

WENNBERG INTERNATIONAL COLLABORATIVE
SPRING POLICY MEETING 2018

Variation of Deep Vein Thrombosis
and Pulmonary Embolism
following orthopedic surgery
in Emilia-Romagna and Tuscany
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Quality and Safety Indicators

Quality and safety are **key elements** in establishing and delivering accessible, effective and responsive care.

The Institute of Medicine considers patient safety “indistinguishable from the delivery of quality health care”.

However, though health care providers continue to work toward a delivery system focused on high-quality care, **adverse events** (unwanted outcomes caused by medical care, whose risk can be reduced, but not necessarily eliminated) **remain a significant cause of morbidity and mortality**.

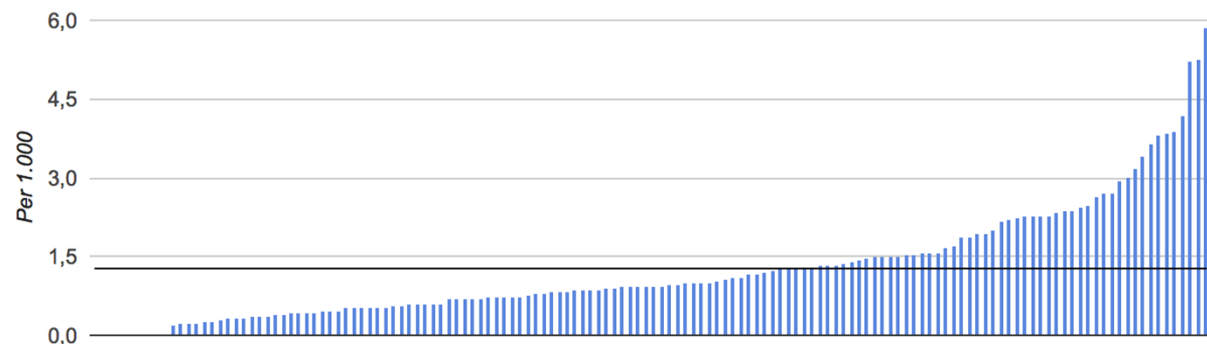
As results, in the last years, researchers, policymakers, and providers have intensified their efforts to support patient safety practice adoption, that is those practices “that **reduce the risk of adverse events** related to exposure to medical care across a range of diagnoses or conditions”.

Shojania, Duncan, McDonald, et al. Making health care safer. 2001

AHRQ PSI 12

Deep Vein Thrombosis (DVT) & Pulmonary Embolism (PE)

- The Agency for Healthcare Research and Quality (AHRQ) defined a set of **Patient Safety Indicators** (PSIs) based on standardized algorithms that use **inpatient administrative data** to identify potential complications or adverse events.
- AHRQ's PSI 12 aims to identify **postoperative DVT/PE** events for surgical procedures occurred **during the index hospitalization**.
- In Italy, AHRQ's PSI 12 is monitored within the Inter-Regional Performance Evaluation System adopted by 13 Italian regions.



Agency for Healthcare Research and Quality. Patient Safety Indicators, PSI. <http://www.qualityindicators.ahrq.gov/>

Nuti S, et al. (2016) Making governance work in the health care sector: evidence from a “natural experiment” in Italy. Health Economics, Policy, and Law. www.wernberg-zurchi.org 15.04.18

Deep Vein Thrombosis & Pulmonary Embolism

- Deep Vein Thrombosis and Pulmonary Embolism are **serious** and **potentially preventable surgical complications** and among the largest cause of preventable hospital death in many developed countries.
 - The risk is particularly high following **lower limb orthopedic procedures** (Tedesco, 2016).
 - DVT/PE process usually begins right after the surgical procedure, but **signs and symptoms may appear also after weeks**.
 - **Expanding the capture period** of PSI 12 may potentially identify more qualifying events (Mull, 2013; Davis, 2015) .
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- Mull HJ, Borzecki AM et al. (2013) Using AHRQ Patient Safety Indicators to Detect Postdischarge Adverse Events in the Veterans Health Administration. American J of Med Qual, vol 29(3).
 - Davies SM, Saynina O et al. (2015). Impact of Including Readmissions for Qualifying Events in the Patient Safety Indicators. American Journal of Medical Quality 30(2).
 - Falck-Ytter, Yngve et al.(2012) Prevention of VTE in Orthopedic Surgery Patients. CHEST Vol (141)
 - Tedesco D, Hernandez-Boussard T, et al. (2016) Evaluating patient safety indicators in orthopedic surgery between Italy and the USA, International Journal for Quality in Health Care

Variation of DVT/PE following orthopedic surgery in Emilia-Romagna and Tuscany

Aims of the study:

- To assess the impact on **PSI 12** of a modified version including 30-day readmissions for DVT/PE (**Augmented indicator**) after the hospitalization for **lower limb orthopedic procedures only** using administrative data from **two Italian regions** (Emilia-Romagna and Tuscany).
- To measure and analyze the **variation** of PSI 12 and the Augmented indicator **among the providers of** the 2 Italian Regions.

Data and Methods (1)

Measures: PSI 12 and Augmented PSI 12 indicator.

Data source: Hospital Discharge Records of Emilia-Romagna (56 hospitals) and Tuscany (39 hospitals).

Inclusion criteria: all patients ≥ 18 years undergone **lower limb orthopedic procedures** (ICD-9-CM procedure codes 79.25-28; 79.35-38; 79.55-56; 79.65-68; 79.85-88; 81.4*; 81.5*) between 2012-2016.

Exclusion criteria: hospitals with a procedure volume < 250 in 5 years, hospital stay < 1 day, age > 100 years.

Data and Methods (2)

Statistical analysis: Observed rates were calculated using AHRQ PSI software; Expected rates were estimated using a **GEE logistic regression model**.

Risk-adjusted rates (RAR) were calculated as:

$$\frac{\text{Observed rate}}{\text{Expected rate}} \times \text{Overall population rate}$$

Confounding variables: age, sex, comorbidities, number of comorbidities and length of stay.

Adverse events occurred within 30-day readmissions from the surgical procedure were calculated using the ICD-9-CM diagnosis codes reported in the AHRQ protocol for PSI 12. 95% CIs were computed to compare hospital-level rates to the overall rate.

Results:

Population: 130,271 discharges in Emilia-Romagna and 102,801 in Tuscany. Tuscany patients were significantly older and with a higher number of females, whereas patients from Emilia-Romagna experienced a higher number of comorbidities; ($p < 0.001$).

Crude Indicators (x 1,000)

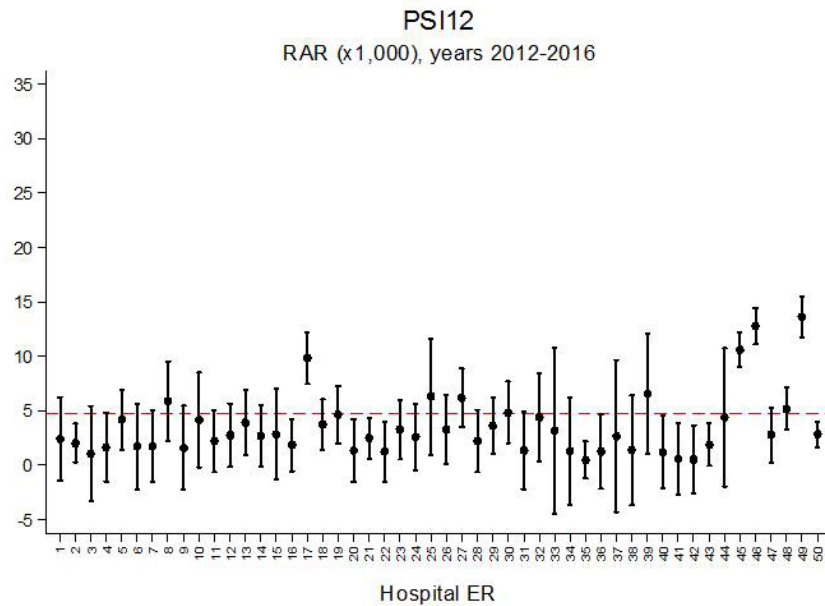
- **PSI 12:** 4.28 (95%CI 3.94–4.65) in Emilia-Romagna and 3.94 (95%CI 3.56–4.35) in Tuscany
- **Augmented PSI 12:** 6.63 (95%CI 6.21–7.09) in Emilia-Romagna and 6.36 (95%CI 5.89–6.89) in Tuscany.

Risk-adjusted indicators (x 1,000)

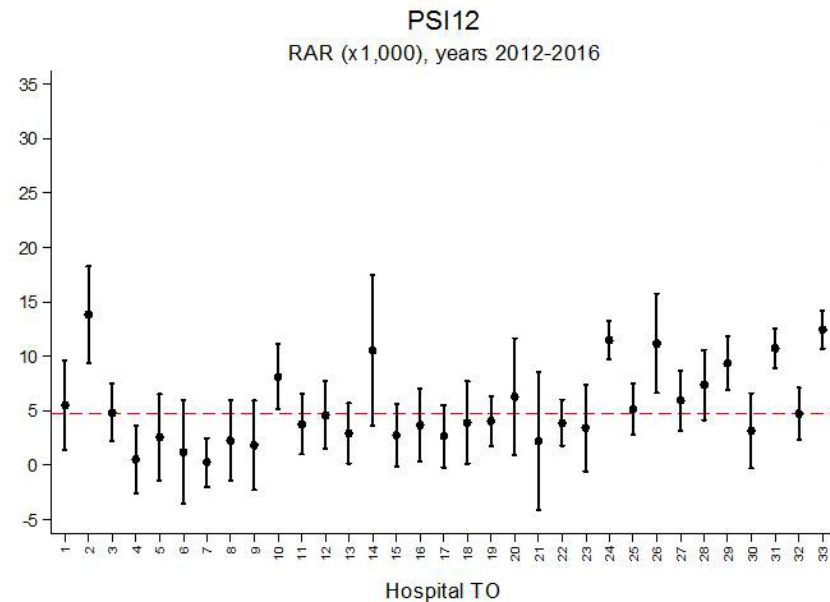
- **PSI 12:** 3.23 (95%CI 2.92–3.53) in Emilia-Romagna and 4.22 (95%CI: 3.80–4.63) in Tuscany
- **Augmented PSI 12:** 7.87 (95%CI 7.40–8.35) in Emilia-Romagna and 6.34 (95%CI 5.84–6.84) in Tuscany.

Risk-adjusted PSI 12 Intra-regional variation

Emilia-Romagna



Tuscany

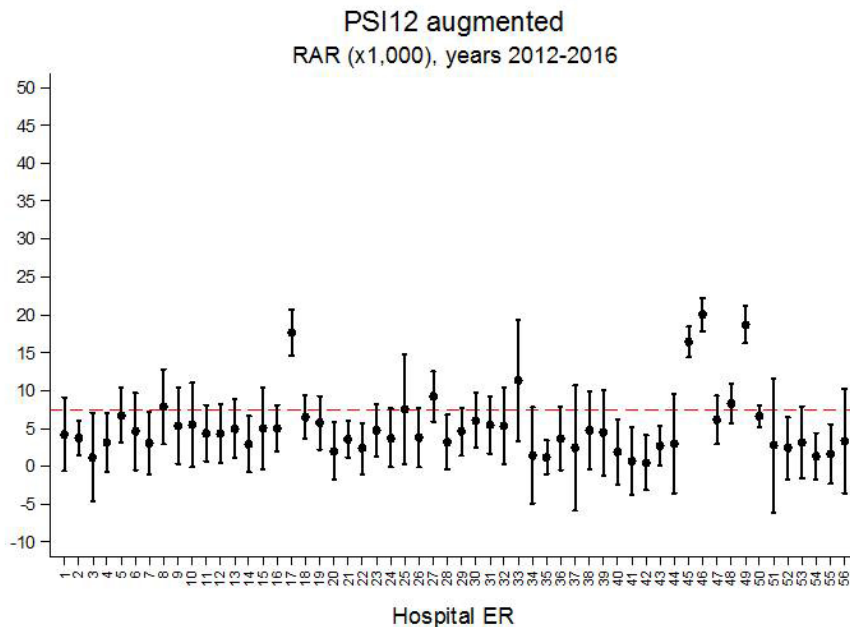


Emilia-Romagna: significantly lower in 12 hospitals and higher in 4 hospitals, **H/L ratio=28.8.**

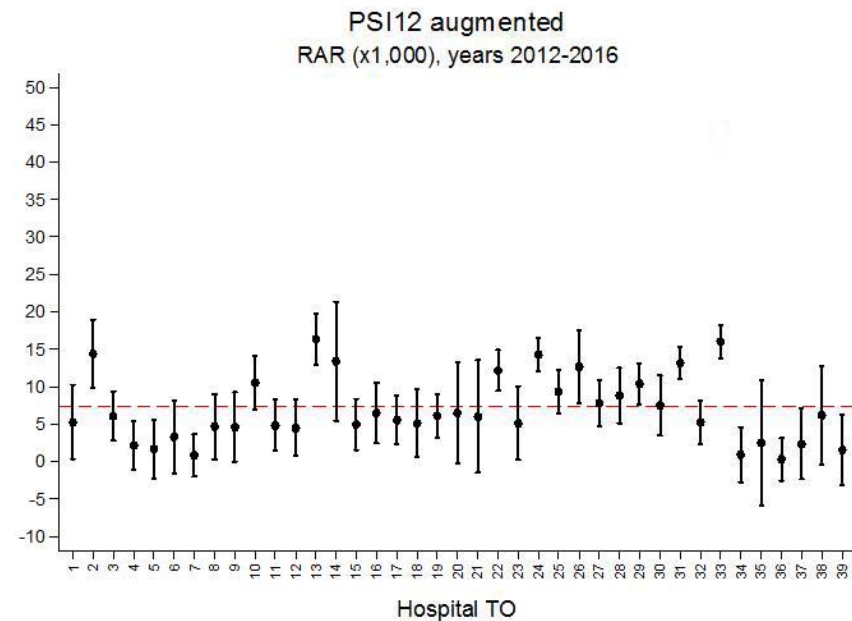
Tuscany: significantly lower in 2 hospitals and higher in 7 hospitals, **H/L=48.1.**

Risk-adjusted Augmented PSI 12 Intra-regional variation

Emilia-Romagna



Tuscany



Emilia-Romagna: 35% hospitals remained in the same relative performance decile, 16% moved more than 2 deciles. **H/L ratio=43.5**

Tuscany: 33% hospitals remained in the same relative performance decile, 12% moved more than 2 deciles. **H/L=56.4**

Discussion

Our study found that **post-discharge period is critical** to develop DVT/PE. Expanding the capture period of PSI 12 helps identifying **more qualifying events**.

A **significant variation** was found between the Regions and among the hospitals for both indicators (PSI 12/Augmented PSI 12), although the **highest variation** is documented for Augmented PSI 12.

Conclusions

An **Augmented indicator** combining PSI 12 and 30-day readmissions in patients undergoing a lower-limb surgery may become a more accurate metric.

Indeed, improving the capture of true events can help researchers to **better assess the impact of DVT/PE** and provide **more precise data** to clinicians, hospital administrators and policy makers.

Next step: identifying the **determinants of the intra- and inter- regional variation** in order to clarify the role of the potential causes including **coding quality and practice**, the different **care practices** (e.g. identification of patients at risk, different LOS, organizational factors).

