



eHEALTH  
2015  
[www.eHealth2015.at](http://www.eHealth2015.at)

**AIT**  
AUSTRIAN INSTITUTE  
OF TECHNOLOGY  
TOMORROW TODAY

# Implementation and Validation of a Conceptual Benchmarking Framework for Patient Blood Management



Kastner Peter, Breznik Nada,  
Gombotz Hans<sup>a</sup>, Hofmann Axel<sup>b</sup>, Schreier Günter

**AIT Austrian Institute of Technology GmbH**

Digital Safety & Security Department, Graz, Austria

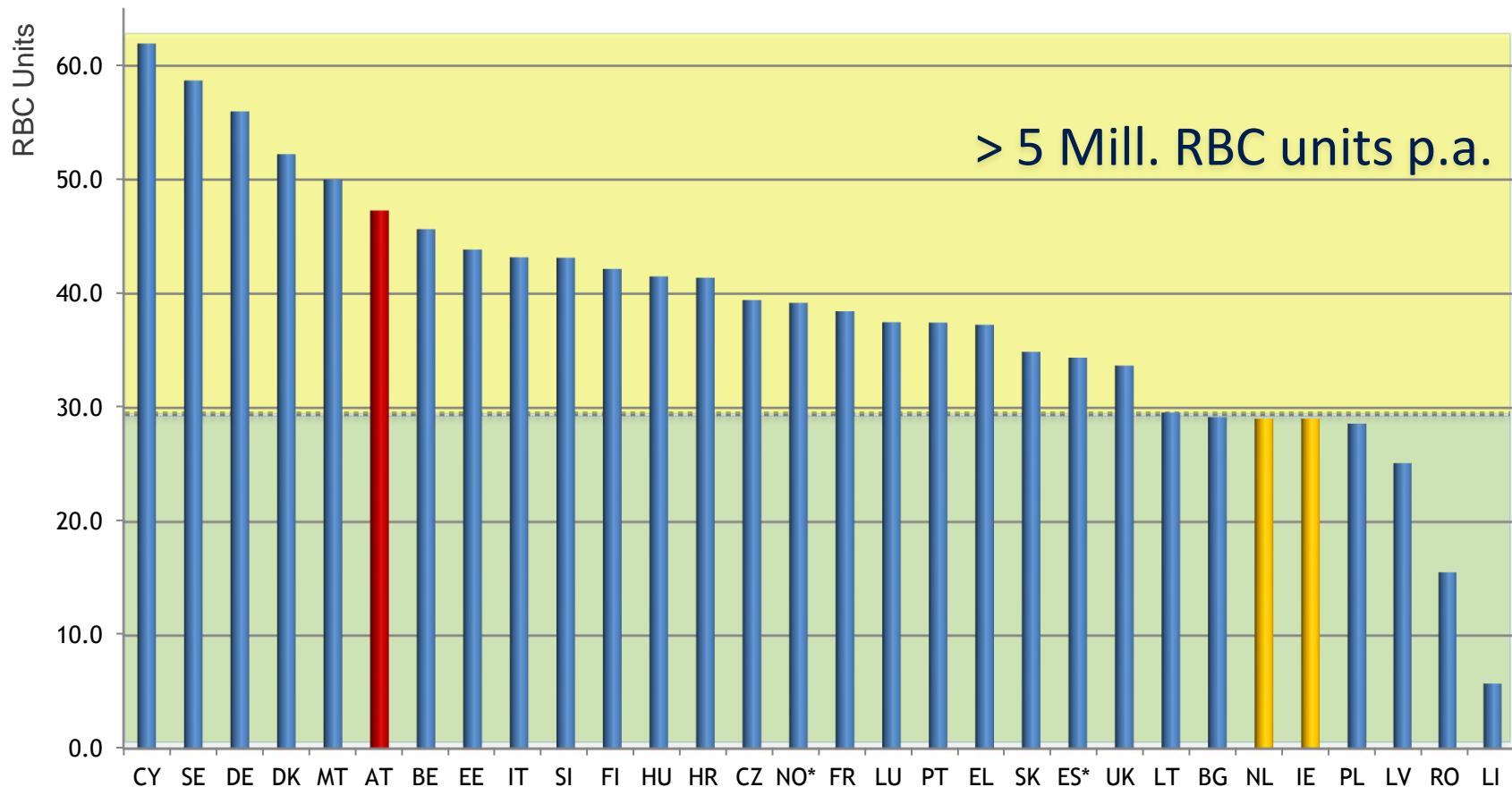
<sup>a</sup>**General Hospital Linz**, Department of Anaesthesiology and Intensive Care

<sup>b</sup>**University Hospital of Zurich**, Institute of Anaesthesiology, Switzerland

Wien, 19.06.2015

# Externes Benchmarking in Europa

## Verwendung von Erythrozythen-Konzentrate (RBC je 1.000 Einwohner)



NATURE, VOL 520, 02. April 2015

*Transfusions are one of the most overused treatments in modern medicine, at a cost of billions of dollars.*

[http://www.nature.com/polopoly\\_fs/1.17224!/menu/main/topColumns/topLeftColumn/pdf/520024a.pdf](http://www.nature.com/polopoly_fs/1.17224!/menu/main/topColumns/topLeftColumn/pdf/520024a.pdf)



## World Medical Association - WMA

The WMA declaration emphasises the need to specifically address inappropriate use of healthcare services.



Continuous and sustainable quality management in healthcare should include a balanced set of methodologies in the following three areas: overuse, underuse, and misuse.

*WMA Declaration on Guidelines for Continuous Quality Improvement In Health Care.* 2009: 60th WMA General Assembly, New Delhi, India, October 2009.

# Benchmarking in Österreich

## Ergebnisbericht der Benchmarkstudie in Österreich inkl. ...

- Methodik
- Originaldaten und Statistische Auswertung (592 Seiten)
- [http://bmg.gv.at/cms/home/attachments/5/3/8/CH1220/CMS1299504978063/bericht\\_blut.pdf](http://bmg.gv.at/cms/home/attachments/5/3/8/CH1220/CMS1299504978063/bericht_blut.pdf)

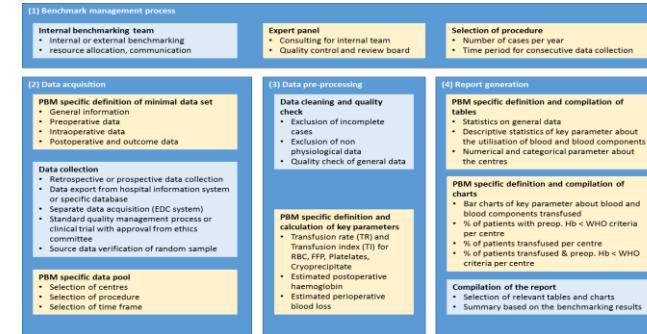
## Zusätzlich:

- Anonymisierter Datensatz mit etwa 3500 Datensätzen von 22 Krankenanstalten in Österreich

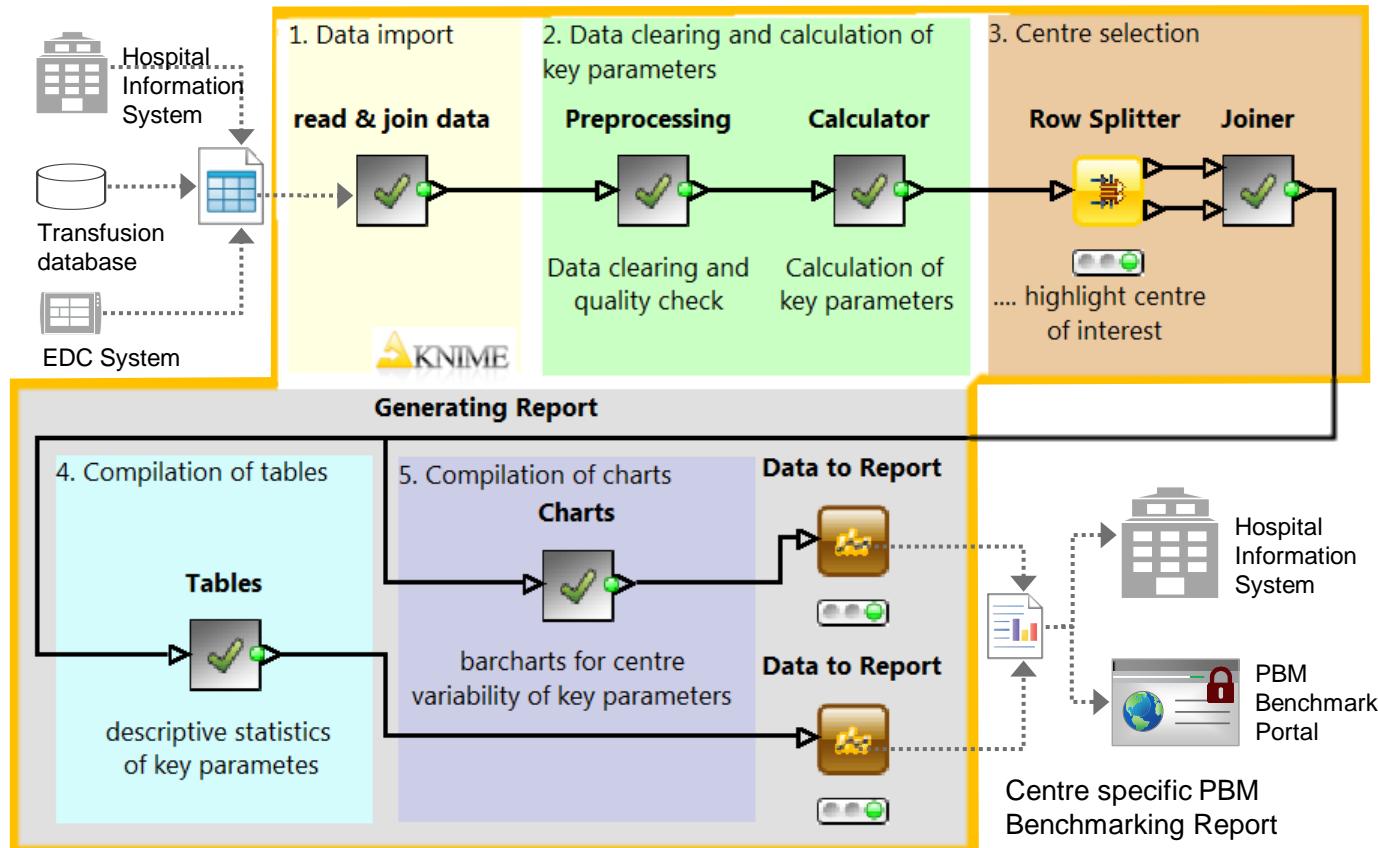


# Benchmarking Prozessschritte

- **Datenerfassung**
  - Spezifikation des minimalen Datensatzes als Basis für die Filterung
  - Datenimport von anonymisiertem Originaldatensatz
- **Qualitätssicherung und Daten-clearing**
  - Ausschluss unplausibler Datenwerte
  - Ausschluss unvollständige Datensätze
- **Algorithmen für Key-Parameter**
  - Transfusionsrate (TR)
  - Transfusionsindex (TI)
  - postoperatives Hb
  - Perioperativer Blutverlust
- **Definition der wesentlichen Reportelemente**
  - Ergebnistabellen
  - Benchmark-Grafiken



# Ergebnis der Prozess-Implementierung mit KNIME



# Ergebnisvergleich mit der Originalarbeit (BMG)

- Analyse anhand ausgewählter Ergebnistabellen aus dem Originalbericht vom BMG
  - Table 7.33 (“pre-operative anaemia”)
  - Table 7.35 (“blood components transfused”)
  - 352 Datenwerte
- Ergebnis
  - Max. Abweichung 1.4%
  - 95% of the data items had a difference below 0.1%
  - 99% below 1%
  - Grund:
    - Selektionsunterschied bei den Fällen
    - Manuelle Auswahl: 3.344 Fälle
    - Automatische Filterung: 3.337 Fälle

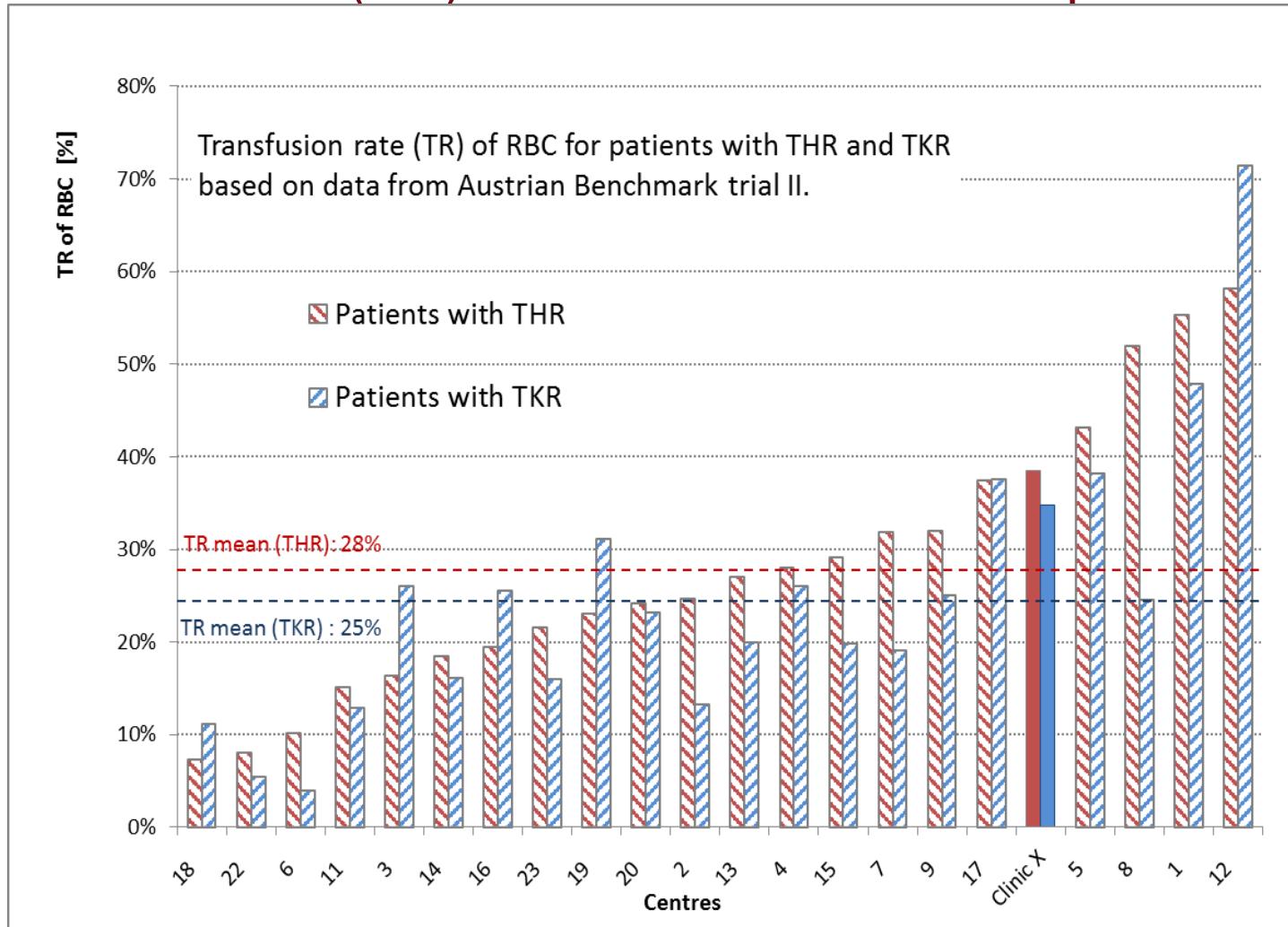
Fortsetzungstudie - Abschlussbericht						
HTEP, PatientInnen, die Erythrozytenkonzentrate (EK) erhielten						
Tabelle 7.33: HTEP/EK: ausgewählte Variable						
ZNr	N	Pat	prAnaB	AnämB	EigBl	FrBl
1	52	46,2%	1,9%	21,2%	66,5%	15,4%
2	33	7,4%	5,4%	21,8%	66,7%	15,5%
3	8	1,8%	1,2%	21,8%	66,7%	15,5%
4	28	25,0%	1,9%	21,2%	66,5%	15,4%
5	5	1,1%	0,0%	21,8%	66,7%	15,5%
6	35	32,2%	1,9%	21,2%	66,5%	15,4%
7	26	13,7%	10,2%	5,1%	0,0%	13,1%
8	2	0,4%	0,0%	0,0%	0,0%	0,0%
9	31	28,3%	14,3%	6,1%	0,0%	26,5%
11	21	19,0%	10,0%	1,0%	0,0%	26,0%
12	25	22,9%	14,5%	5,5%	7,3%	30,9%
13	6	5,4%	6,0%	0,0%	0,0%	4,0%
14	17	15,8%	13,9%	0,0%	19,1%	11,1%
15	40	37,5%	14,3%	0,0%	24,5%	24,5%
16	8	7,4%	6,3%	1,0%	4,2%	20,0%
17	34	31,3%	25,2%	1,4%	0,0%	12,9%
18	3	2,7%	49,4%	6,1%	10,2%	67,3%
19	9	8,1%	45,5%	22,2%	0,0%	71,4%
20	23	21,0%	93,7%	1,1%	0,0%	16,1%
21	10	9,1%	142	14,8%	6,3%	4,9%
22	16	14,3%	47	14,9%	0,0%	0,0%
23	6	5,4%	101	14,9%	5,9%	4,9%
Gesamt	463	36	14,9%	25,0%	2,8%	0,0%
Minimum	3	19	45	13,3%	2,2%	0,0%
Maximum	52	20	96	26,0%	3,1%	5,2%
Bei den PatientInnen, d	21	23	77,4%	8,7%	0,0%	31,1%
Mittel bei 37% (8% bis	22	74	14,9%	0,0%	0,0%	0,0%
Eigenart kam im Mittel	23	69	10,1%	0,0%	0,0%	11,1%
Die Gesamt-Komplikatio	Gesamt	1685	16,0%	2,9%	2,7%	21,5%
(10%).	Minimum	23	6,0%	0,0%	0,0%	23,7%
Maximum	142	26,0%	8,7%	14,9%	67,3%	0,3%
* In diesem Zentrum hi	21	52	15,9%	5,4%	0,0%	0,0%
6% bis 26% der PatientInnen waren prOperativ anämisch (nach WHO, Abb. 7), eine Anämiebehandlung fand im Mittel nur bei 3% der PatientInnen statt.						
In nur 2 Zentren wurde Eigenart in einer Häufigkeit von >10% verabreicht (10% und 13%), während sie in den anderen Zentren geringer war. Eigenart wurde insgesamt bei 4% bis 71% der Operations Erythrozytenkonzentrate (EK) verabreicht (Abb. 7b).						
Weiter ist aus der Tabelle 7.33 ersichtlich, dass „Fresh frozen Plasma“ und „Faktorenkonzentrate“ sehr selten verabreicht wurden. Thrombozytenkonzentrate wurden gar nicht gegeben.						

▪ WHO-Definition der Anämie, 2001: Frauen Hb < 12 g/dl, Männer Hb < 13 g/dl.
--

# Beispielgrafik:

## Transfusionsrate (TR) bei Hüft- und Knieendoprothese



# Implementation and Validation of a Conceptual Benchmarking Framework for Patient Blood Management



Kastner Peter, Breznik Nada, Gombotz Hans\*, Hofmann Axel\*, Schreier Günter

\*AIT Austrian Institute of Technology GmbH, Digital Safety & Security Department, Assistive Health Information Technology, Graz, Austria

†Department of Anesthesiology and Intensive Care, General Hospital Linz

‡Institute of Anaesthesiology, University Hospital of Zurich, Switzerland

## Introduction

Because of the high variability of the utilisation of blood and blood components, benchmarking is indicated in transfusion medicine to sustainable monitor implementation of patient blood management (PBM) modalities.

In Austria, benchmark studies for blood use in elective surgery were commissioned by the Austrian Federal Ministry of Health and were conducted from 2004 to 2005 and from 2009 to 2010.

## Objectives

- Development of conceptual framework for internal and external PBM benchmarking
- Definition of a minimal dataset based on literature review
- Implementation of core technical modules for automatic analysis and report generation
- Validation of the data processing chain

## Methods

- Implementation of core benchmarking modules for analysis and report generation with KNIME ([www.knime.org](http://www.knime.org)).
- Automatic analysis using the data pool of the second Austrian Benchmark Trial including 3,344 individual data sets.
- Validation with delta analysis by comparing automatically processed results with the official report from second Austrian Benchmark Trial including all items of two tables of crucial importance: "pre-operative anaemia" and "blood components transfused" after total hip (THR) and knee arthroplasty (TKR).



Figure 1: Components of the conceptual benchmarking framework with specifically adjusted modules for PBM (yellow boxes).

## Conclusion

A validated process for automated data analysis and report generation is an efficient tool for internal or external PBM benchmarking. The technical integration of such a systematic approach with a hospital information system would be an integral step to achieve the ultimate goal: continuously providing results for healthcare professionals who are responsible for improving the quality of health services.

## Results

Core modules have been implemented in KNIME (Konstanz Information Miner, [www.knime.org](http://www.knime.org)): data import, data cleaning and calculation of key parameters, centre selection, compilation of tables and charts, report generation. The Import Interface allowed to include data from Hospital Information Systems (HIS), transfusion databases or a dedicated electronic data capture system (EDC). The resulting report can be provided via a secure PBM benchmarking portal or retransferred to the HIS of the selected centre.

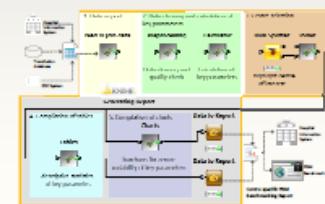


Figure 2: Components of the conceptual benchmarking framework with focus on automatic analysis and report generation

Results of delta analysis of 352 automatically calculated data items with original results from benchmark reports showed a deviation  $<0.1\%$  for 95% (max. 1.4%) which is far beyond the centre differences of up to 56.1% in THR and 71.4% in TKR.

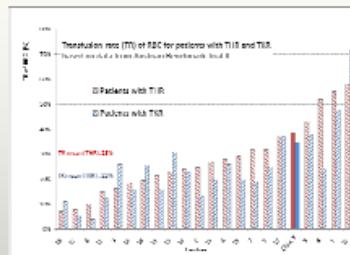


Figure 3: Example of a typical benchmark chart to compare transfusion rate (TR) of red blood cells (RBC) per centre for two different medical procedures: THR and TKR. The chart was compiled for "Clinic X".