

# **Nurse Staffing and patient safety**

## **The case of RN4CAST**

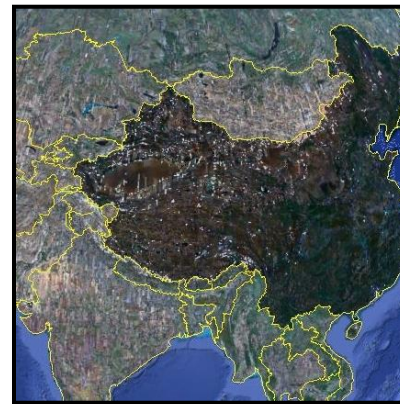
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**Catholic University Leuven**

# 7th Framework Programme for Research and Technological Development

RN4CAST: 'nurse forecasting in Europe': €3 million funding for 2009-2011

- Health theme 3: Optimising the delivery of health care
- 16 partners: 12 European countries, USA, China, South-Africa, Botswana

Co-ordination: Leuven University (W. Sermeus), U. Pennsylvania (L. Aiken)



# Design & data

- Multicountry, multilevel, cross-sectional design to obtain important unmeasured factors in forecasting models, collected at the hospital, nursing unit, and individual nurse and patient level:
  - Nurse survey: working environment, quality & safety, staffing
  - Patient survey: patient experiences with nursing staff, hospital, information
  - Hospital survey: : type of hospital, inflow & outflow
  - Hospital Discharge data: ICD9/10, length-of-stay, adverse events, mortality
- Setting
  - At least 30 general acute hospitals in each European country.
  - At least 2 general surgical and internal medicine wards in each hospital.

# RN4CAST-data

## EUROPE (2009-2010) - 12 COUNTRIES

Belgium, Finland, Germany, Greece, Ireland, Netherlands, Poland, Sweden, Norway, Spain, Switzerland, UK



486 hospitals  
33541 nurses  
  
11318 patients  
210 hospitals  
HDD: 8,8 million

## USA (2006-2008) - 4 STATES

Pennsylvania, California, New Jersey, Florida



617 hospitals  
27509 nurses  
  
Millions of patients  
In 430 hospitals

## CHINA (2008-2010) – 9 SITES

6 provinces, 2 municipalities,  
1 autonomous region



181 hospitals  
9698 nurses  
  
6494 patients  
In 181 hospitals

## SOUTH-AFRICA (2009-2010)

6 provinces



62 hospitals  
4657 nurses

# Results


BMJ

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## RESEARCH

### Patient safety, satisfaction, and quality of hospital care: cross sectional surveys of nurses and patients in 12 countries in Europe and the United States

 OPEN ACCESS

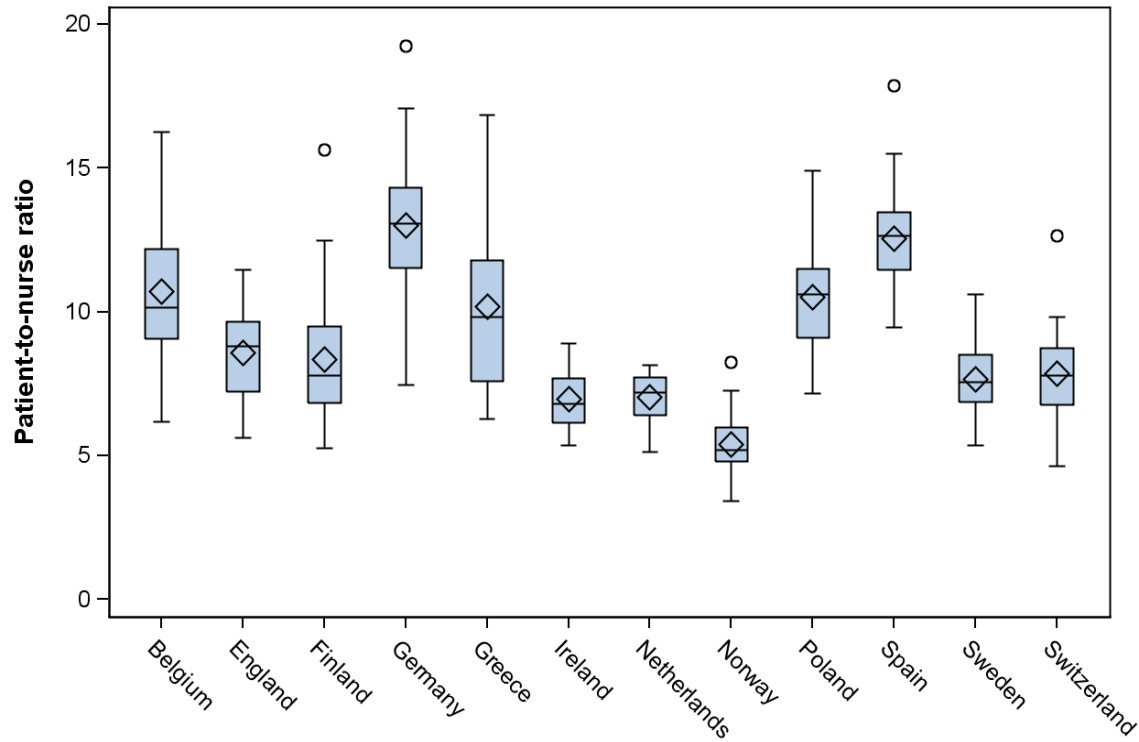
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Aiken L, Sermeus W. et al.,  
BMJ, 2012

# Nurse to Patient Ratios (3 shifts)

Patient-to-nurse ratio for RN4CAST countries: within-country variation at hospital level



Country	Mean	25th Pctl	50th Pctl	75th Pctl
Belgium	10.7	9.1	10.1	12.2
England	8.6	7.2	8.8	9.6
Finland	8.3	6.8	7.8	9.5
Germany	13.0	11.5	13.1	14.3
Greece	10.2	7.6	9.8	11.8
Ireland	6.9	6.2	6.8	7.7
Netherlands	7.0	6.4	7.2	7.7
Norway	5.4	4.8	5.2	6.0
Poland	10.5	9.1	10.6	11.5
Spain	12.5	11.5	12.6	13.5
Sweden	7.7	6.9	7.5	8.5
Switzerland	7.9	6.8	7.8	8.7

# Practice environment: hospitals

- **Practice Environment Scale/Nursing Work Index**
  - Staffing adequacy
  - Nursing foundations for quality
  - Nurse manager ability & leadership
  - Nurse-physician relations
  - Nurse involvement in hospital affairs
- **Summary measure divides hospitals into quartiles by PES scores**

	Poor		Mixed		Better	
	pct	n	pct	n	pct	n
<b>Belgium</b>	31%	21	60%	40	9%	6
<b>Switzerland</b>	3%	1	26%	9	71%	25
<b>Germany</b>	14%	7	53%	26	33%	16
<b>Spain</b>	64%	21	30%	10	6%	2
<b>Finland</b>	16%	5	56%	18	28%	9
<b>Greece</b>	67%	16	33%	8	0	0
<b>Ireland</b>	33%	10	33%	10	33%	10
<b>Netherlands</b>	4%	1	77%	20	19%	5
<b>Norway</b>	9%	3	69%	24	23%	8
<b>Poland</b>	67%	20	27%	8	7%	2
<b>Sweden</b>	20%	16	62%	49	18%	14
<b>England</b>	2%	1	46%	21	52%	24
<b>Total</b>	25%	122	50	243	24.9	121



# Nurse Assessments' of hospitals (percents)

**Table 4| Nurse outcomes in 12 European countries and the US. Data are number of nurses reporting outcome/total number of nurses surveyed, and percentage**

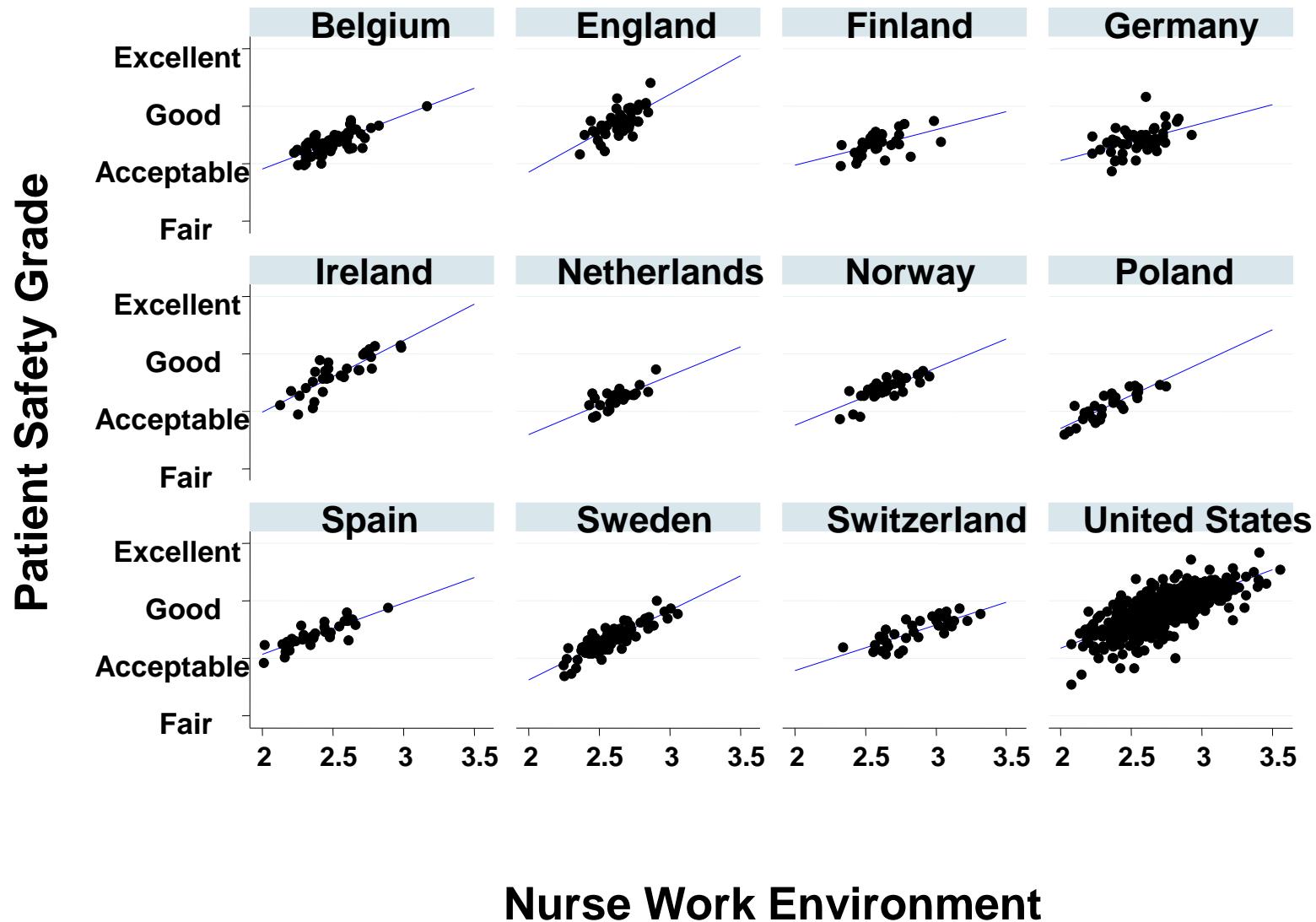
Country	Reported ward to have poor or fair quality of care		Gave ward poor or failing safety grade		Regarded themselves to be burnt out		Dissatisfied with job		Intended to leave their job in the next year		Not confident that patients can manage own care after hospital discharge		Not confident that hospital management would resolve patients' problems	
Belgium	886/3167	28	199/3150	6	730/2938	25	680/3159	22	934/3164	30	1921/3153	61	2518/3134	80
England	540/2899	19	191/2895	7	1138/2699	42	1136/2904	39	1261/2896	44	981/2901	34	1856/2893	64
Finland	141/1099	13	76/1095	7	232/1047	22	300/1114	27	546/1111	49	441/1098	40	890/1094	81
Germany	526/1507	35	94/1506	6	431/1430	30	561/1505	37	539/1498	36	473/1505	31	879/1504	58
Greece	170/361	47	61/358	17	246/315	78	199/358	56	177/358	49	231/358	65	311/356	87
Ireland	152/1389	11	117/1385	8	536/1293	41	581/1383	42	612/1380	44	588/1385	42	872/1381	63
Netherlands	756/2185	35	123/2187	6	211/2061	10	240/2188	11	418/2197	19	889/2195	41	1781/2200	81
Norway	468/3732	13	199/3712	5	823/3501	24	773/3729	21	942/3712	25	2097/3710	57	2739/3698	74
Poland	683/2581	26	463/2579	18	929/2321	40	663/2584	26	1056/2387	44	1890/2571	74	2196/2571	85
Spain	897/2794	32	173/2784	6	787/2670	29	1053/2786	38	740/2774	27	1554/2779	56	2370/2767	86
Sweden	2750/10051	27	1117/10035	11	2788/9477	29	2251/10027	22	3418/10013	34	2833/9995	28	7308/9988	73
Switzerland	324/1604	20	71/1606	4	228/1563	15	338/1610	21	447/1623	28	564/1612	35	1216/1612	75
US	4196/26316	16	1628/26772	6	9122/27163	34	6692/26935	25	3767/27232	14	11449/25110	46	15240/26717	57



# Patients' Assessments of Hospitals

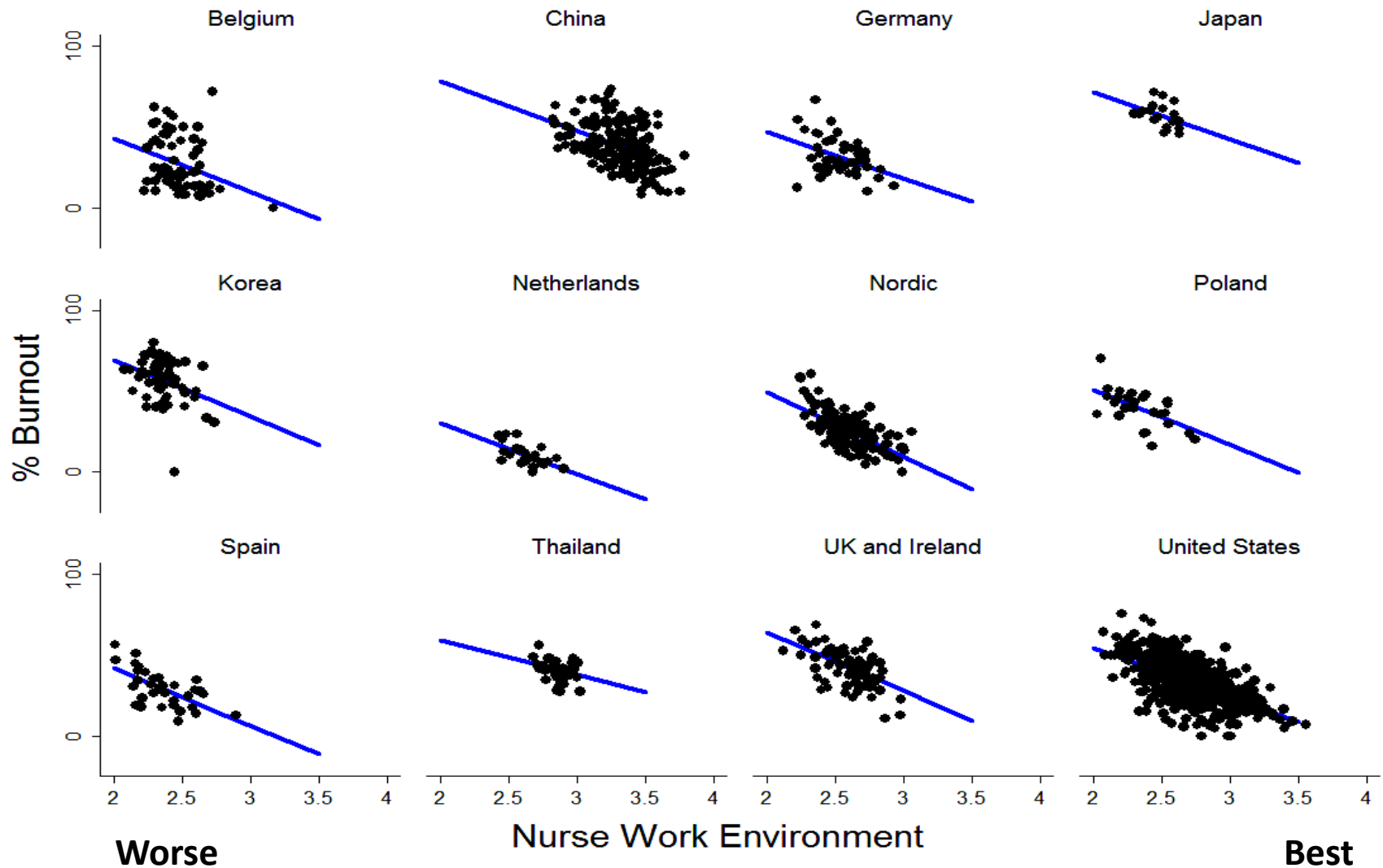
	Rate hospital 9 or 10 (%)	Recommend Hospital (%)
<b>Belgium</b>	<b>47</b>	<b>60</b>
<b>Switzerland</b>	<b>60</b>	<b>78</b>
<b>Germany</b>	<b>48</b>	<b>66</b>
<b>Spain</b>	<b>35</b>	<b>56</b>
<b>Finland</b>	<b>61</b>	<b>67</b>
<b>Greece</b>	<b>42</b>	<b>53</b>
<b>Ireland</b>	<b>61</b>	<b>74</b>
<b>Poland</b>	<b>55</b>	<b>57</b>
<b>United States</b>	<b>59</b>	<b>64</b>

# Hospital Safety Grade is Higher in Hospitals with Better Work Environments

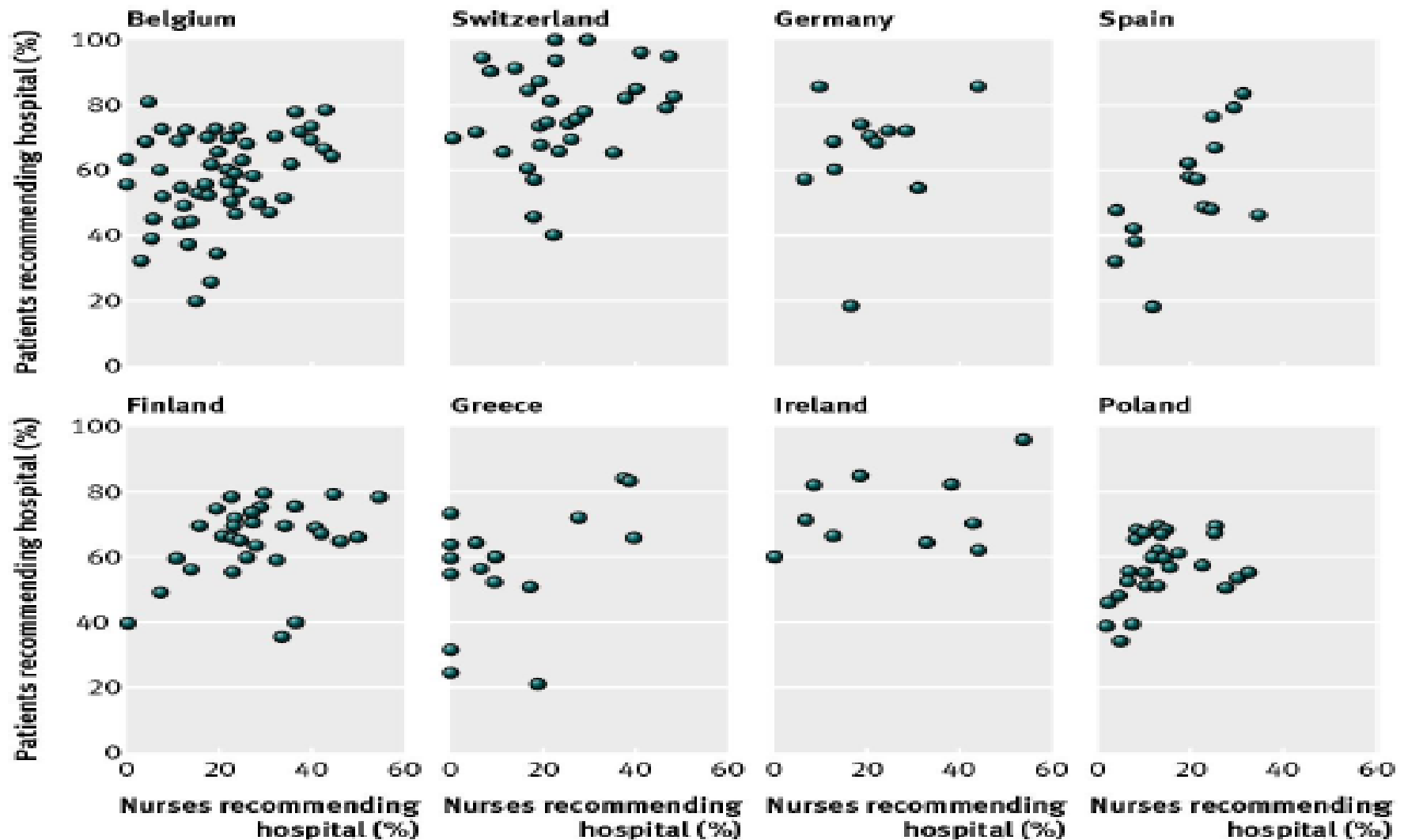


Nurse Work Environment

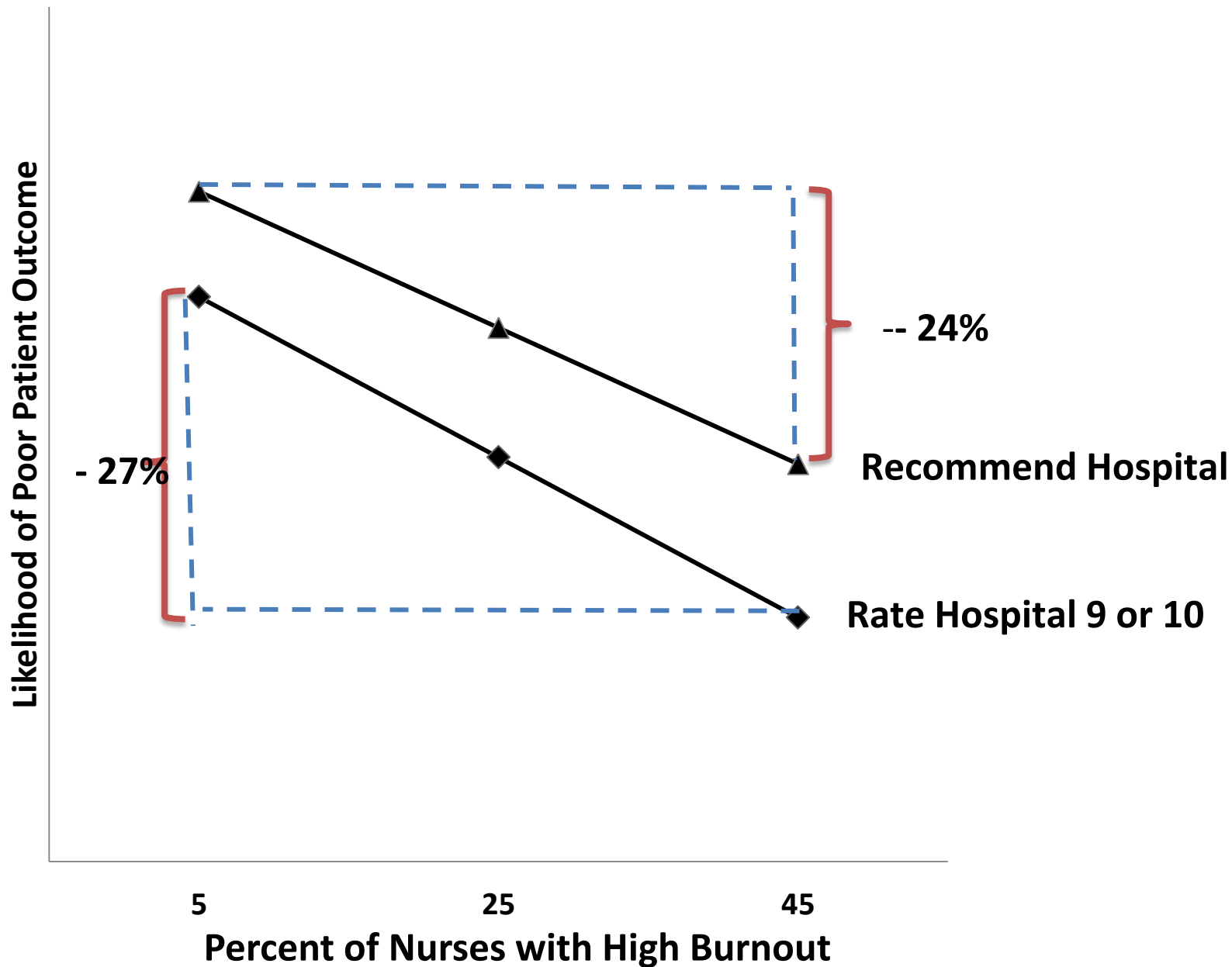
# Hospitals with Better Work Environments: Lower Nurse Burnout Every Country



# Nurses and Patients Agree Which Hospitals Are Good



Percentages of patients and nurses recommending their hospital



# **Quality of Work Environments Mediate Effect of Staffing on Mortality**

- **Impact of better staffing much greater in hospitals with best work environments**
- **Decrease in nurse workload of 1 patient per nurse lowers mortality by**
  - **9% in best work environment hospitals**
  - **4% in mixed work environments**
  - **No effect in hospitals with poor environments**



# **Effect of Nurse Staffing on Hospital Mortality in Europe**

- **Methods:**
  - **Patient selection: 422,730 vascular, orthopedic and general surgery patients, aged 50-85, from the 300 hospitals in 9 European countries**
  - **Explanatory variables: nurse staffing per hospital, qualification level (% BSN), work environment**
  - **Effect variable: inpatient deaths - 1.3% mortality rate**
  - **Risk adjustment: age, sex, ER admission indicator, surgery type, Charlson comorbidity index**
  - **Mixed-level models (GEE) analysis**

(Aiken et al. 2012, intermediate results)

# **Effect of Nurse Staffing on Hospital Mortality in Europe**

- **Results:**
  - every additional patient per nurse produces a 7% increase in the odds on patients dying
  - Every 10% increase in BSN nurses produces a 7% decrease in the odds on patients dying
  - Interaction effect:
    - In poorer environments, no effect of education;
    - in better environments, an 10% increase in BSNs implies a 14% decrease in the odds on dying.

# Conclusions

- **Room for improvement in most European countries and hospitals**
- **Large variability across hospitals and health systems**
- **Perceptions of nurses and patients about hospitals are related**
- **High consistent relationship between working environment and indicators of job satisfaction (burn-out, intention-to-leave)**
- **Significant impact of nurse staffing on patient outcomes (mortality) in 9 European countries**
- **First working environment, then nurse staffing**