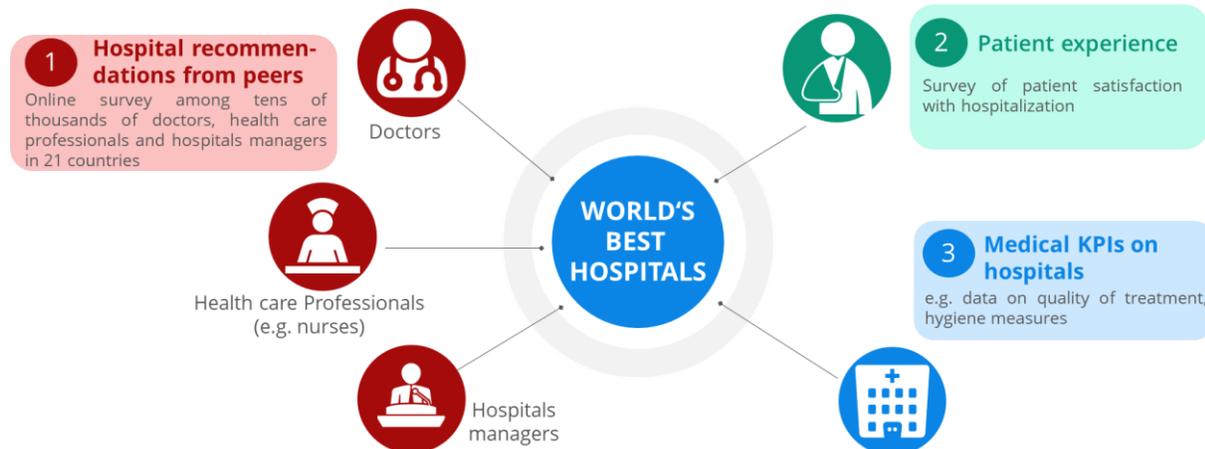
Hospital recommendations from peers: The peer recommendations were collected in two survey waves. First, Newsweek and Statista performed an online survey among tens of thousands of doctors, health care professionals and hospitals managers in 21 countries. Over 70,000 medical experts in the 21 surveyed countries were invited to participate in the online survey.

The data was collected by Newsweek and Statista, in collaboration with GeoBlue, during an initial survey period from September to November 2019. The survey was also

promoted on newsweek.com. The distribution of respondents was approximately 83% physicians, 9% hospital managers and 8% other healthcare professionals (e.g. nurses). Participants were asked to recommend hospitals in their own country as well as in other countries. The questionnaire did not suggest a list of recommended hospitals, therefore respondents were free to suggest any hospital they deemed recommendable (merely aided by an autocomplete function for convenience). Self-recommendations were not allowed. Statista performed plausibility checks on all data to prevent self-nomination.

For the second survey period, Statista asked physicians (general practitioners and specialists) to classify a set number of hospitals per country (the selected amount per country was relative to the total number of hospitals in the respective country e.g. 200 out of ca, 1,500 relevant hospitals in Germany). The list was comprised of the hospitals which received the highest number of national recommendations in the first wave as well as the leading hospitals from the previous year's ranking (both criteria had a huge overlap). Participants were asked to assign a ranking position to these hospitals (e.g. Top 1, Top 5, Top 10, Top 20, Top 30, Top 50, Top 100).

Answers were then weighted by a) the type of respondent by profession (with doctors receiving the highest weight) and b) the confidence respondents had in their vote (0-100%). Combined, the two survey periods resulted in almost 50,000 individual hospital recommendations.

Finally, the combined data was analyzed and a national, as well as an international, recommendation score (0-100%) was calculated for every hospital in each country based on the weighted number of national and international recommendations. The hospital with the highest number of weighted national recommendations always received a national recommendation score of 100%. The next best hospitals, in general, received a score relative to the number of weighted national votes they received, e.g. when hospital A received the most votes with 100, hospital B with 80 votes receives a score of $\frac{80}{100}$ =80%. In some cases, mostly for smaller countries, where one hospital would accumulate significantly more votes than the next best hospitals, the scoring curve was smoothed slightly to reduce the drop-off in relative scores, e.g. the abovementioned hospital b would be adjusted around 85% or 90% in the same situation but always less than the leading hospital. Since the achieved score is only relative to other hospitals within the same country, this is a mathematically correct approach to grade hospitals by the received recommendations. The calculation of the international recommendation score was the same as with the national score, but the scoring drop-off was smoothed for all countries to account for the lower average number of international votes (without the smoothing factor distribution is more skewed).

Patient experience: Publicly available data from existing patient surveys were used to analyze patient experience. Patient surveys are typically conducted by insurance companies among patients after their hospitalization Examples of survey topics include:

- o General satisfaction with hospital
- o Recommendation of hospital
- o Satisfaction with medical care
- o Satisfaction with service and organization

As a dimension of perceived quality, patient experience reflects both the quality of care (from the patient's perspective) as well as the patient's satisfaction with the hospital stay as a whole, including service factors such as friendliness of the staff or quality of food. Although there is some overlap between medical outcomes and KPIs we consider this a separate quality dimension as has been established in scientific literature on patient reported outcomes and patient reported experiences in recent years.

An overview of the patient satisfaction data used in each country is provided in chapter 3. Data on patient' experience from official sources was not available for Canada, Singapore, Australia, Japan, Sweden, Denmark, Finland, Thailand, Brazil, India, Spain, South Korea and the United Kingdom. In these countries evaluations from Google serve as a substitute but were considered with a lower weight in the scoring model (see chapter 2.3). Based on the available data, a patient satisfaction score (0-100%) was calculated for each hospital in each country using the weighted sum of indicators available in the specific data set.

Medical KPIs: Key performance indicators (KPI) on hospitals from a variety of public sources were collected for most countries. These KPIs differ greatly between countries. Some examples for indicators are:

- o Data on quality of care for specific treatments
- o Data on hygiene measures and patient safety
- o Data on staffing, e.g. number of patients per doctors / per nurse

An overview of the KPI data used in each country is provided in chapter 3. The data sources were identified through an extensive research process in each country and through consultation with local experts. Some publicly available data sources were excluded for reasons mostly related to data quality and/or availability, e.g. certain data was

only available for a small number of hospitals in a given country or the number of missing values in regard to the KPIs was too high to perform a valid analysis. As a result of this process, Hospital KPIs were not available for Japan, Singapore, Spain, Denmark, Finland, Thailand, India, Israel and the Netherlands. For each country with available data, a KPI score (0-100%) was calculated based on the characteristics of the specific dataset.

The national recommendation score, the international recommendation score, the patient satisfaction score (when available) and the KPI score (when available) were used to calculate a **preliminary hospital score**. This score was presented to a newly formed expert board as well as a medical journalist and his network for validation.

2.2 Validation by the Expert Board

The following section outlines the function of the global board of medical experts which was founded by Statista to support the World's Best Hospital Project.

The idea behind the board of experts is to create an independent body that is tasked with the continuous development of the quality and scope of the project. The board of experts is therefore tasked with providing quality assurance by validating the preliminary hospital rankings outlined in chapter 2.1(which includes providing feedback on discrepancies in the rankings) as well as providing input on possible improvements and expansions of the current methodology. This includes input regarding new data sources and improvements to the scoring algorithms as well as the expert's opinion on the best hospitals in specific medical fields. The members of the board of experts were carefully chosen based on their national and international expertise and decade-long experience in their respective medical fields as well as their scientific output. Current members of the board of experts are:

Global Board of Experts

Prof. Dr. David Bates
Professor of Medicine, Harvard Medical School, USA

Dr. Eyal Zimlichman, MD
Chief Medical Officer, Sheba Medical Center, Israel

Prof. Dr. Gregory Katz
Chair of Innovation Management & Value in Health, University of Paris Medical School, France

Dr. Gary Kaplan
CEO, Virginia Mason Health System, USA

Prof. Dr. med. Christoph Meier
Chief Medical Officer, University Hospital Basel, Switzerland

Dr. med. Jens Deerberg-Wittram
CEO, RoMed Kliniken, Germany

The preliminary rankings were also sent to a medical journalist and his international network of medical journalists and physicians for plausibility checks. These local experts know the intricacies of the national health care systems and recent events or major changes (e.g. in health policy) which might affect the standing of certain hospitals. For these reasons they are an important part of the quality assurance process. The results of this process are cross-referenced by Statista and sent to the expert board again for final validation. Based on this aggregate feedback a quantitative score for expert opinion is calculated. The national recommendation score is then adjusted by this expert score to reflect the expert board validation in the rankings.

The expert board also gathers for an annual conference where they have the opportunity to discuss the status quo as well as new ideas and future improvements to the methodology in person.

2.3 Scoring Model

The Scoring model is based on the national recommendation score, the international recommendation score, the patient satisfaction score and the KPI score and uses different weights for the individual components as shown in this overview:

Scoring Model
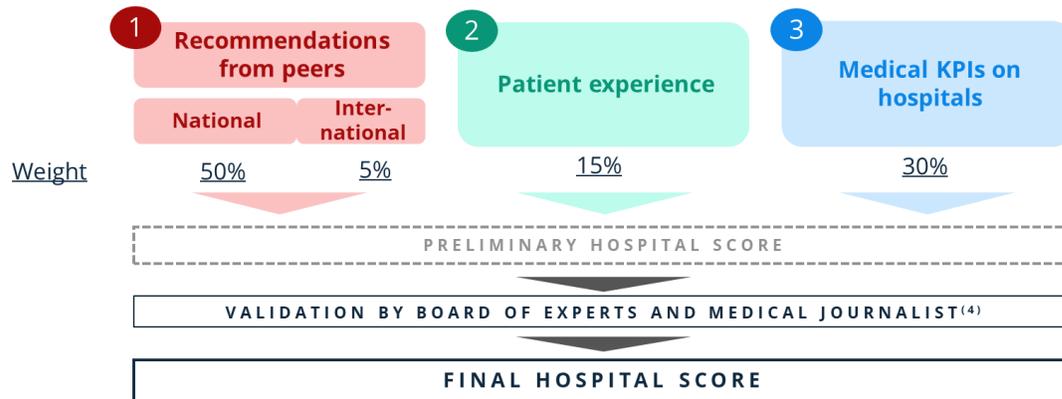
As shown above, recommendations from peers (doctors, hospital managers and healthcare professionals) account for 55% (50% national recommendations from peers from the respective country and 5% international recommendations from peers from other countries) of each hospital's score. They are assigned the highest weighting in the calculation of the score because medical experts are best suited to assess the quality of a hospital. If patient experience data was not available for a certain country Google Star Ratings were used to approximate patient satisfaction. Because these are less reliable as a data source the weight of patient experience in the Scoring Model was halved to 7.5%[2].

For countries where Medical KPIs were not available the weights were re-proportioned accordingly, e.g. the weight of National Recommendations from peers increases from $\frac{50}{100}$ to $\frac{50}{70}$ (71%).

The final hospital score is the weighted average of the available scores for each hospital, adjusted by the expert score (see chapter 2.2). Based on this score and the chosen cut-off for list length in the given country, hospitals are ranked top to bottom in each country. The results of this ranking are displayed in the country lists published by Newsweek:

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[2] Patient Experience Data was not available for Japan, UK, South Korea, Spain, Australia, Brazil, Canada, India, Thailand, Sweden, Denmark, Finland and Singapore

Country Rankings

Example: World's Best Hospitals - USA

Rank	Hospital	Score	City	# of hospital beds
1	Mayo Clinic	97.3	Rochester	1,220
2	Cleveland Clinic	93,7	Cleveland	1,285
3	Massachusetts General Hospital	93.3	Boston	1,011
4	The John Hopkins Hospital	92.5	Baltimore	1,007
5	University of Michigan Hospital	86.5	Ann Arbor	1,006

Example: World's Best Hospitals - Germany

Rank	Hospital	Score	City	# of hospital beds
1	Charité – Universitätsmedizin Berlin	93.1	Berlin	3,011
2	Universitätsklinikum Heidelberg	90.7	Heidelberg	1,988
3	Universitätsklinikum Hamburg-Eppendorf	90.0	Hamburg	1,436
4	Klinikum der Universität München	87.4	München	2,058
5	Medizinische Hochschule Hannover	87.2	Hannover	1,520

2.4   Specialty Hospitals

The study is aimed at rating the reputation and performance of general hospitals. Due to the open design of the study, participants could not be restrained from recommending specialty hospitals. However, these hospitals were not ranked by their performance in the respective medical fields due to the survey structure used, e.g. there was no ranking among hospitals that specialize in treating cancer because the survey questions did not specifically ask for recommendations regarding cancer patients.

The same data sources were used for KPIs and patient satisfaction scores of specialized hospitals as for general hospitals, but the score calculated using the approach described in 2.3 was removed from the national rankings, resulting in these specialized hospitals not being a part of the country lists. The underlying reason is that specialized hospitals like heart or cancer hospitals differ greatly in their services from general hospitals and should therefore not be compared in their performance to these hospitals. On the other hand, since these hospitals did receive a number of peer recommendations and performed well enough in regard to KPIs and Patient Satisfaction Scores to enter the national rankings in their respective countries (despite usually being smaller and much more specialized than their general counterparts), the authors of this study decided not to omit specialized hospitals completely. Instead, these are displayed in a separate list. This list is sorted alphabetically because, as outlined above, specialties are very heterogenous, not only in the treatment/procedures required, but also in the patient population, e.g. when comparing patients from heart clinics to patients from psychiatric clinics. No conclusion should be drawn from the order of the specialized hospitals in this list. Since only a relatively low number of hospitals per country is represented in this list the

fact that these specialized hospitals were recommended by peers frequently enough to make the list is a huge distinction compared to other specialized hospitals in the same medical field in their respective country which did not make the list.

2.5 Global Top 100 List

In addition to the country lists two additional lists were created to identify the Top 100 best hospitals worldwide. These two lists are:

- o Top 50 hospitals, sorted by rank

- o Top 51 to 100 hospitals, sorted alphabetically

The top 50 hospitals were determined by the number of international recommendations received in the survey and their national rank. The logic behind this approach is that hospitals which are ranked higher in the national rankings should not be ranked lower than their national peers in the international ranking (to ensure internal validity), e.g. #1 in country A #1 was ranked above #2 in country A on the global list.
Numbers 51 through 100 in the list consist of the next best hospitals in each country. They are sorted alphabetically and not by rank because the data is too heterogenous between countries to allow for further cross-country comparison past the top 50.
The global list does not include specialized hospitals for the same reasons they were separated from the national rankings. Hospitals that were distinguished in this Global Top 100 List are the very best hospitals in each country and therefore, across the world. Out of over 1500 hospitals included in the 2020 World's Best Hospital Ranking, this elite group represents less than 7% of all hospitals, making this the most prestigious ranking available to date.

3 Specific Methodology

The following section expands on the general methodology outlined in chapter 2 by describing country specific lists and data sources for each country.

3.1 United States of America

There are currently around 6,150 hospitals in the USA according to the American Hospital Association (American Hospital Association 2020). The majority of Hospitals (around 5,200) are classified as Community Hospitals, which are defined as all nonfederal, short-term general, and other specialized hospitals. Hospitals that are not accessible to the general public, such as prison hospitals or college infirmaries, are excluded. The average

number of inpatient beds per community hospital in the US is currently 152 (American Hospital Association 2020).

Community hospitals differ in terms of ownership type, with around 2,900 being non-government not-for-profit community hospitals, around 1,300 being for-profit community hospitals and the remaining ca. 1,000 being state and local government community hospitals. There is also a smaller number of other hospitals such as federal government hospitals (around 200) and nonfederal psychiatric hospitals (around 600). Texas and California have the highest number of community hospitals with 523 and 359 respectively, while Delaware and the District of Columbia have the smallest number with 7 and 10.

The hospital KPIs used for the USA ranking are part of the Medicare "Hospital Compare" dataset published by the Centers for Medicare & Medicaid Services (CMS). This comprehensive dataset revolves around an "Overall Hospital Quality Star Rating", developed by the Yale New Haven Health Services Corporation – Center for Outcomes Research and Evaluation (CORE) and is available for over 4,500 hospitals publicly reporting quality information on the Hospital Compare platform. Each hospital is assigned one to five stars based on the hospital's overall performance across a number of quality measures regarding common conditions that hospitals treat. Hospitals are only assigned a Star Rating upon meeting certain data availability thresholds (outlined further below). Since the start of the public reporting in 2016, between 78.9% and 80.3% of hospitals have received a Star Rating for each reporting period (YNHHSC/CORE 2018).

Some more complex or specialty procedures are not reflected in the summary rating. The aim is to generate a comprehensive representation of overall quality that can be interpreted by patients and consumers, but also to identify performance categories within the large number of hospitals in the US.

The following section describes the methodology used by CMS to generate the Star Rating which is useful to understand as a basis for the KPI score used in the World's Best Hospital Ranking for the USA.

In order to define the aforementioned Star Rating, measures that are relevant in the context of assessing overall hospital quality were identified through stakeholder and expert feedback. Measures that are only reported by a small number of hospitals or which were not necessarily indicative of higher quality were excluded, reducing the total number of included measures from 120+ to 51 in the currently reported Star Rating. The selected measures were standardized into seven group performance categories which make up the overall rating:

- o Mortality (7)
- o Safety of Care (8)
- o Readmission (7)
- o Patient experience (10)
- o Effectiveness of care (9)
- o Timeliness of care (5)
- o Efficient use of medical imaging (5)

The KPI score for US hospitals in the World's Best Hospital 2020 Ranking was calculated using the latest data from the October 2019 Hospital Compare database. The data samples for the group performance rankings were collected from:

Mortality		Data collection	
		From	Through
1.	Death rate for heart attack patients	7/1/2015	6/30/2018
2.	Death rate for coronary artery bypass graft (CABG) surgery patients	7/1/2015	6/30/2018
3.	Death rate for chronic obstructive pulmonary disease (COPD) patients	7/1/2015	6/30/2018
4.	Death rate for heart failure patients	7/1/2015	6/30/2018
5.	Death rate for pneumonia patients	7/1/2015	6/30/2018
6.	Death rate for stroke patients	7/1/2015	6/30/2018
7.	Deaths among patients with serious treatable complications after surgery	7/1/2016	6/30/2018

Safety of Care		Data collection	
		From	Through
1.	Central line-associated bloodstream infections (CLABSI)	1/1/2018	12/31/2018
2.	Catheter-associated urinary tract infections (CAUTI)	1/1/2018	12/31/2018
3.	Surgical site infections from colon surgery (SSI: Colon)	1/1/2018	12/31/2018
4.	Surgical site infections from abdominal hysterectomy (SSI: Hysterectomy)	1/1/2018	12/31/2018

5.	Methicillin-resistant Staphylococcus Aureus (MRSA) Blood Laboratory-identified Events (Bloodstream infections)	1/1/2018	12/31/2018
6.	Clostridium difficile (C.diff.) Laboratory-identified Events (Intestinal infections)	1/1/2018	12/31/2018
7.	Rate of complications for hip/knee replacement patients	4/1/2018	3/31/2018
8.	Serious complications	7/1/2016	6/30/2018

Readmission		Data collection	
		From	Through
1.	Hospital return days for heart attack patients	7/1/2015	6/30/2018
2.	Rate of unplanned readmission for coronary artery by-pass graft (CABG) surgery patients	7/1/2015	6/30/2018
3.	Rate of unplanned readmission for chronic obstructive pulmonary disease (COPD) patients	7/1/2015	6/30/2018
4.	Hospital return days for heart failure patients	7/1/2015	6/30/2018
5.	Rate of unplanned readmission after hip/knee surgery	7/1/2015	6/30/2018
6.	Hospital return days for pneumonia patients	7/1/2015	6/30/2018
7.	Rate of unplanned readmission after discharge from hospital (hospital-wide)	7/1/2017	6/30/2018

Patient experience		Data collection	
		From	Through
1.	Patients who reported that their nurses communicated well	1/1/2018	12/31/2018
2.	Patients who reported that their doctors communicated well	1/1/2018	12/31/2018
3.	Patients who reported that they received help as soon as they wanted	1/1/2018	12/31/2018
4.	Patients who reported that staff explained about medicines before giving it to them	1/1/2018	12/31/2018
5.	Patients who reported that their room and bathroom were clean	1/1/2018	12/31/2018
6.	Patients who reported that the area around their room was quiet at night	1/1/2018	12/31/2018

Patient experience		Data collection	
		From	**Through**
7.	Patients who reported that they were given information about what to do during their recovery at home	1/1/2018	12/31/2018
8.	Patients who understood their care when they left the hospital	1/1/2018	12/31/2018
9.	Patients who gave their hospital a rating on a scale from 0 (lowest) to 10 (highest)	1/1/2018	12/31/2018
10.	Patients who would recommend the hospital to their friends and family	1/1/2018	12/31/2018

Effectiveness of care		Data collection	
		From	**Through**
1.	Patients assessed and given influenza vaccination	10/1/2018	3/31/2019
2.	Percentage of patients who left the emergency department before being seen	1/1/2017	12/31/2017
3.	Percentage of patients who came to the emergency department with stroke symptoms who received brain scan results within 45 minutes of arrival	1/1/2018	12/30/2018
4.	Percentage of patients receiving appropriate recommendation for follow-up screening colonoscopy	1/1/2017	12/31/2017
5.	Percentage of patients with history of polyps receiving follow-up colonoscopy in the appropriate timeframe	1/1/2017	12/31/2017
6.	Percent of mothers whose deliveries were scheduled too early (1-2 weeks early), when a scheduled delivery was not medically necessary	1/1/2018	12/31/2018
7.	Percentage of patients who received appropriate care for severe sepsis and septic shock.	1/1/2018	12/31/2018
8.	Patients who developed a blood clot while in the hospital who did not get treatment that could have prevented it	1/1/2018	12/31/2018
9.	Percentage of patients receiving appropriate radiation therapy for cancer that has spread to the bone	1/1/2017	12/31/2017

Timeliness of Care		Data collection	
		From	**Through**
1.	Average (median) time patients spent in the emergency department, before they were admitted to the hospital as an inpatient	1/1/2018	12/31/2018
2.	Average (median) time patients spent in the emergency department, after the doctor decided to admit them as an inpatient before leaving the emergency department for their inpatient room	1/1/2018	12/31/2018
3.	Average (median) number of minutes before outpatients with chest pain or possible heart attack who needed specialized care were transferred to another hospital	1/1/2018	12/31/2018
4.	Average (median) number of minutes before outpatients with chest pain or possible heart attack got an ECG	1/1/2018	12/31/2018
5.	Average (median) time patients spent in the emergency department before leaving from the visit	1/1/2018	12/31/2018

Efficient use of medical imaging		Data collection	
		From	**Through**
1.	Outpatients with low-back pain who had an MRI without trying recommended treatments first, such as physical therapy	7/1/2017	6/30/2018
2.	Outpatient CT scans of the abdomen that were "combination" (double) scans	7/1/2017	6/30/2018
3.	Outpatient CT scans of the chest that were "combination" (double) scans	7/1/2017	6/30/2018
4.	Outpatients who got cardiac imaging stress tests before low-risk outpatient surgery	7/1/2017	6/30/2018
5.	Outpatients with brain CT scans who got a sinus CT scan at the same time	7/1/2017	6/30/2018

Hospitals may not be able to report data on all measures due to low patient volume, on average hospitals reported 36 measures with an Interquartile Range of 21 to 50 during the 2017 reporting period (YNHHSC/CORE 2018).

Based on these measures, **group performance categories** are created by comparing the hospital's group score to the national average group score in the same hospital

category using confidence intervals for each hospital group score. Group performance categories were therefore defined by the CMS as follows:

Group performance categories	Description
Above the national average	group score with a confidence interval that fell entirely above the national average
Same as the national average	group score with a confidence interval that included the national average;
Below the national average	group score with a confidence interval that fell entirely below the national average

After calculating the group scores for each hospital, the seven performance groups were combined into a single hospital summary score by using weighted averages. The CMS, taking into account stakeholder input from a survey that asked professionals to rank groups for the purpose of the weighting, defined the weights based on the following criteria:

o   Group importance: Outcome groups (Mortality, Safety, Readmission) should be weighted higher than process groups (Effectiveness and Timeliness of Care). The weight of the efficient use of medical imaging group should reflect the limited population receiving these measures.

o   Consistency with existing CMS Policies and Priorities: Weights should be consistent with existing weighting schemes of other CMS programs and the CMS Quality Strategy

o   Stakeholder input: weighting should take into account the priorities of medical professionals and patients

The weighting scheme was also vetted by other stakeholders such as the Patient & Patient Advocate Work Group through a public input period during which feedback was collected. The final weights used were:

Category	Weight
Mortality	22%
Safety of Care	22%
Readmission	22%
Patient Experience	22%

Effectiveness of Care	4%
Timeliness of Care	4%
Efficient Use of Medical Imaging	4%

Based on this weighting scheme the formula for the calculation of the hospital summary score is:

$$\text{Hospital Summary Score}_h = \frac{\sum_{d=1}^{7} W_d \alpha_{hd}}{\sum_{d=1}^{7} W_d}$$

In a penultimate step, **minimum thresholds** were applied to ensure hospitals with low numbers of certain patient types that were not able to report data on all measures get excluded from public reporting if the total number of reported measures or groups is below the threshold. This approach ensures the reliability (minimum reliability level of 0.75) and validity of the rating system. In the current methodology, the minimum number of measures per group is set at three and the minimum group threshold for a star rating is three groups (with a minimum of one outcome group).

Lastly, the summary scores were clustered into five categories to assign the final star ratings. In this classification, a three-star rating is considered average. The classification into star ratings does not conclude that hospitals with the same star rating have identical quality, rather the rating reflects the weighted average of the summarized, group-level quality information for a hospital. Due to this approach, by definition, some hospitals will be close to the boundaries of the next higher/lower star category. Therefore, to get a clearer understanding of the quality of each hospital, the different set of measures contributing to its star ranking are considered.

The distribution of the Star Ratings in the 2017 Hospital Compare dataset is as follows:

Star Rating	Number of Hospitals
5 Stars	337 (9.1%)
4 Stars	1.155 (31.3%)
3 Stars	1.187 (32.2%)
2 Stars	753 (20.4%)
1 Star	260 (7.0%)

Because the Star Ratings are highly aggregated, the World's Best Hospital 2020 rankings for the USA do not merely take the Overall Star Rating into account to calculate the KPI score. Instead, the weighted group performance scores using the same weights as the CMS were chosen for the KPI score calculation. This ensures that the approach is comparable with the CMS but allows for a more differentiated KPI score than merely using an overall Star Rating.

The full methodology report for the Hospital Compare Quality Star Rating can be found at:

https://www.qualitynet.org/inpatient/public-reporting/overall-ratings/resources

Patient Satisfaction

In the US, the Patient Satisfaction Score is based on Medicare HCAHPS data. The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey is a standardized survey of hospital patients in the USA regarding their experiences during a recent inpatient hospital stay (HCAHPS 2020). While many hospitals in the US already collected information on patient satisfaction, prior to HCAHPS there was no national standard for collecting or publicly reporting patients' perspectives of care information that would enable valid comparisons to be made across all hospitals. The survey is composed of 29 items that encompass all aspects of the patients' hospital experience. The most recent dataset from 2019 consists of about 2.9 million completed surveys. Based on the collected survey data, the CMS reports eleven HCAHPS Star Ratings on Hospital Compare: 10 for the publicly reported HCAHPS measures, as well as an HCAHPS Summary Star Rating. The specific measures are derived from certain items in the HCAHPS survey as shown below:

HCAHPS Composite Measures		Questions
1.	Communication with Nurses	1,2,3
2.	Communication with Doctors	5,6,7
3.	Responsiveness of Hospital Staff	4,11
4.	Communication about Medicines	16,17
5.	Discharge Information	19,20
6.	Care Transition	23,24,25
HCAHPS Indidual Items		**Questions**
7.	Cleanliness of Hospital Environment	8
8.	Quietness of Hospital Environment	9
HCAHPS Global Items		**Questions**
9.	Hospital Rating	21
10.	Recommend the Hospital	22

Hospitals had to have at least 100 completed HCAHPS surveys over a given four-quarter period in order to receive a Star rating.

The HCAHPS Summary Star Rating is the average of the Star Ratings. It is constructed from the Star Ratings from the 6 HCAHPS Composite Measures, a single Star Ratings for the two HCAHPS Individual Items listed above and a single Star Rating for the two HCHAPS Global Items (also listed above). The Star Ratings for the HCHAHPS Individual Items and HCHAPS Global Items are constructed by calculating the average of the Star Rating for the two individual items contained in these composite measures. The resulting 8 Star Ratings are combined into a simple average and rounded using normal rounding rules:

HCAHPS Summary Star Rating	Rounded Star Rating
≥1.00 and <1.50	1 Star
≥1.50 and <2.50	2 Stars
≥2.50 and <3.50	3 Stars
≥3.50 and <4.50	4 Stars
≥4.50 and ≤5.00	5 Stars

To avoid the loss of information on the individual measures, the World's Best Hospital Patient Satisfaction Score for US Hospitals is based on the more precise individual measures described above rather than the simple Summary Star Rating. This approach also allows for a more precise differentiation of hospitals which are at the upper or lower boundaries of their respective Summary Star Rating category.

The full methodology for the HCAHPS Star Rating is published at:

https://hcahpsonline.org/en/hcahps-star-ratings/

Best-in-State

Due to the extensive KPI dataset and the large number of recommendations for US hospitals it was possible to differentiate the national ranking by US states, resulting in a number of Best-in-State lists. In total, 44 states were represented in the Top 300 list of US hospitals and could therefore be recognized in a Best-in-State list. California and Illinois had the biggest state representation with 33 and 20 hospitals respectively. Arizona, the District of Columbia, Delaware, Indiana, Nebraska, Tennessee, West Virginia and Wyoming were home to just a single hospital in the Top 300 list.
The total number of existing hospitals in these lowly represented states is certainly higher, but these other hospitals did not make the Top 300 list. Plausibility checks were

performed to ensure that the share of awarded hospitals is no greater than one third of the existing hospitals per state, with an average of 12% of hospitals awarded per state. This relatively low number ensures that the Best-in-State distinction is reserved for the top-performing hospitals in each represented state.

3.2 Germany

Germany currently has 1,942 hospitals (Statistisches Bundesamt 2018) which can be classified into four groups defined by the type and level of care provided. This classification is based on existing health policy regulations:

- o Basic and standard care hospital
- o General care hospital
- o Maximum/tertiary care hospital
- o Specialized hospitals

Basic and standard care hospitals are usually the smallest types of hospitals, providing only general services or basic surgeries. They usually do not have specialty wards. Because of these limitations they are mostly not represented in the World's Best hospital ranking for Germany.

General care hospitals usually have several specialty wards and even provide maternity care. They usually do not have highly specialized specialty wards, instead referring their patients to specialized hospitals or maximum care hospitals if needed.

Maximum care hospitals usually treat the most complex and resource intensive cases. They are therefore most often equipped with expensive and cutting edge technical and diagnostic equipment as well as specialized physicians. Many maximum care hospitals are university hospitals.

Specialized hospitals, while often providing a range of general services, are focused on certain specialties (e.g. Cardiology) or complex diagnoses (e.g. Cancer). They are represented in the national ranking for Germany relatively often (compared to other countries) because the German hospital landscape is still relatively heavy on specialized hospitals which are known for their expertise in certain medical fields. Their number has been slowly decreasing over the last several years, with a tendency towards centralization into larger and more diversified medical centers.

Hospitals in Germany can be differentiated further by ownership type, with 29% of hospitals being under public, 34% under private non-profit and 37% under private for profit

ownership (Statistisches Bundesamt 2018). The average size of a hospital in Germany is 245 inpatient beds, with public hospitals on average being by far the largest and private hospitals being the smallest on average.

The 2020 edition of the World's Best Hospital list for Germany ranks the top 200 hospitals out of 1451 eligible hospitals (>100 beds) in Germany, which is the second longest list due to the large amount of recommendations and the good quality of available KPIs and patient experience data (see below).

German hospitals are required to publish freely available annual **quality reports** online since 2005 (originally published bi-annually from 2005 - 2012), therefore data on a large number of KPI's for German hospitals is readily available. The quality reports provide in-depth information about the structure and services of each hospital, such as range of diagnoses and number of provided treatments, number of staff, hygiene measures, number of complications or barrier-free accessibility. The reports not only feature de-scriptive information but also quality indicators which give an indication of the quality of the care provided in each hospital. Further information about hospital quality reports in Germany is available at:

https://www.g-ba.de/institution/themenschwerpunkte/qualitaetssicherung/quali-taetsdaten/qualitaetsbericht/

The following KPIs from the quality reports were used for the World's Best Hospital rank-ing in Germany because they are most comparable across hospitals and representative of a hospital's general performance:

- o Medical Staffing: Number of cases per doctor

- o Nurse Staffing: Number of cases per nurse

- o Patient safety: Number of measures to increase patient safety (e.g. standardized pre-surgery checklists)

- o Hygiene: Number of measures to increase hygiene (e.g. hospital infection sur-veillance system)

- o Quality and complaint management: number of measures to guarantee quality and manage complaints (e.g. patient surveys, quality management work groups, structured complaint management systems)

Additionally, quality of care data from **Qualitätssicherung mit Routinedaten (QSR)** was used for the ranking. QSR is based on claims data from the large German health insurer AOK and includes a large number of indicators for a range of surgeries which are analyzed in regard to quality of care. The eight publicly reported surgeries which were considered in the scoring model are:

- o Appendectomy
- o Gall bladder removal
- o Percutaneous Coronary Intervention (PCI)
- o Hip joint endoprosthesis due to coxarthrosis
- o Hip joint endoprosthesis or osteosynthesis due to hip fracture
- o Total knee endoprosthesis due to gonarthrosis
- o Prostate surgery due to Benign Prostatic Hyperplasia (BPS)
- o Radical Prostatectomy (RP) due to prostate carcinoma

The data used for the 2020 ranking was published by the AOK in October 2019 and includes surgeries performed in 2015 to 2017 (with follow up treatment including up until 2018). Additional information about QSR is available at:

http://www.qualitaetssicherung-mit-routinedaten.de/

Lastly, **Planungsrelevante Qualtiätsindikatoren** (plan. QI-RL) were used as KPI's for German hospitals. The plan. QI-RL were first published in a report by the Gemeinsamer Bundesausschuss (G-BA) in 2018. The G-BA is a regulatory body in the German healthcare system who defined quality indicators that are relevant for hospital planning on a regional level. The report described eleven quality indicators in different medical fields such as gynecological surgeries, Maternity care and mammoplasty surgery. Further information is available at:

https://www.g-ba.de/informationen/beschluesse/3545/

Patient Satisfaction

BARMER and AOK, two of Germany's largest health insurers, are performing a patient satisfaction survey since 2011 in cooperation with "Weisse Liste", the leading hospital quality directory in Germany. The survey is based on the Patients' Experience

Questionnaire (PEQ) which has been validated scientifically. Since 2018, KKH, a medium sized German health insurer, has joined the survey. In total, over a million pen&pencil based patient questionnaires are sent out with a response rate of close to 50%. The survey includes about 15 questions covers the following areas:

- o Recommendation of Hospital
- o Satisfaction with medical care
- o Satisfaction with nursing care
- o Satisfaction with service and organization

Results are calculated for each department and aggregated to a total score per hospital. Results are reported for hospitals that have at least 75 completed surveys (or at least 50 for a single department). The detailed description of the survey can be found at the Weisse Liste website:

https://www.weisse-liste.de/de/service/ueber-krankenhaussuche/versichertenbefra-gung/

3.3 Canada

There are currently 1,467 hospitals in Canada. The hospitals are funded publicly, acting as independent institutions incorporated under provincial Corporations Acts. The most populated provinces in Canada, Ontario and Quebec, also have the largest number of hospitals (492 in Ontario and 267 in Quebec). Prince Edward Island on the other hand only has four hospitals, followed by Yukon which only has one. Canada is one of the countries with the lowest density of hospital beds per inhabitant according to the Organization for Economic Co-Operation and Development (OECD), with just 1.9 acute care beds per 1,000 inhabitants (OECD 2019). Subsequently, the average hospital in Canada has just 49 acute care beds, a relatively small number when compared to similar countries.

The KPI data used for the ranking of Canadian hospitals is published by the **Canadian Institute for Health Information (CIHI)**. In Canada, hospitals in all provinces except Quebec submit data to the Discharge Abstract Database (DAD) and/or the National Ambulatory Care Reporting System (NACRS) that is governed by CIHI. In Quebec, hospitals submit their data to the Maintenance et Exploitation des Données pour l'Étude de la Clientèle Hospitalière (MED-ÉCHO) database, which in turn submits their data to CIHI. The combined data is entered into the Hospital Morbidity Database (HMDB) and contains a wide range of risk-adjusted clinical indicators that indicate health system performance.

Data is only reported if a certain number of cases per treatment/measure is met or if certain stability criteria (based on the risk adjustment) are met. CIHI also applies statistical outlier analysis to detect values that lie outside of the range of acceptable indicator values, and subsequently removes these outliers in order to prevent bias in the reported averages.

The data used is based on the most recent reporting period for 2018/2019. The 21 indicators used to determine the score were:

- o All Patients Readmitted to Hospital

- o Hip Fracture Surgery Within 48 Hours

- o Hospital Deaths (Hospital Standardized Mortality Ratio)

- o Hospital Deaths Following Major Surgery

- o Medical Patients Readmitted to Hospital

- o Obstetric Patients Readmitted to Hospital

- o Obstetric Trauma (With Instrument)

- o Pediatric Patients Readmitted to Hospital

- o Emergency Department Wait Time for Physician Initial Assessment

- o Experience Pain in Long-Term Care

- o Experiencing Worsened Pain in Long-Term Care

- o Falls in the Last 30 Days in Long-Term Care

- o Improved Physical Functioning in Long-Term Care

- o In-Hospital Sepsis

- o Potentially Inappropriate Use of Antipsychotics in Long-Term Care

- o Restraint Use in Long-Term Care

- o Surgical Patients Readmitted to Hospital

- o Total Time Spent in Emergency Department for Admitted Patients

- o Worsened Depressive Mood in Long-Term Care

- o Worsened Physical Functioning in Long-Term Care

- o Worsened Pressure Ulcer in Long-Term Care

All Patients Readmitted to Hospital is a measure for the risk-adjusted rate of urgent readmissions within 30 days of discharge for obstetric, pediatric, surgical and medical patients. **Hip Fracture Surgery Within 48 Hours** is the risk-adjusted proportion of hip fractures that were surgically treated within 48 hours of a patient's initial admission to an acute care hospital. **Hospital Deaths** or Hospital Standardized Mortality Ratio refers to the ratio of the observed number of in-hospital deaths to expected in-hospital deaths, based on the types of patients treated in the respective hospital. **Hospital Deaths following Major Surgery** measures the rate of in-hospital deaths due to all causes within 30 days after a major surgery.

Medical Patients Readmitted to Hospital is the indicator for the risk-adjusted rate of readmission for medical patients within 30 days. Similarly, **Obstetric Patients Readmitted to Hospital** measures the risk-adjusted rate of urgent readmissions for obstetric patients. **Obstetric Trauma (with Instrument)** measures the rate of obstetric trauma for instrument-assisted vaginal deliveries. **Pediatric Patients Readmitted to Hospital** refers to the risk-adjusted rate of urgent readmissions for patients age 17 and younger. The **Emergency Department Wait Time for Physician Initial Assessment** measures the time interval between registration and initial assessment in the emergency department in hours (90% of the patients spent less than the recommended maximum waiting time).

Some hospitals in Canada also perform long-term care, therefore **Experiencing Pain in Long-Term Care** (in %) was used for those hospitals. **Experiencing Worsened Pain in Long-Term Care** refers to the percentage of long-term care residents who experienced worsened pain. Worsened pain is connected to a resident's health status and the quality of care received. **Falls in the Last 30 Days in Long-Term Care** is an indicator for the percentage of residents in long-term care who fell in the last 30 days before their quarterly clinical assessment. Less falls indicate higher safety and quality of care for residents.

Improved Physical Functioning in Long-Term Care indicates the percentage of long-term care residents who improved or remained independent in transferring and locomotion. This is an indicator of overall health status and autonomy of the resident. **In-Hospital Sepsis** refers to the risk-adjusted rate of sepsis after admission.

The percentage of residents on Antipsychotics Without a Diagnosis of Psychosis is captured by the **Potentially Inappropriate Use of Antipsychotics in Long-Term Care** indicator. The lack of careful monitoring might indicate concerns about safety and quality of care. **Restraint Use in Long-Term Care** measures how many long-term residents are in daily physical restraints. A high rate carries potential physical and psychological risks.

The indicator **Surgical Patients Readmitted to Hospital** measures the risk-adjusted rate of urgent readmissions for surgical patients within 30 days. Furthermore, **Total Time Spent in Emergency Department for Admitted Patients** is used to determine the time interval between registration, admissions and release from the emergency department (90% of the patients spent less than the recommended maximum waiting time). **Worsened Depressive Mood in Long-Term Care** indicates the percentage of long-term care residents whose mood from symptoms of depressions worsened, whereas **Worsened Physical Functioning in Long-Term Care** indicates the percentage of residents whose transfer and locomotion functioning worsened or remained completely dependent. Lastly, **Worsened Pressure Ulcer in Long-Term Care** shows the percentage of long-term care residents whose stage 2 to 4 pressure ulcer worsened since the previous assessment.

In order to account for differences in patient characteristics across hospitals, CIHI used established regression-based risk-adjustment methods to control for patient characteristics and other risk factors that may affect outcomes. As a result, risk-adjusted indicators report the risk-adjusted rate, e.g. by dividing the observed number of cases by the expected number of cases, multiplied by the Canadian average.

Not all indicators were relevant for all hospitals depending on the type of patients treated, e.g. if the hospital does not have any or enough ulcer patients the indicator does not apply (applies mostly to long-term care indicators). Only relevant indicators were incorporated in the calculation of the KPI score of a hospital.

3.4 Brazil

In Brazil, healthcare is structured in a National Healthcare System, resulting in universal, free coverage for all permanent Brazilian residents. It's provided by both private and public institutions, currently operating around 6,702 Hospitals (Confederação Nacional de Saúde 2019). Despite the large number of hospitals, the average Hospital size is quite small. The density of hospital beds is also quite low with 1.95 hospital beds per 1,000 inhabitants in 2019 (Confederação Nacional de Saúde 2019). Based on the minimum size of 100 inpatient beds to be considered in this project, 1,912 general and 430 specialized Brazilian hospitals qualified for further analysis.

In addition to the peer recommendations, medical KPIs were used to calculate the overall score. All analyzed KPIs were published by the Brazilian national supplementary health agency (orig. Agência Nacional de Saúde Suplementar), which is responsible for the

health insurance sector in their country. For the analysis, four different published KPIs of 2018 were used:

- o Readmission Rate
- o Patient Safety
- o Maximum Accreditation Certificate
- o Quality Factor (Fator de Qualidade)

Readmission Rate is a measure that shows whether a hospital exceeded the nationally defined readmission quota. The quota is calculated by the number of patients that are readmitted to the hospital within 30 days of the last hospital discharge. **Patient Safety** displays the hospitals that are officially registered patient safety centers at ANVISA (Agência Nacional de Vigilância Sanitária). ANVISA is the Brazilian regulatory agency responsible for the approval and supervision of pharmaceuticals, health services, medical devices and other areas. Established in 1999, it's an independent acting agency. The **Maximum Accreditation Certificate** is conferred by ONA (Organização Nacional de Acreditação), CBA (Consórcio Brasileiro de Acreditação), IQG (Acreditação Internacional) and DNV (Det Norske Veritas). The available source displays a list of hospitals that reached maximum accreditation by the institutions listed above. The **Quality Factor**, established by ANS (Agência Nacional de Saúde Suplementar) measures the fulfillment of quality requirements, established in the normative resolution No. 364 / 2014. It includes both the Readmission Rate and Patient Safety centers, as well as other criteria. The more criteria a hospital meets, the higher the score of the Quality Factor is. All used data was accessed from and is available at:

http://www.dados.gov.br/organization/agencia-nacional-de-saude-suplementar-ans

3.5 France

According to the OECD, France currently has 3,046 hospitals (OECD 2019). 1,364 are owned by the government, 1,002 by private for-profit organizations and 680 by private non-profit organizations. The density of beds is 3.1 acute care beds per 1,000 inhabitants. To calculate the KPI score for French hospitals, publicly available data from the Haute Autorité de Santé (HAS) was analyzed. HAS is an independent public authority that contributes to the regulation of the French health system and assures quality standards in health care measurements. It publishes data regarding the quality and safety of French hospitals, following a consistent methodology to guarantee validated and

comparable data measures. HAS also measures patient satisfaction and experience, resulting in a comprehensive dataset, allowing for a detailed comparison of different hospitals.

For the World's Best Hospitals Ranking, nine different KPIs were used. If available, the following KPIs were used to calculate an overall score:

- o Patient rights
- o Patient journey
- o Medication management
- o Quality and risk management
- o Infection risk
- o Patient records
- o Management of emergencies
- o Organization of the operating rooms
- o Safety of endoscopy patients

The measures above were chosen due to their availability for most hospitals as well as for their relevance as a measure of the general quality of a hospital. HAS used a four-point grading scale system, where A is the best achievable grade and D is the worst. **Patient rights** assesses whether a hospital is treating the patients according to their rights, respecting their privacy and ensuring the confidentiality of their data. **Patient journey** refers to the organization of a patient's entire journey during their stay. The received rating is an indicator of the continuity and coordination of care, the cooperation between different teams, as well as the accessibility of information by all healthcare professionals. **Medication management** shows if a hospital ensures patient security at all stages of medical treatment, including adequate information regarding the treatment. **Quality and risk management** assesses whether a hospital has a well-defined policy for improving the quality and safety of care. **Infection risk** is an indicator for measures that are taken by a hospital to avoid infections during hospitalizations. Hospitals also get a higher score if their employed personnel are correctly trained in hygiene regulations. The correct use of antibiotics also contributes to the control of the infection risk. **Patient records** measures the traceability of information in the patient's file, which is important to guarantee coordinated and continuous care. **Management of emergencies** assesses whether the establishment is organized to receive patients in the emergency

department 24 hours a day, 7 days a week. It involves reception by trained professionals, care adapted according to the degree of emergency, reorientation or transfer, and knowledge of the availability of hospital beds. **Organization of the operating rooms** indicates whether a hospital has set up an organization in the operating room to ensure maximum patient safety. Since operating rooms often handle difficult, complex cases, a highly structured organization is crucial for patient safety. **Safety of endoscopy patients** assesses whether the hospital has identified the major risks that may arise at each stage of an endoscopy. Endoscopy is a medical examination that explores the interior of an organ or a body cavity by inserting a small camera.

All the data and the description of the KPI's are also available at:

https://www.scopesante.fr

Patient Satisfaction

Patient satisfaction data was also used in determining the overall score of French hospitals. HAS provides comprehensive data from patient surveys, reflecting their experience and satisfaction with a hospital stay. For this project, the overall score given by hospitalized patients was used, as well as the share of patients who would recommend the hospital that they were treated in. The overall score is calculated using a range of different variables such as the level of support from doctors and/or nurses, the organization of the whole treatment process, the quality of food, patient satisfaction with the accommodation, etc. The recommendation of a hospital was assessed by asking the patients, whether they would recommend the respective hospitals to friends and family members.

All the data and the description of patient satisfaction are available at:

https://www.scopesante.fr

3.6 Israel

There are currently 85 hospitals in Israel (OECD 2018). 37 are classified as public hospitals, 26 as non-profit private hospitals and 22 as for-profit private hospitals. Differentiated by type of hospital, 44 are general hospitals, 12 are mental health hospitals and 29 are specialized hospitals (Ministry of Health 2016). They are medium sized on average, with the average hospital having 312 inpatient beds. The density of beds per inhabitants

is average in comparison to most other countries in the ranking, with 2.99 beds per capita in 2018.

The Ministry of Health performs a bi-annual survey of patient experience in general hospitals in Israel. The latest national survey was held in 2018 and the results are accessible to the general public.

The survey population consists of patients over the age of 18 who were hospitalized for at least two nights. Patients from a wide range of hospital wards have been surveyed to generate data on the hospital level as well as for specific wards. The interviews were performed as telephone interviews, resulting in a solid response rate of 50%, with approximately 11,000 patients from 26 hospitals being interviewed.

The questionnaire contained over 40 questions regarding patient-reported experiences: attitude of staff, information delivery, treatment continuity and patient empowerment, efficiency perception as well as environmental conditions. Each resulting measure has been calculated as the average of the satisfied patient rate among the respondents in each question. The number of answers per hospital was adjusted by the ratio of respondents in the sample to the number of actual discharges in each hospital to reflect the national distribution of patients. The Ministry of Health used Cronbach's Alpha to control for the internal consistency of each measurement.

Measurements used for the calculation of the patient satisfaction score in the World's Best Hospitals ranking for Israel were:

- o   Efficiency Measures Index
- o   Patient Empowerment Index
- o   Sequence of treatment Index
- o   Information and Clarity of Expectations index
- o   Attitude and Respect for Patient Index
- o   Willingness to Recommend Score
- o   General Satisfaction Score
- o   Overall Mean Score of Patient Experience

Each of the indices was comprised of two to six questions relevant to the dimension of patient experience measured by the index. The patient satisfaction score used for the World's Best Hospitals Ranking was the weighted average of the abovementioned

measures, with the most global indicator "Overall Mean Score of Patient Experience" having the highest weight.

The data for the 2018 survey is available at:

https://www.health.gov.il/UnitsOffice/HD/publicComplains/Quality_Service/surveys/general/Pages/general-2018.aspx

3.7 Sweden

Sweden currently has 100 hospitals, out of which 85 are public hospitals that are run by regional governments and 15 of which are private hospitals (OECD 2019). Seven of the 85 public hospitals are regional university hospitals offering specialized care and focusing on research. The average size of a Swedish hospital is 224 inpatient beds, with an average of 2.22 per 1000 inhabitants.

The KPIs used for Swedish hospitals are based on data published by regional governments and local municipalities. Indicators are selected by Swedish officials in cooperation with different data holders such as specific registry data or the National Board of Health and Welfare in Sweden. However, not all indicators are published on a hospital-level (e.g. only on a regional level) and others are not comparable across hospitals. Therefore, the most generally applicable indicators for the process were selected to determine the KPI score:

- o Waiting time in emergency room for patients 19 years and older
- o Waiting time in emergency room for patients 80 years and older
- o Mortality rate 28 days after hospitalized stroke
- o Mortality rate 28 days after hospitalized heart attack

The data used is available at:

https://vardenisiffror.se/

3.8 Italy

There are currently around 1,063 hospitals in Italy (OECD 2019). The healthcare system is based on a national health service known as Servizio Sanitario Nazionale (SSN).

According to OECD, approximately 40% of the hospitals are owned by the public and 60% are owned by private for-profit or private non-profit organizations.

In order to provide measures for these hospitals, publicly available data was used for both medical KPIs and patient satisfaction.

The data about medical KPIs derives from the National Outcome Assessment Program (PNE), managed by the National Agency for Regional Health Services on behalf of the Ministry of Health and is published and presented at *Dove e Come Mi Curo* (https://www.doveecomemicuro.it/). For this project, only the indicators that are comparable to the national reference values are used. These reference values are recognized and validated by the Italian Ministry of Health. All quality indicators that are published fulfill the same criteria: scientific validity, expressiveness, and operational feasibility, making it possible to compare them on a national level. The individual indicators are rated using a five-point scale.

The number of available indicators differs from hospital to hospital, based on their size and range of treatment. In general, all indicators can be divided into four different categories:

- o Effectiveness

- o Safety

- o Appropriateness

- o Competence

KPIs from the category **Effectiveness** indicate whether a hospital achieves the expected results in terms of patient health. An example for this category is the indicator "mortality within 30 days after surgery". It's a measure that compares the number of patients that died within 30 days after a conducted surgery to the total number of patients who had the same surgery. The lower the relative number of patients that died, the higher the value for this indicator. KPIs that belong to the category **Safety** measure how well a hospital avoids or prevents adverse events during the care process. One of the indicators in this category is "complications within 30 days after surgery", which measures the number of patients that experience at least one complication in the 30 days following a surgery. The third category, **Appropriateness**, comprises measures that indicate if a hospital offers adequate clinical services to a patient. The offered services should meet the needs of a patient and aim for the best medical outcome. An example for this case would be the measure "number of primary caesarean sections". Sometimes cesarean delivery is performed without there being a need (medical indication), and therefore exposes the

mother and unborn child to an avoidable risk. A low number of caesarean sections may therefore indicate a higher degree of appropriateness. The last category, **Competence**, lists indicators that can be associated with the competence and experience of the hospital's personnel. A typical indicator in this category is the "annual volume of a specific type of surgery". A higher volume of the same surgical procedure indicates more experienced physicians and a higher level of routine for the given procedure. Still, it cannot be associated with the outcome of a single surgery.

All the data and the descriptions of the KPIs are also available at:

https://www.doveecomemicuro.it/

Patient Satisfaction

Dove e Come Mi Curo also provides an online platform for patients to rate their hospital stay from 1 to 5 in different areas. The categories are: Overall recommendation to family and friends, cleanliness, privacy, general quality, availability and kindness of the staff, medical information received, administrative organization, food, visits.

All the data and the description of patient satisfaction are available at:

https://www.doveecomemicuro.it/

3.9 United Kingdom

In the UK, there are currently around 1,257 hospitals (Interweave Healthcare 2019). 865 of these are located in England, 279 in Scotland, 83 in Wales and 41 in Northern Ireland. Most of them are owned by the government and run by the National Health System (NHS) but there are also a few private hospitals. The healthcare system is tax-based and guarantees universal coverage for all UK citizens.

The data used for this project is derived from the Care Quality Commission's (CQC) database as of January 2nd, 2020. CQC is an independent regulator of health and social care in England. The commission monitors, inspects, and rates health services that are provided to the public. After a comprehensive inspection, CQC publishes a rating on a location-by-location basis in five different categories:

- o   Safe

- o Effective
- o Caring
- o Responsive
- o Well-led

For each of these categories, a health care organization can be graded as "outstanding", "good", "requires improvement" or "inadequate". The achieved grade is a result from findings during the inspection, done by a professional team. **Safe** is an indicator for the overall protection of patients. The inspectors gather evidence that patients are protected from abuse and avoidable harm. Several different factors play a role for the patient's safety, e.g. an appropriate number of staff, the correct use of medicine, prevention of infections, etc. **Effective** assesses whether a patient's treatment and the support they receive lead to good outcomes and promote a good quality of life. This metric also results from the inspection of different variables: level of training and experience of staff, assessment of patient needs, cooperation with other organizations to secure the best outcome, etc. The next category, **Caring**, refers to the compassion, kindness, dignity, and respect that patients are treated with during their stay. Inspectors determine whether patients' equality, diversity, and privacy are respected, and whether they are involved in decisions regarding their care. For the fourth category, **Responsive**, CQC is looking for evidence that the service meets patients' needs. This is the case if a hospital meets the individual needs of their patients, if the staff is learning from and responding to complaints and concerns, and if the hospital is planning ahead in order to improve access and flow. The last category, **Well-led**, is an indicator for the quality of leadership, management, strategy, and improvement of the inspected organization. Organizations receive a higher grade if the management is promoting a person-centered and open culture, if they are being clear about their roles, if they work in partnership with others to improve outcomes, and if they are continuously improving their service.

Since CQC only rates hospitals in England, data is not available for hospitals in Scotland, Wales, and Northern Ireland.

All used data was accessed from and is available at:

https://www.cqc.org.uk/

3.10 Australia

According to the Australian Institute of Health and Welfare, there are approximately 1,350 hospitals in Australia as of 2018 (AIHW 2019). 693 of these are public, while 657 are private hospitals. The total number of available hospital beds per 1,000 inhabitants is 3.9.

For the World's Best Hospitals ranking, the following data provided by the Australian Institute of Health and Welfare was used for comparison:

- o   Time spent in emergency departments
- o   Healthcare associated bloodstream infections
- o   Waiting times for elective surgery

The available dataset for **Time spent in emergency departments** displays data for public Australian hospitals in the time period between 2018 and 2019. It measures how many patients from the emergency department were seen within the recommended maximum waiting time. Recommended maximum waiting times vary depending on the urgency of the patient's need for care and are clustered in five different categories: resuscitation, emergency, urgent, semi-urgent, and non-urgent. For each reporting unit, the percentage of patients seen on time is compared to their peer group average. The hospitals are clustered into seven different peer groups: large metropolitan hospitals, large regional hospitals, major hospitals, medium metropolitan hospitals, medium regional hospitals, small hospitals, and children's hospitals. The differentiation by urgency levels and hospital sizes allows for a fairer basis of comparison and more precise measures. **Healthcare associated bloodstream infections** measures how many bloodstream infections can be associated with care provided at a hospital. Hospitals are also clustered into different peer groups for better comparison: major hospitals, large hospitals, medium hospitals, and children's hospitals. Private hospitals are listed in their own peer group. The infection is displayed as a rate per 10,00 patient days, next to the peer group average. The latest available data relates to the time period between 2017 and 2018. The last indicator, **waiting times for elective surgery**, measures the percentage of elective surgeries within the recommended maximum waiting time. The hospitals are clustered in the same peer groups as in the first described indicator. Additionally, the treating doctor determines how urgently surgery is needed and then assigns the patient to one of three urgency categories: recommended within 30 days, recommended within 90 days, or recommended within 365 days. Each hospital then has three values that are comparable to their peer group average. The data derives from the time period between 2018 and 2019.

All used data was accessed from and is available at:

https://www.aihw.gov.au/

3.11 Switzerland

The Swiss health care system is highly decentralized, divided among three levels of the government: the federal level, that of the respective cantons, and the municipal level. As health care insurance is mandatory for every citizen, coverage is universal. According to the Swiss Ministry of Health (Bundesamt für Gesundheit (BAG) 2019) there are 280 Hospitals in Switzerland as of 2017. 122 are classified as general hospitals and 158 as specialized hospitals. The average size of a hospital is relatively small, with approximately 150 beds (Kennzahlen Schweizer Spitäler, 2017).

The BAG publishes standardized mortality ratios for each hospital, which are used as medical KPIs for the Swiss national ranking. Up until the end of 2019, the most recent data available was from 2016. The mortality rates are risk-adjusted by age and sex.

All used data was accessed from and is available at:

https://www.bag.admin.ch/bag/en/home/zahlen-und-statistiken/zahlen-fakten-zu-spitaelern.html

Patient Satisfaction

In Switzerland, the ANQ is a national association for quality improvement in Swiss hospitals. They have measured patient satisfaction in general hospitals among adults since 2009. Patient satisfaction is assessed in different categories. The following were used for this ranking:

- o Quality of treatment
- o Questions asked
- o Answers given
- o Medication management
- o Hospital discharge

For all categories, patients could rate their hospital stay from 1 to 5, 5 being the highest grade possible. For the first question, patients were asked how satisfied they were with their **quality of treatment** in general. **Questions asked** assesses whether patients had the possibility to ask questions of the medical staff. **Answers given** asks the patient if they received satisfying and understandable answers to their questions. **Medication management** relates to whether the use of medication at home was explained to the patient in an understandable way. Finally, patients were asked about their experience with the organization of their **Hospital discharge.**

3.12 Netherlands

There are 126 hospitals in the Netherlands, 101 of them are general hospitals, 8 are University Medical Centers and 7 are specialized pediatric clinics (Inventarisatie ziekenhuislocaties, RIVM 2019). Health care is managed by the government and is universal for all Dutch citizens. Anyone living or working in the Netherlands must obtain basic level health insurance from a private insurance company.

For the hospital ranking in the Netherlands, patient satisfaction data was used. This data is provided by Patiëntenfederatie Nederland (Patients Federation of the Netherlands). The data is available on ZorgkaartNederland, an online platform where patients can give their (subjective) rating of hospitals where they received treatment. The hospitals can obtain a grade between 1 and 10, based on the number of recommendations they receive from patients.

All used data was accessed from and is available at:

https://www.zorgkaartnederland.nl/

3.13 Norway

In Norway health care is publicly tax-financed, providing universal coverage for all residents. The public health care system is structured in four different regional health authorities (RHF), where each authority operates several trusts (The Commonwealth Fund 2019). Each trust manages one or more hospitals, resulting in 64 public hospitals in Norway. The private hospital sector in Norway is relatively small, including only 11 facilities.

KPIs and patient satisfaction data for Norwegian Hospitals is provided by the Norwegian Directorate of Health. The directorate is an executive agency and professional authority under the Ministry of Health and Care Services, which aims to improve the quality of health services and to promote factors that ensure the population remains in good health (Helsedirektoratet 2020). Data about the quality of hospitals is displayed for each hospital trust. For medical KPI's, the following data was used:

- o   30-day Survival Rate (Overall, Stroke, Heart Attack, Hip Fracture)
- o   5-year Survival Rate (Breast Cancer, Rectal Cancer Men/Women)
- o   On-time planned operations

The **30-day Survival Rate (Overall, Stroke, Heart Attack, Hip Fracture)** is a medical KPI often used to measure the quality of treatment. In this case, it shows the percentage of patients that survived a time period of 30 days after their discharge from the hospital. It is differentiated between four different categories: Overall survival rate, survival rate of stroke patients, survival rate of patients who had a heart attack, and survival rate of patients with a hip fracture. The most recent data was available for 2017. The **5-year Survival Rate (Breast Cancer, Rectal Cancer Men/Women)** displays the number of patients that survived a 5-year time period after being diagnosed with different cancer types. The most recent data was available for 2018. Finally, **In-time planned operations** indicates how many planned operations were executed on time. This KPI is an often-used measure for the structure and organization of a hospital. The most recent data was available for 2018.

All used data was accessed from and is available at:

https://www.helsedirektoratet.no/

Patient Satisfaction

Patient satisfaction data for the Norwegian hospital trusts was available for 2015. For this project, the average score of the four following categories was used:

- o   Standard, average score
- o   Information, average score
- o   Doctors, average score
- o   Nursing staff, average score

The results are based on a national survey, carried out by the National Institute of Public Health in Norway.

All used data was accessed from and is available at:

https://www.helsedirektoratet.no/statistikk/kvalitetsindikatorer/sykehusopphold/pasienterfaringer-med-somatiske-sykehus

3.14 South Korea

The healthcare system in South Korea has two components, health insurance and medical aid. The national health insurance system provides coverage to all citizens and it is managed comprehensively in the form of social insurance (Health Insurance Review & Assessment Service 2020). According to the Ministry of the Interior and Safety, in 2017 the country had 343 large general hospitals, 1,467 long-term care hospitals, and 197 specialized hospitals. Seoul is the region with the most hospitals in South Korea and Jeju is the region with the fewest. The number of hospital beds in relation to the population is one of the highest worldwide, with 13.5 beds per 1,000 inhabitants (Korean Statistical Information Service 2020).

The medical KPIs used for ranking South Korean hospitals are published by the national Health Insurance Review & Assessment Service (HIRA). Besides other activities, HIRA monitors the health care system through on-site investigations of hospitals, quality assessments, medical claim reviews, etc. Hira provides an open-data platform with assessments of different quality indicators. For this project, the following indicators from hospital investigations were used:

- o ICU evaluation
- o Acute disease evaluation
- o Cancer Disease Evaluation
- o Drug evaluation

HIRA publishes ratings for each category, based on the results of their evaluation. The ratings for each indicator are presented on a 5-point scale.

All used data was accessed from and is available at:

https://www.data.go.kr/dataset/3048126/fileData.do

3.15 Other Countries

KPI and Patient Satisfaction data was not available for a few countries. These countries are:

- o   Japan
- o   India
- o   Thailand
- o   Denmark
- o   Finland
- o   Singapore
- o   Spain

For these countries, the national score is based solely on national and international recommendations as well as Google-Scores, albeit with a lower weight than preferable Patient Satisfaction data sources (7.5%). The length of these lists is relatively short compared to the total amount of hospitals in these countries to reflect the fact that less data was available than for the other countries.

4   Disclaimer

The rankings are comprised exclusively of hospitals that are eligible regarding the scope described in this document. A mention in the ranking is a positive recognition based on peer recommendations and publicly available data sources. The ranking was created through an elaborate process, however, the information provided in this ranking should be considered in conjunction with other available information about hospitals or, if possible, accompanied by a visit to a facility. The quality of hospitals that are not included in the rankings is not disputed.

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