

How to assess the quality of care between hospitals: An example from the Berlin Myocardial Infarction Registry (BHIR)



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Purpose

The ranking of hospitals according to their quality of care with respect to process or outcome parameters is one of several approaches to improve hospital performance. The statistics behind these rankings are frequently rather simple when crude arithmetic means or simple one-way analyses of variance are applied. These simple approaches do not take into account the hierarchical nature of the data and the different challenges the hospitals have to face for differences in patient mix and environment. Our study was aimed at showing that it is possible to compare the quality of care between departments of cardiology on a statistically sound basis with adjustment for differences in patients' characteristics.

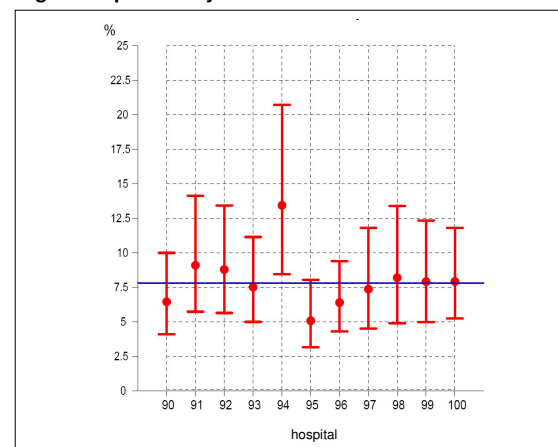
Results

Fig. 1: Baseline Data of hospital populations

	All patients		Differences between hospitals	
	Mean	Range	η^2	p
Age (In years)	67.0 ±13.4	[63.6; 75.3]	6.9%	<0.001
Female sex	35.5%	[26.5%; 51.9%]	3.0%	<0.001
BMI > 30	17.2%	[8.6%; 25.0%]	1.7%	0.001
BMI < 20	3.8%	[1.7%; 10.4%]	1.6%	0.002
Smoker	40.2%	[32.4%; 51.0%]	1.5%	0.003
Diabetes Mellitus	28.4%	[19.2%; 44.3%]	2.1%	<0.001
Arterial Hypertension	72.8%	[50.0%; 92.5%]	5.5%	<0.001
Hypercholesterolemia	44.5%	[27.5%; 85.8%]	7.5%	<0.001
Previous infarction	19.6%	[12.7%; 26.7%]	0.6%	0.433
Previous ACVB	7.2%	[4.7%; 10.0%]	0.2%	0.950
Previous PTCA	14.3%	[7.4%; 18.8%]	0.7%	0.250
Renal failure	14.1%	[3.3%; 44.3%]	7.2%	<0.001
STEMI	54.5%	[23.5%; 70.6%]	6.1%	<0.001
LBBI	5.2%	[1.6%; 13.2%]	1.8%	<0.001
CHF	14.2%	[1.9%; 48.1%]	10.7%	<0.001
Ejection fraction < 55%	49.1%	[17.6%; 60.6%]	4.7%	<0.001
Ejection fraction < 35%	11.9%	[4.4%; 20.0%]	1.3%	0.008
Reanimation, Defibrillation or IABP	6.8%	[0.9%; 12.2%]	2.5%	<0.001

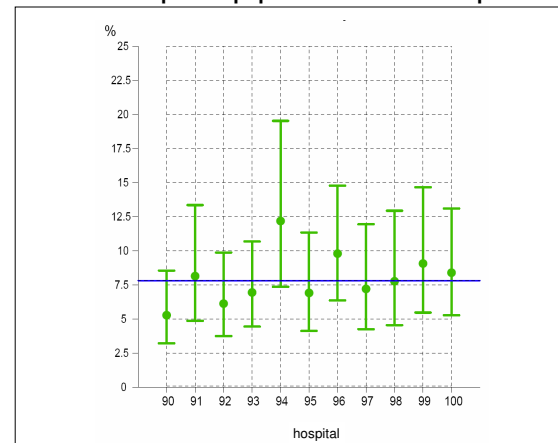
Hospital populations revealed large significant differences in many respects .

Fig. 3: Empirical Bayes-Estimates of mortalities



After Bayesian shrinkage only one hospital remained with a hospital mortality significantly above average.

Fig. 4: Empirical Bayes-Estimates of mortalities adjusted for differences in patient populations between hospitals

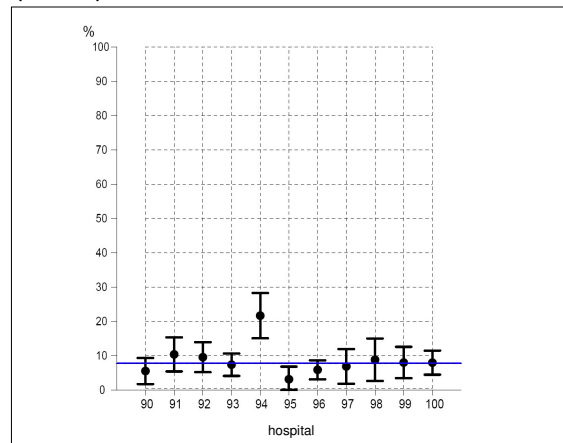


After adjustment for the differences in patients' characteristics, the range was reduced to 5.3%–12.2%. The order of the hospitals was considerably shuffled as compared to the order of the crude means.

Methods

The BHIR is an ongoing prospective acute myocardial infarction registry including all Troponine positive ACS Patients who reach one of the participating hospitals within 48 hours after symptom onset. The analysis is on 1767 patients included in 11 Berlin hospitals in 2004 or 2005. Hospital mortalities were compared by fitting a two-level random effects model with patient characteristics as covariates to the data. The resulting mortalities are Empirical Bayes (EB) estimates adjusted for differences in patient populations between hospitals. This method was chosen to establish fair comparisons and to account for the extra variability caused by random effects.

Fig. 2: Crude hospital mortalities with confidence intervals (ANOVA)



Crude hospital mortalities also differed considerably between departments (3.1%–21.7%).

Conclusion: The analysis demonstrates that the naïve comparison of hospitals by crude means (here: mortalities) may be unfair and misleading. A statistical analysis that takes population differences and random effects into account may result in different conclusions. Two-years of data collection may not be enough to demonstrate relevant differences between average-size German city hospitals. We suggest a minimum of three years of data collection for mortality comparisons.

Participating hospitals 3rd phase of BHIR since 1.1.2007

- Caritas-Klinik Pankow
- Charité Campus Mitte
- Charité Campus Virchow
- DPK-Kliniken Westend
- Gemeinschaftskrankenhaus Havelhöhe
- Helios Klinikum Buch
- Jüdisches Krankenhaus
- Königin Elisabeth Herzberge
- Krankenhaus Lichtenberg
- Martin-Luther-Krankenhaus
- St. Gertrauden-Krankenhaus
- Vivantes Kliniken:
 - Auguste-Viktoria Klinikum
 - Humboldt-Klinikum
 - Klinikum am Urban
 - Klinikum Hellersdorf
 - Klinikum im Friedrichshain
 - Klinikum Neukölln
 - Klinikum Prenzlauer Berg
 - Klinikum Spandau
 - Wenckebach Klinikum
- Unfallkrankenhaus Berlin

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- Helios Klinikum Berlin-Buch
- Jüdisches Krankenhaus Berlin
- Lilly Deutschland GmbH
- Märta Heilmischung Caritas-Klinik Pankow
- Medizinische Klinik II der DPK Kliniken Berlin/Westend
- MSD SHARP & DOHME GmbH
- Sana Kliniken Brandenburg GmbH, Sana Klinikum Lichtenberg
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