



EUROPEAN HEALTH CARE OUTCOMES,  
PERFORMANCE AND EFFICIENCY

# Comparing use of resources between districts and countries

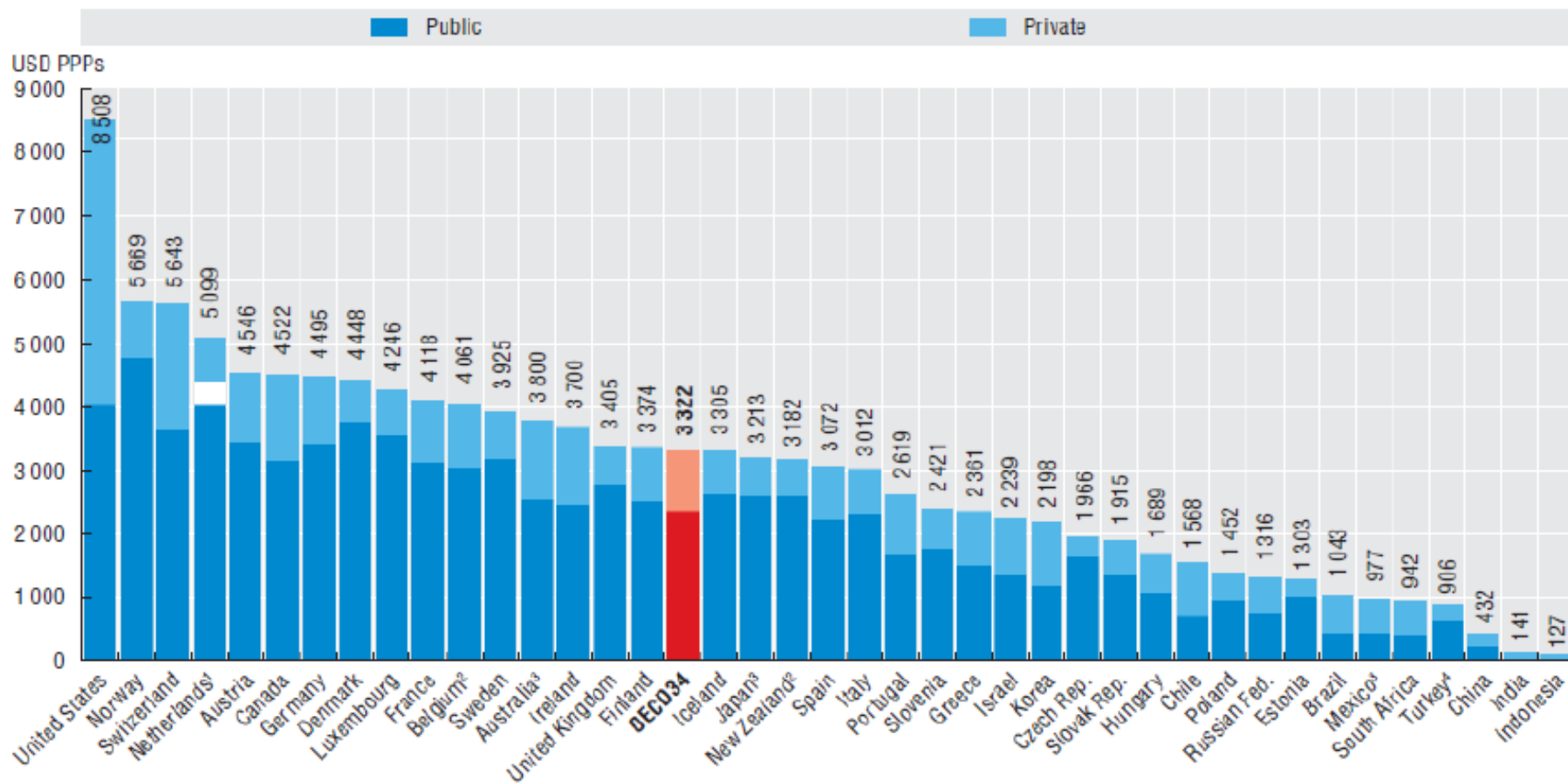
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EUROHOPE

- International comparisons show huge variation in resources allocated to health care across countries

# Health expenditure per capita varies widely across OECD countries. The United States spends two-and-a-half times the OECD average

Health expenditure per capita, 2011 (or nearest year)

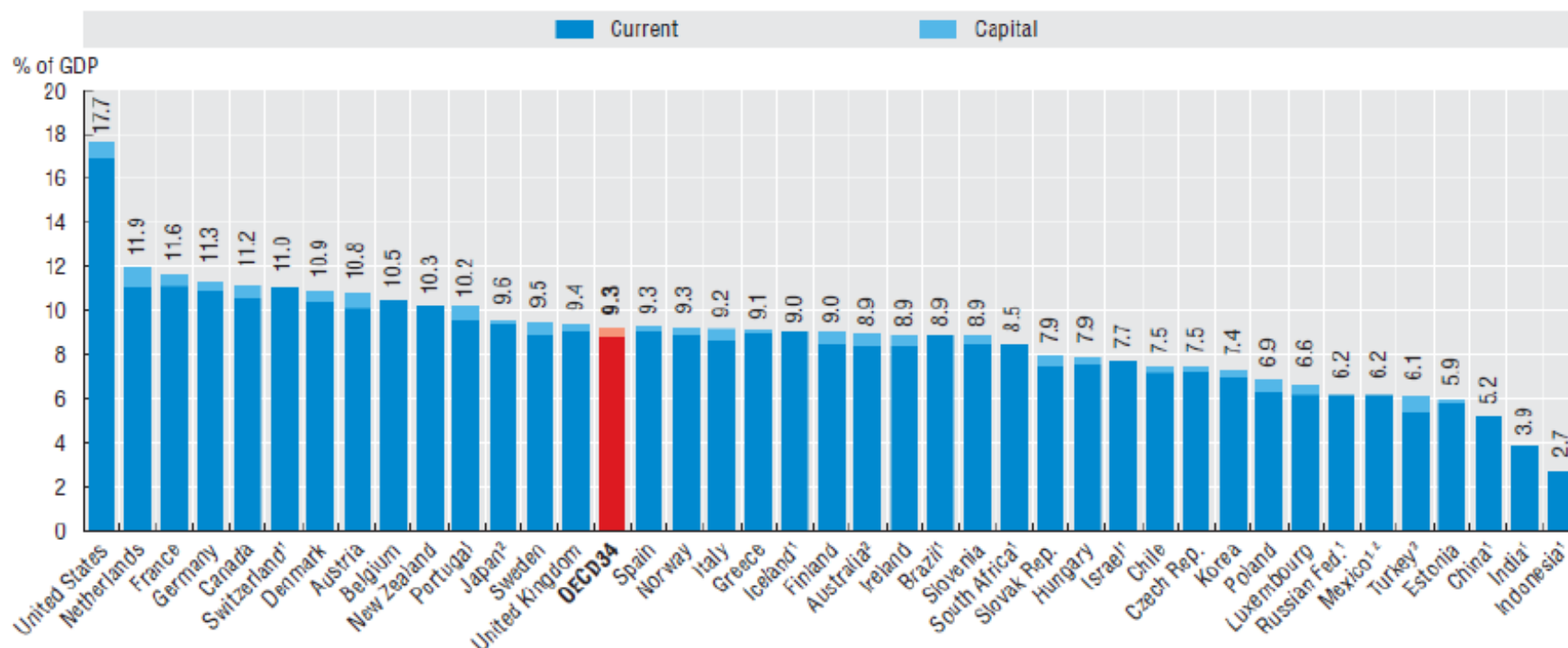


1. In the Netherlands, it is not possible to clearly distinguish the public and private share related to investments.
2. Current health expenditure.
3. Data refer to 2010.
4. Data refer to 2008.

**Source:** OECD Health Statistics 2013, OECD (<http://www.oecd.org/health/healthdata>)

# OECD countries allocated 9.3% of their GDP to health in 2011, ranging from over 17% in the United States to around 6% in Estonia, Mexico and Turkey

Health expenditure as a share of GDP, 2011 (or nearest year)



1. Total expenditure only.
2. Data refer to 2010.
3. Data refer to 2008.

Source: OECD Health Statistics 2013, OECD (<http://www.oecd.org/health/healthdata>)

Many possible reasons for the variation in resource use are suggested:

- Differences in occurrence of disease
- Similar diseases are given different treatments in different countries
- The boundary of the health care sector is different across countries
- Efficiency in terms of required resources to produce specified services varies between countries
- Differences in the general cost level and wage level that may not be appropriately accounted for

Important to go beyond macro figures to know if the level of use of resources is a problem that should be addressed

## Across country comparison with micro-data at the patient level

Three major challenges:

- the development of methods for calculating resource use;
- modelling the distribution of the estimated risk-adjusted cost function;
- finding a method for ranking of outcome and cost in order to determine differences between countries (regions).

Main objective: adapt methodology that makes ranking work and explore the robustness of ranking countries

Acute Myocardial Infarction (AMI) as an example

A measure of the total cost of care at the individual patient level is not available.

Approach I:

Registration of main components of resource use (services) from discharge registers and pharmaceutical prescription data bases. The registered components are mainly related to procedures and hospital length of stay. Combined with weights from Swedish Cost per patient data.

# AMI: Items of resource use according to Approach I



A	Hospital costs - individual patient level
A1	Total number of coronary by-pass surgery (CABG)
A2	Total number (regular, stent, drug eluting stent) of percutaneous coronary intervention (PCI)
A3	Total number of admissions related to AMI (ICD 10: I20-I25 and I44-I50)
A4	Total number of admissions for other diagnoses
A5	Total number of inpatient days related to AMI (ICD 10: I20-I25 and I44-I50)
A6	Total number of inpatient days for other diagnoses
A7	Total number of outpatient consultations irrespective of diagnosis
B	Cost of medicines outside hospitals
B1	Calculate from the prescription register the total sum of medicines (irrespective of ATC code) dispensed outside hospital calculated at the pharmacy's retail price in local currency with VAT included Calculate from the prescription register the sum of medicines with an ATC related to AMI dispensed outside hospital calculated at the pharmacy's retail price in local currency with VAT included.
B2	
C	Assigning Hospital Costs Unit cost is based on data from the Swedish cost-per-patient (CPP) data base provided by Swedish Association of Local Authorities and Regions (SALAR).
C1	Hospital cost components from the Swedish CPP data base (outliers are excluded) are calculated for procedures (CABG and PCI), basic ward cost per day for AMI patients, mean cost per day for all inpatient stays and for outpatient visits.
D	Adjust for cost level in Sweden using Eurostat PPP: for GDP are used for pharmaceuticals and PPP for hospital services (input-based) for procedures and ward related cost.



## Approach II:

- Each country contributes with their best cost estimate given their own system of cost calculations. In the majority of countries, cost estimates generated by variants of the DRG system are used and costs of medicines based on data from the prescription register are added

## Approach III:

- Finland, Norway and Sweden
- Approach III uses the common Nordic DRG grouper. When patient-level discharge data from each country is fed into the grouper, the assignment of DRG groups is similar in each country.

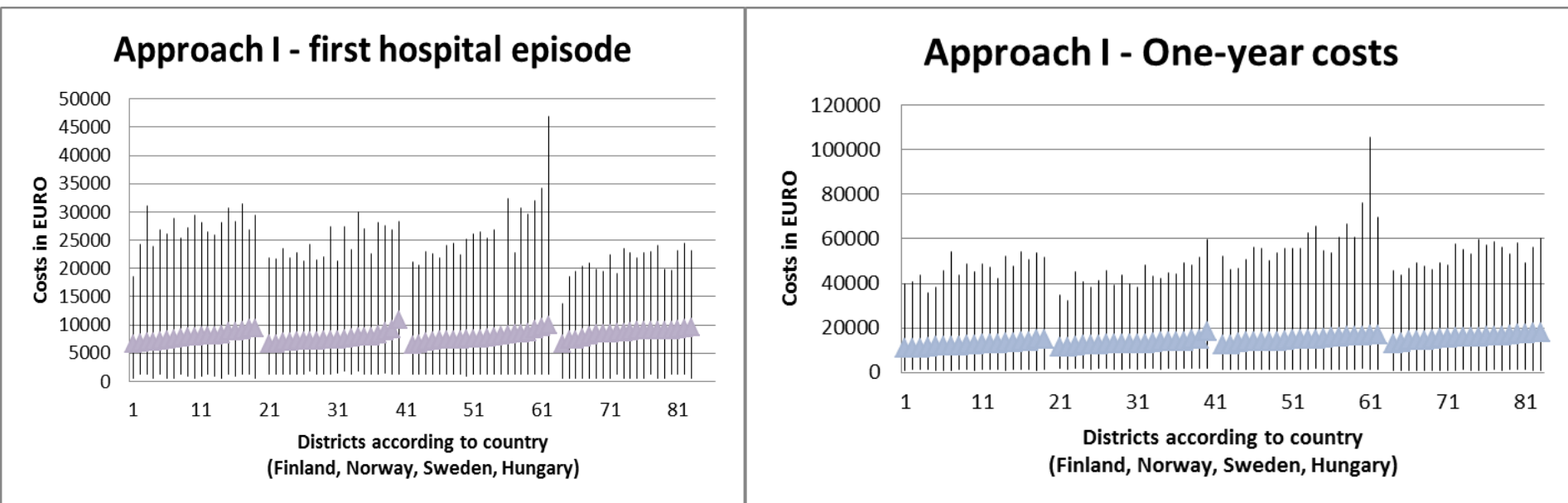
**Table 1: Descriptive statistics of treatment costs using Approach I according to treatment period, country and health status. Finland and Norway (2009), Hungary and Sweden (2008) in EURO**

<i>Approach I</i>	<i>Status</i>	<i>Country</i>	<i>#obs</i>	<i>Mean</i>	<i>Median</i>	<i>St.dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>	<i>Kurtosis</i>
<b>First hospital episode</b>	Total	Finland	8345	8243	6805	7871	905	257434	6.67	139.7
		Hungary	14130	8522	8071	5516	633	108901	3.10	29.2
		Norway	10719	7441	6805	5368	633	41309	2.17	9.3
		Sweden	22954	8066	6805	7988	633	187045	5.42	61.0
<b>One year cost</b>	Total	Finland	8016	11843	8254	11302	1266	259245	3.95	44.0
		Hungary	14130	15812	11780	14114	633	221132	2.74	17.6
		Norway	10719	13002	9406	11743	633	140906	3.07	19.2
		Sweden	22954	14971	9337	16159	633	295757	3.47	24.4

**Table 2: Descriptive statistics of treatment costs using Approach II according to treatment period, country and health status. Finland and Norway (2009), Hungary and Sweden (2008) in EURO**

<i>Approach II</i>	<i>Status</i>	<i>Country</i>	<i>#obs</i>	<i>Mean</i>	<i>Median</i>	<i>St.dev</i>	<i>Min</i>	<i>Max</i>
<b>First hospital episode</b>	Total	Finland	8345	9683	6466	11588	477	251509
		Hungary	14130	9092	9606	5838	995	58366
		Norway	10719	7272	5656	6525	856	103392
		Sweden	22940	9937	6378	13725	432	329476
<b>One year cost</b>	Total	Finland	8016	13917	9528	14534	1214	221154
		Hungary	14130	12756	12908	8620	995	86129
		Norway	10719	16886	11778	16186	856	248028
		Sweden	22946	17694	9347	23175	432	585043

**Figure 1: Treatment costs using Approach I according to treatment period, country and health status. Numbers for 2008 and 2009 in EURO**



# Cost adjusted for disease severity

Challenging to estimate health care costs by means of econometric

- Data have heavy right-hand tails.
- Data are right-skewed.

In EuroHOPE we are mainly interested in mean costs accrued in hospitals and their differences between countries.

We select a model based on various goodness-of-fit measures.  
Based on the preferred model, we study differences in costs between regions and countries.

- We estimate mean cost adjusted for disease severity according to regions
- Testing differences in mean regional cost across countries



# Table 5 Differences in predicted cost across countries tested with Wilcoxon rank sum test

	First hospital episode				One year cost		
		FIN	HUN	NOR	FIN	HUN	NOR
A I	FIN						
	HUN	HUN>FIN			HUN>FIN		
	NOR	FIN>NOR	HUN>NOR		NOR>FIN <sup>?</sup>	HUN>NOR	
	SWE	FIN>SWE <sup>?</sup>	HUN>SWE	SWE>NOR	SWE>FIN	HUN>SWE	SWE>NO
A II	FIN						
	HUN	FIN>HUN			FIN>HUN		
	NOR	FIN>NOR	HUN>NOR		NOR>FIN	NOR>HUN	
	SWE	SWE>FIN	SWE>HUN	SWE>NOR	SWE>FIN	SWE>HUN	SWE>NOR
Nordic grouper	FIN						
	HUN						
	NOR	FIN>NOR			FIN>NOR		
	SWE	SWE>FIN		SWE>NOR	SWE>FIN		SWE>NOR

\*Differences are statistically significant at the five percent level with a two-sided test

## Conclusions

- First, the hospital discharge registers do not contain sufficient information on treatment procedure to calculate cost estimators for all diseases. AMI and hip fracture have the best procedure information.
- Second, registered indicators of disease severity are able to explain only small proportion (5-10) percent of the variation in the calculated cost across patients.
- Third, the ranking of countries depend on the cost indicator used.
- Fourth, the ranking of countries depend on the length of the time-period taken into account.
- And finally, the ranking of countries does neither depend on risk-adjusters included nor the specification of the cost function.

This means that the ranking of countries according to crude cost gives the same result as ranking of countries according to the estimated expected cost adjusted for variation in disease severity.



## Future research

- Include more complete data on resource use
- Improved econometric techniques
- Explore further to what extent results depend on type of disease.
- Although this research has revealed variation in treatment cost between regions and countries, the reasons for this variation less known.

**Table 1: Descriptive statistics of treatment costs using Approach I according to treatment period, country and health status. Finland and Norway (2009), Hungary and Sweden (2008) in EURO**

<i>Approach I</i>	<i>Status</i>	<i>Country</i>	<i>#obs</i>	<i>Mean</i>	<i>Median</i>	<i>St.dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>	<i>Kurtosis</i>
<b>First hospital episode</b>	Alive	Finland	7463	8505	6963	7834	905	257435	6.98	154.0
		Hungary	11734	9118	8229	4973	633	108901	3.36	32.5
		Norway	9985	7613	6805	5335	633	41310	2.20	9.5
		Sweden	20697	8334	6805	7943	633	187045	5.60	64.9
	Dead	Finland	882	6029	3798	7832	905	91747	4.91	40.9
		Hungary	2396	5601	3165	6933	633	101647	3.82	30.2
		Norway	734	5096	3165	5265	1266	35860	2.46	10.2
		Sweden	2257	5613	3165	7983	633	102097	4.69	36.3
	Total	Finland	8345	8243	6805	7871	905	257434	6.67	139.7
		Hungary	14130	8522	8071	5516	633	108901	3.10	29.2
		Norway	10719	7441	6805	5368	633	41309	2.17	9.3
		Sweden	22954	8066	6805	7988	633	187045	5.42	61.0

**Table 1: Descriptive statistics of treatment costs using Approach II according to treatment period, country and health status. Finland and Norway (2009), Hungary and Sweden (2008) in EURO**

<i>Approach II</i>	<i>Status</i>	<i>Country</i>	<i>#obs</i>	<i>Mean</i>	<i>Median</i>	<i>St.dev</i>	<i>Min</i>	<i>Max</i>
<b>First hospital episode</b>	Alive	Finland	7463	10028	6698	11766	477	251509
		Hungary	11734	9592	12908	5281	995	49079
		Norway	9985	7375	5757	6476	856	103392
		Sweden	20688	10113	6403	13488	432	306470
	Dead	Finland	882	6764	3626	9476	566	83165
		Hungary	2396	6643	2962	6830	1459	58366
		Norway	734	5877	3857	7019	856	69568
		Sweden	2252	8324	4467	15643	432	329476
Total	Finland	8345	9683	6466	11588	477	251509	
	Hungary	14130	9092	9606	5838	995	58366	
	Norway	10719	7272	5656	6525	856	103392	
	Sweden	22940	9937	6378	13725	432	329476	

<i>Approach I</i>	<i>Status</i>	<i>Country</i>	<i>#obs</i>	<i>Mean</i>	<i>Median</i>	<i>St.dev</i>	<i>Min</i>	<i>Max</i>	<i>Skewness</i>	<i>Kurtosis</i>
<b>One year cost</b>	Alive	Finland	6168	12358	8704	11079	1266	259245	4.32	54.8
		Hungary	10238	17065	13134	13734	633	221132	3.15	22.2
		Norway	8726	13150	9590	11101	1266	140906	3.16	21.0
		Sweden	17858	14920	9337	15360	633	295957	3.84	30.4
	Dead	Finland	1848	10126	5969	11858	1266	124397	3.12	18.0
		Hungary	3892	12517	7438	14565	633	102609	2.20	9.2
		Norway	1993	12351	7596	14201	633	131430	2.77	14.3
		Sweden	5096	15149	8229	18691	633	205864	2.63	12.9
	Total	Finland	8016	11843	8254	11302	1266	259245	3.95	44.0
		Hungary	14130	15812	11780	14114	633	221132	2.74	17.6
		Norway	10719	13002	9406	11743	633	140906	3.07	19.2
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