IfMDA
Institut für Mikrodaten-Analyse

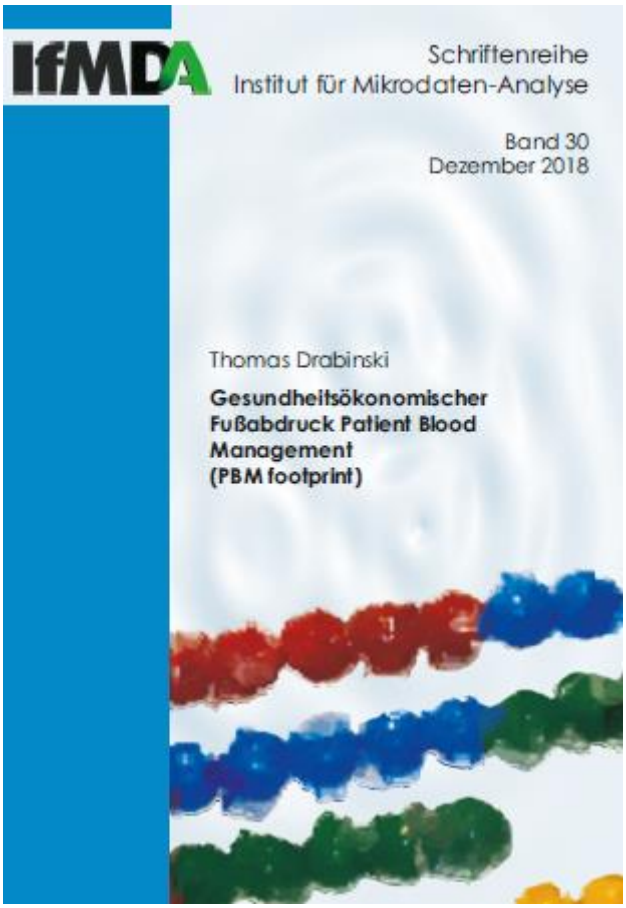
+++ Executive Summary +++

IfMDA expertise „PBM footprint“ (Dez. 2018)

Brief summary. In Germany, some 4.6 million patients, *i.e.* one in four patients, have elective (plannable) surgery in the hospital. Of these 4.6 million patients, 227,000 receive an EC[1] blood transfusion. These 227,000 patients are transfused about 1.026 million EC units.[2]

Generally, an EC blood transfusion is administered in case of anaemia which may have been triggered by iron deficiency, haemorrhage or other causes.

Iron deficiency in elective interventions is avoidable, *i.e.* it is treatable by timely administration of therapy. Analyses show that in patients with iron deficiency anaemia the risk of receiving an EC transfusion is increased by the factor of 5. Moreover, treatment costs can be demonstrated to be 3 to 4 times higher for patients with blood transfusion than for patients without blood transfusion. Additionally, for patients with blood transfusion the length of hospital stay is 2.5 to 4 times that of patients without blood transfusion. The mortality risk of patients with blood transfusion is increased by the factor of 26.
In Germany, timely treatment of iron deficiency by preoperative anaemia therapy (preoperative PBM) would save health insurance companies up to € 479 million in direct hospital costs. This would be associated with 529,000 hospital days saved for the patients, again leading to savings of € 54 million in indirect costs. In addition, preoperative PBM could prevent clearly more than 2,000 deaths in the hospital, thereby avoiding € 8.246 × 10^3 million in indirect costs for society.



Preoperative anaemia treatment (PBM)—so the result of the health-economic Patient Blood Management foot print (PBM footprint)—could realise savings in direct and indirect costs of at least € 8.769 × 10^3 million in Germany.

[1] EC = erythrocyte concentrate (regular / most common form of allogeneic blood products administered).
[2] Source (including for the subsequent statistics): Research Data Centre (FDZ) of the Federal and State Statistical Offices. 2015 DRG Statistics, own calculations.

Summary. The expertise "PBM Footprint" explores the potential effects of basic quality assurance measures if implemented for patients with anaemia in connection with elective surgical interventions in the hospital.

In 2015, one in four patients had an elective ("plannable") surgical intervention in the hospital, with a total number of 4.591 million patients [cf. Table 5.2 of the expertise]. Twenty-nine thousand patients were diagnosed with iron deficiency anaemia (ICD D50.8, D50.9) perioperatively ("pre-, intra- and postoperatively"). Anaemia secondary to blood loss/haemorrhage (ICD D50.0, D62) was diagnosed in 275,000 patients [cf. Table 5.2].

Anaemias caused by iron deficiency or blood loss are frequently corrected by transfusion of erythrocyte concentrates (EC). In 2015, 227,000 patients received a total of 1.026 million EC units [cf. Table 5.2]. On the international level, Germany takes the top rank with regard to stored blood [cf. Table 2.1]. Without additional quality assurance measures, the demographic situation is predicted to cause an increase until 2050 [cf. Table 2.7].

Numerous international medical and health-economic studies show that there are apparent associations between (iron deficiency) anaemia, stored blood, treatment outcomes (patient outcomes) and consumption of resources [cf. Section 3]. Anaemia, for instance, more frequently leads to EC transfusions. Both, i.e. anaemia and EC transfusions, result in poorer patient outcomes as reflected in higher mortality, complication, and morbidity rates and consequently in prolonged hospitalisations (length of stay), leading to increased individual and economic costs for the patients and their families, for the hospital, for the cost carriers (statutory and private health insurances, and social benefits), for the employers, and thereby for society in general.

Against this background, meanwhile numerous recommendations for the implementation of Patient Blood Management (PBM) programmes have developed. In this context, a PBM programme is a set of measures for quality assurance to avoid preoperative anaemia (PBM pillar 1), to reduce unnecessary pre- and intraoperative blood loss (PBM pillar 2), and to apply more stringent rules to the intra- and postoperative use of stored blood (PBM pillar 3).

The recommendation to implement hospital-specific or macroeconomic PBM programmes with elective operations is key to quality assurance in health care precisely when the associations between anaemia, stored blood, quality of outcomes and costs, as uncovered by international studies, also apply to Germany. In this case, patients, hospitals, cost carriers and health politics should work towards the mandatory implementation of PBM programmes and a more efficient and patient-oriented configuration of the German health care system.

A secondary data analysis of the 2015 DRG statistics with n = 1.867 million patients (representative random sample of 10% from the full survey with 18.672 million patients) with the data base pursuant to Sect. 21 Hospital Reimbursement Act [KHEntgG] (source: Research Data Centre (FDZ) of the Federal and State Statistical Offices. 2015 DRG Statistics, own calculations) conducted in the research project "Kontrolle von Risikofaktoren über Patienten-individualisierte Hämotherapie" [Risk factor control via patient-individualised haemotherapy] at the Hospital for Anaesthesiology, Intensive Care Medicine and Pain Therapy of Frankfurt University Hospital, the following results could be quantified for elective operations in the PBM setting (all figures of 2015):

The risk for an EC transfusion is increased by the factor of 5.031 if the patient having elective surgery was diagnosed with iron deficiency anaemia [cf. Table 5.9].

The average treatment costs for transfused patients are 3 to 4 times higher than the costs for patients without blood transfusions: patients with iron deficiency anaemia € 21,744 vs. € 7,883, patients without iron deficiency anaemia € 21,173 vs. € 4,560 [cf. Table 5.10].

The average length of hospital stay of transfused patients is 2.5 to 4 times that of the length of stay of patients without transfusions: patients with iron deficiency anaemia 27.8 days vs. 11.4 days, patients without iron deficiency anaemia 23.6 days vs. 5.5 days [cf. Table 5.11].

The mortality risk is increased by the factor of 24.628 if the patient with elective surgery received a blood transfusion [cf. Table 5.21].

The mortality risk is also high if the patient having elective surgery was diagnosed with iron deficiency anaemia: in this case the risk is increased by the factor of 3.633 [cf. Table 5.23].

The results of the secondary data analysis allow for the conclusion that PBM measures can be of use for quality assurance in cases where these measures exert a positive influence on the quality of outcomes (mortality, length of stay). Moreover, if PBM measures satisfy stringent economic principles such as cost efficiency (lower costs), the PBM measure must be considered as leading to an overall increase in welfare.

With regard to preoperative anaemia management, Section 6 of the expertise therefore explores the changes ensuing for prevalence and the economic conclusions to be drawn from this. Assumptions are used here to make a "what-if analysis" plausible: What if prior to the elective surgery those patients whose current status is "iron deficiency" are treated, but would be allocated to the patient group "no iron deficiency anaemia" under the PBM regime.

Within the concept of the "PBM footprint", the "what-if analysis" therefore produces patients with avoidable anaemia and, derived from this, avoidable costs as, according to the assumption, a lower number of anaemic patients triggers fewer hospital days, fewer blood products, fewer complications and, therefore, lower costs.

The model of "PBM footprint" as specified in the expertise reaches the conclusion that preoperative iron deficiency anaemia management will allow for saving direct costs for the cost carriers to the amount of AC_1 = € 479 million (DRG proceeds) in the hospitals.

Along with these savings some 529,000 hospital days can be avoided for the patients, their families and employers. Assuming a statistical or health-economic value of € 101.74 for a day, as derived in the expertise on the "value of a statistical life" concept, preoperative iron deficiency anaemia management allows for avoiding indirect costs to the amount of AC_2 = € 54 million.

The highest amount of avoidable indirect costs are found in the deaths avoided. Quantification in the PBM footprint shows that in all likelihood 2,752 deaths could be avoided by preoperative iron deficiency anaemia management alone. If the value of a statistical life is estimated to be € 2.996 million—for ethical reasons considered irrespective of the age reached—this amounts to avoidable indirect cost of AC_3 = € 8.246 $\times$ 10^3 million in deaths avoided.

In the PBM footprint, preoperative iron deficiency anaemia management is not only associated with savings in the form of avoided costs, but also treatment costs: For each patient receiving IV iron therapy the mean treatment costs (consumables, laboratory and personnel) incurred amount to € 176.68 [cf. Table 3.3]. In the PBM footprint model some 59,000 patients receive treatment in the "preoperative PBM" group. This amounts to treatment costs (TC) of TC = € 10 million.

When balancing the calculated values (Σ_i AC_i – TC), a comprehensive preoperative iron deficiency anaemia management will result in a health-economic Patient Blood Management footprint (PBM footprint) amounting to € 8.769 $\times$ 10^3 million. This footprint must be regarded as gain in benefit for society, i.e. as an increase in welfare. This footprint is the result of lower statutory health insurance, benefit and private health insurance expenditures for direct hospital costs (due to a reduced utilisation of the hospital infrastructure), of the improved outcome quality for patients, their families and employers, and of lower indirect costs due to avoided deaths.

Indeed, the gain in benefit for society derived from PBM must be assumed to be considerably higher as, in general, the modelling hypotheses assumed in the PBM footprint model

were specified “conservatively”. Furthermore, in addition to preoperative anaemia management (PBM pillar 1), intra- and postoperative PBM measures can also be implemented in the hospitals, such as measures to reduce or avoid unnecessary blood loss (PBM pillar 2) and patient-friendly use of allogeneic blood products (PBM pillar 3). Quantification of an extended PBM footprint considering these measures is still pending.

In conclusion, all facts suggest that—not only with elective operations—PBM is a key factor to achieving quality assurance and cost effectiveness in health care. The associations between anaemia, stored blood, outcomes quality and cost, as apparent from international studies, apply to Germany as well. This was shown by empirical analyses that were quantified in the research project “Kontrolle von Risikofaktoren über Patienten-individualisierte Hämotherapie” [Risk factor control via patient-individualised haemotherapy] at the Hospital for Anaesthesiology, Intensive Care Medicine and Pain Therapy of Frankfurt University Hospital on the basis of the representative 2015 DRG statistics.

This allows for deriving the regulatory, supply and health-political brief recommendation that patients, their families, hospitals, cost carriers and health politics should insist on the obligatory implementation of PBM programmes, thereby working towards an efficient and patient-oriented configuration of the German health care system.

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