

Patient Blood Management Implementation Strategies and Their Effect on Physicians' Risk Perception, Clinical Knowledge and Perioperative Practice – the Frankfurt Experience

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Keywords

Patient blood management · Anemia · Blood transfusion · Surgery – preoperative period · Medical decision-making · Implementation strategy

Summary

Introduction: A multicomponent, evidence-based and interdisciplinary Patient Blood Management (PBM) program was introduced at the University Hospital Frankfurt in July 2013. The implementation strategy included practical and tactical components aimed to increase knowledge on the risks of preoperative anemia, to standardize hemotherapy, and to facilitate PBM components. **Methods:** This article analyzes barriers to PBM implementation and outlines a strategy to introduce and manifest PBM. The effects in Frankfurt were measured in a before and after questionnaire study distributed among groups of physicians immediately before and 1 year after PBM implementation. **Results:** 142 clinicians completed the questionnaire in July 2013 and 101 clinicians in August 2014. Absolute certainty that the treatment of preoperative anemia favorably influences morbidity and mortality rose from 25 to 37%. Transfusion behavior seems to have been affected: In 2014, 56% of clinicians stated that they clinically reassess the patient and analyze hemoglobin following each single red blood cell unit compared to only 38% stating this in 2013. **Conclusion:** These results show that our implementation strategy was effective in changing physicians' risk perception, attitude, and knowledge on PBM principles. Our experience highlights key success factors for the implementation of a comprehensive PBM program.

Introduction

Patient Blood Management (PBM) is an evidence-based, multidisciplinary approach to optimize the care particularly of those patients who are at risk of anemia and/or might need blood transfusions during hospitalization. PBM encompasses the pre-interventional optimization of red blood cell (RBC) mass, the minimization of blood loss, and the advancement of appropriate transfusion decision making. The imperative goal is to improve clinical outcome and patient safety.

The medical background of PBM is based on two major points: Firstly, anemia is associated with worse postoperative outcome, higher rates of infectious complications, prolonged hospitalization, and an increased likelihood of allogeneic blood transfusions [1–4]. Secondly, increasing evidence suggests that over-transfusion of allogeneic blood products is associated with increased morbidity and mortality due to infectious, immunological, pulmonary, and thromboembolic complications [5–8]. Especially worrisome is the substantial inter-institutional variability of transfusion practice, implicating high levels of insecurity regarding the indication for hemotherapy and potentially inappropriate usage [9, 10]. Furthermore, it appears odd that hemoglobin levels of critically ill patients on intensive care units show a convergence over time, irrespective of the admitting hemoglobin level, age, and comorbidities [11]. PBM programs tackle these problems, using a multidisciplinary, multimodal, patient-focused approach to screen for, avoid and treat anemia as well as to minimize and standardize RBC transfusion with the ultimate goal of improving patient outcome [12, 13].

The World Health Organization (WHO) has been officially urging member states to implement PBM since 2010 (WHA63.12). PBM programs have already been rolled out more or less success-



Fig. 1. Art versus science? A physician's craftsmanship applied to the field of science. – by Dr. Pia Ockelmann.

fully in most of Western Australia centers and in a few centers in Europe and the USA [14–16]. Hence, there are vast regions around the world where PBM concepts still await profound and sustainable implementation. Acknowledging this, the European Commission recently announced a pilot program for the implementation of PBM in five European teaching hospitals [17]. It has to be emphasized that the implementation of PBM is of critical importance especially in Germany as it has one of the highest blood usages worldwide: 51.1 RBC units per 1,000 population (2013) are transfused [16] as compared to 27.5 units per 1,000 in Western Australia (2012) [18].

However, experience from guideline implementation in other medical fields shows that this can be a very challenging task: despite a wide promulgation of evidence-based practice, adherence is often poor and the implementation into daily routine may take decades [19, 20]. Thus, in order to implement new standards of care successfully, it seems reasonable and necessary to analyze the formation of medical decisions alongside the pragmatic, educational, and attitudinal obstacles to evidence-based practice. This article outlines methods to influence the behavior of medical care providers and suggests an action plan for the wider implementation of PBM programs.

The recommendations are based on experience from launching a multicenter PBM program in four German university hospitals, affecting the care of more than 50,000 surgical patients/year. As sustainable behavioral changes can only result from influencing knowledge and attitude; both are targeted by the measures proposed [21].

Medical Decision Making and Motivation

Many guidelines, based on excellent trials, are available that are not being followed due to various barriers preventing their application [19]. The barriers impeding the employment of evidence-based practice are manifold: One main point is paucity of knowledge as keeping up to date with evidence-based data is time-consuming. As regards PBM and transfusion practice, these important subjects are to date underrepresented in the education of young physicians. The resulting significant variation in hemotherapy and patient care is often based on inadequate interpretation of controversial evidence, errors in reasoning, gross oversimplification and wide variations in belief [22]. Furthermore, lack of agreement, of self-efficacy in light of the overwhelming volume of clinical responsibilities and of outcome expectancy as well as inertia of previous practice aggravate this problem. A widespread apprehension of excessive clinical guideline proliferation is also a potential barrier in terms of physician attitude [21]. Personal reservations concerning any external influences on practice patterns are met with skepticism that autonomy will be eroded and practice will become more protocol driven [23].

From our point of view, the key to a successful initiation and maintenance of a large-scale behavioral change is the understanding what motivates medical professionals. We believe that health care providers are generally motivated to make right decisions. However, it is important to consider that transfusion decisions are highly complex and affected by many factors, ranging from a sincere but often unsubstantiated desire to maintain health and ensure and accelerate patients' recovery to an arbitrary phobia of any legal consequences. Therefore, recommendations and standard operating procedures need to be easily accessible, science-based, and aimed at supporting clinical judgment as the cornerstone of patient care. Smooth infrastructure should be provided to overcome practical barriers, and regular evaluation of effects on outcome should function as an iterative feedback for medical professionals. When designing the desired change, it is very important to communicate that medicine is not just science applied to products, but an art of combining evidence and experiences in new and diverse situations to the best solution for each individual patient. It should be kept in mind that even if guidelines offer evidence-based information, their scope is still limited to the realm of the 'knowledge' in medicine. For them to additionally address the 'art' element in medicine effectively, multifaceted tools have to be applied to alter transfusion behavior [24]. Figure 1 illustrates a medical artist, applying a physician's craftsmanship to the field of science – resulting in a PBM logo symbolic for prosperous interlocking and better patient care.

Patient Blood Management

Developing a PBM Concept That Fits into Your Health Care Facility

Many important factors such as infrastructure, staff, equipment, and economic resources differ between hospitals, and individuali-

Table 1. Key strategies to implement PBM programs [35]

Target	Method
Knowledge	<ul style="list-style-type: none"> – Develop clinical education materials for M.D.s that include the risks and benefits of anemia and transfusion. Convey the best practices and guidelines supported by evidence. Expand education on transfusion avoidance and appropriate alternatives to transfusion – Distribute educational materials via website and/or central virtual room and prepare comprehensible checklists – Appoint local guideline implementation teams to teach and maintain the program's components – Design optional examination course with an associated certificate on transfusion practice and PBM – Standardize performance metrics and data collection to allow valid benchmarking within organizations. Identify research priorities to close evidence gaps in what constitutes optimal transfusion practice – Develop a separate informed consent process consistent with current evidence for transfusion that communicates the risks and benefits – Coordinate regular exposure to PBM during medical school, continuing professional education, residency curriculum – Offer hands-on workshops with simulated patient contacts in the perioperative setting – Identify local frequent users of blood transfusions – Identify elective procedures where patients will benefit from early anemia screening and therapy
Attitude	<ul style="list-style-type: none"> – Foster team spirit and corporate identity <ul style="list-style-type: none"> • Vocabulary: develop a concept that fits into your hospital • Communicate the flexibility of measures and be open-minded to input from all parties involved • Highlight learning-continuum for all • Aggressive marketing: i.e. logo, poster, flyer, promotion booth, PBM-T-Shirts for Charity-runs, car advertising, buttons, ties, shirts, pens, PBM-hotline • Identify subject matter experts – local opinion leaders within organizations to provide guidance – Invite journalists from medical and general papers and television delegates who support the propagation of the PBM idea – Hire PBM 'ambassador' as a incarnated reminder
Behavior	<ul style="list-style-type: none"> – Change the infrastructure and preoperative flow of patients - <ul style="list-style-type: none"> • Decrease preclinical pressure by allocating greater time frames ahead of elective surgery • Define and allocate clear responsibilities for the investigation and treatment of anemia (preoperative assessment) – Provide low-threshold logistics by improving computer information support services – Advocate scheduled periodic assessments of physicians' PBM competency and for accountability to organizational standards as part of ongoing professional practice evaluation – Measure individual physician transfusion practice via hard facts such as RBC units transfused, patients screened for anemia etc. – Negotiate with health insurance companies: reimbursement of i.v. iron therapy – Include guidelines into Standard operating procedures (make treatment algorithms available online) – Create visual aids – check-lists for the walk-in-clinic and operation rooms

zation is vitally important for the social acceptance of any new standard [25]. For this reason, PBM programs need to be specifically designed for each site using the bigger frame of the recommended PBM concept. A multidisciplinary agenda can maximize its acceptance. The Frankfurt University Hospital PBM program, for instance, was based on a consensus between a large team of medical professionals, including hematologists, surgeons, gastroenterologists, anesthesiologists, critical care physicians, laboratory technicians as well as administrative and quality management personnel. The most important partner in the development and implementation of the PBM scheme is The German Red Cross Blood Donor Service Baden-Wuerttemberg – Hessen as the provider of all blood products used at the University Hospital Frankfurt.

An official order from the University Hospital Board chapters the program, adding authority. For organizational reasons, PBM in Frankfurt initially focused on surgical patients; however, the non-surgical setting is just as important and should be included to achieve maximum benefit for the patients.

Besides being multidisciplinary in origin, new standards need to be practical and feasible. This is why we think that it is important to communicate throughout the implementation period that the project is alive and flexible. Constructive criticism and suggestions from the whole medical community are highly important to adjust and improve the program and should be welcomed. Hospitals with similar settings should collaborate and create or participate in joint PBM programs.

Systematic Methods for Designed Behavior Change

Before practice guidelines can positively affect patient outcome, they first need to affect physicians' knowledge, attitude, and finally behavior [21]. During the implementation phase, multiple training programs were undertaken in the four German University Hospitals in order to increase knowledge on the risks of preoperative anemia and the indications of blood transfusions, and to facilitate the execution of PBM components. In order to monitor the induced changes in risk perception, clinical knowledge and periop-

erative practice, we used a questionnaire study at the University Hospital Frankfurt before and 1 year after the introduction of PBM. Physicians were asked about their exposure to PBM recommendations and their knowledge of the components of the multifaceted intervention. Furthermore, their individual desire to change practice was assessed. This questionnaire was a first incentive for people to reflect their transfusion behavior.

Learning and Closing Knowledge Gaps

There are a number of ways in which individuals learn new information, and these should be addressed effectively. The PBM learning materials need to be related to physician goals. Essentially, this can be achieved by stressing the clinical implications of anemia and the need for alternatives to transfusion. The focus should be placed upon clinical outcomes and the inappropriateness of transfusion practice variability. The learning materials should be easily accessible, e.g. via a website (www.patientbloodmanagement.eu) or a central virtual room for documents / guidelines / posters / education materials. In addition, we prepared a local online certification course for PBM and general transfusion practice that can be obtained voluntarily. The systematic strategies applied and recommended by us to influence knowledge, attitude, and behavior are summarized in table 1.

When scheduling the PBM education program, it is recommended to identify frequent users of blood transfusions to focus on. In this respect, both surgical procedures that are associated with the highest rate of transfused patients and procedures with the highest number of RBC units transfused should be listed. These high-risk surgical procedures should be carefully assessed for their potential to implement further blood-sparing techniques such as cell salvage or topical hemostatic agents. Additionally, this will help identify those elective procedures where patients will benefit from early preoperative anemia screening, diagnosis and therapy, which is crucial for further planning and modification of preoperative patient flows [26].

The local guideline implementation teams performed both group and individual teaching sessions in Frankfurt where they reinforced increasing exposure to and the use of bedside educational materials and checklists. The latter were distributed to all wards and to all operation rooms [28]. For example, the recommendations regarding the screening and therapy of preoperative anemia in Frankfurt were integrated into flow charts and are displayed in the surgical ambulances identifying target patient groups. PBM measures were also incorporated in laboratory order sets. Finally, we recommend hands-on workshops with simulated patient encounters in the perioperative setting as well as coordinated regular exposure to PBM not only during continuing professional education and residency curriculum, but also during medical school. Medical students are the future of health care and should grow up with PBM!

Marketing

To make sustainable progress in the rationale use of blood, we recommend an aggressive marketing strategy. The Frankfurt PBM

working group designed a logo, posters, pens, shirts, and ties to establish a 'brand' and provided flyers to all hospital areas. An advertisement booth was set up in front of the cafeteria, PBM T-shirts were sponsored for a charity-run, and a special PBM hotline was created along with car advertisements. By including the PBM logo on the main homepage of the hospital as a marketing instrument, public attention is directed to the hospital, making it a valuable tool for image promotion. Other ways to propagate the PBM concept are press conferences and meetings with journalists from medical and general papers as well as television delegates. We suggest structural marketing techniques as an important tool for the promotion of the desired paradigm shift in transfusion practice. Lastly, to ensure continuity of the program, we engaged a PBM 'ambassador' as an incarnated reminder and for repetitious 'drill' of PBM contents to ensure coherence and consistency of the program.

Transfer of Learning into Practice

The establishment of corporate identity boosts desirable behavior as it ignites team spirit, which has a major effect on behavior. The associated social pressure might even foster healthy competition between wards and departments. Appointed PBM experts in every department can lead this movement and establish a social platform online where involved parties can interact and ask each other questions.

The PBM working group should emphasize the importance of having the infrastructure and supportive tools that help physicians making the best decisions and documenting why they were made. Appropriate knowledge and attitude are necessary but not sufficient for adherence; ways have to be paved for a better understanding of coherence. Regarding preoperative diagnostics, the pressure not to delay surgery often hinders an adequate preoperative assessment and improvement of patients. Our recommendation is to relieve pressure by allocating a greater timeframe prior to elective surgery by changing the infrastructure and preoperative flow of patients [27] i.e., provide low-threshold logistics by improving computer information support services and define clear responsibilities for the preoperative diagnosis and treatment of anemia. In Frankfurt, for instance, a noninvasive tool was bought to measure the hemoglobin levels of elective patients via a finger clip device [29]. This also enlivened the professional training through hands-on practice. It is also advisable to negotiate with health insurance companies for the reimbursement of the measures applied. Finally, it seemed to be helpful to create and hang up visual aids and checklists in the walk-in-clinics and the operating rooms. A continued education program will help to maintain the PBM program and to ensure sustainability.

Measuring the Effects on Patient Outcome

Other centers and hospitals around the world face similar problems as there is great need for PBM and difficulties in the implementation [30]. Quality assessment of the new standard of care is one way to successfully enhance the acceptance of PBM [31–33]. Periodic assessment of physicians' PBM competency and advocate

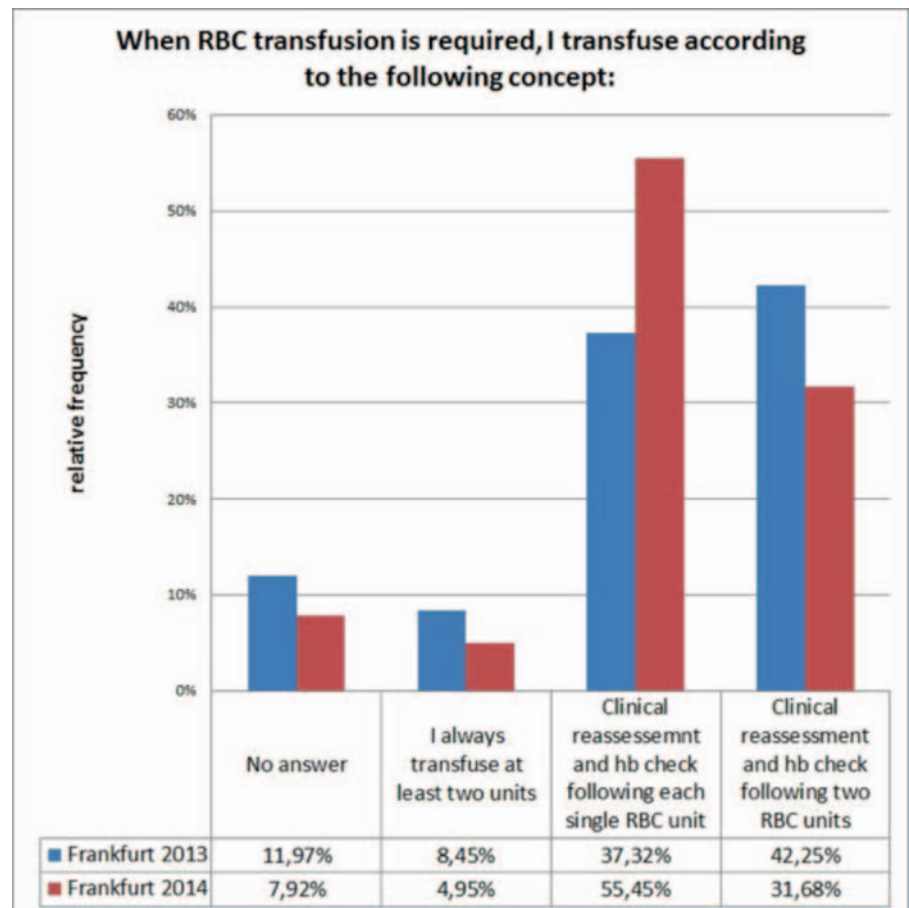


Fig. 2. Comparison of answers to a survey on transfusion policy – 142 participants before PBM (June 2013), 101 after 1 year of PBM (July 2014).

accountability to organizational standards as part of ongoing professional practice evaluation should be scheduled. We are currently conducting a prospective multicenter trial to address safety concerns and to evaluate the cost-effectiveness of our PBM program at four German University Hospitals (Frankfurt, Bonn, Kiel, and Münster). The study will be completed in 2015 (ClinicalTrials.gov Identifier: NCT01820949). A composite endpoint is analyzed including in-hospital mortality and morbidity, such as sepsis, myocardial infarction, stroke, renal failure and pneumonia, before and after the implementation of PBM. It is expected that PBM will reduce the incidence of preoperative anemia in elective patients, result in lower blood product usage, and will thereby potentially reduce costs and complications and improve individual patient outcome as it has already been shown in other trials [32, 34]. Such high-quality data will also help to sustain the program through positive feedback to the medical experts.

Results of a Questionnaire Study in Frankfurt

In order to monitor progress regarding risk perception, clinical knowledge and perioperative practice among the staff, we used a questionnaire at the University Hospital Frankfurt. As PBM in Frankfurt currently focuses on surgical patients and their attending physicians, the questionnaires were distributed to surgeons and anesthesiologists. They were handed out in paper format to physicians attending the introduction session of PBM and before a PBM

lecture 1 year thereafter. In July 2013, 142 clinicians completed the questionnaire and 101 in August 2014.

Absolute certainty that the treatment of preoperative anemia favorably influences morbidity and mortality rose from 25 to 37%. Common transfusion triggers changed as well: 29% compared to 22% stated that they routinely use 'hemoglobin < 6 g/dl' as an indicator for RBC transfusion. Furthermore, 31% of the clinicians used physiological transfusion triggers such as ECG changes or lactic acidosis as a trigger for transfusion after 1 year of PBM compared to 27% before implementation. Additionally, transfusion behavior seems to have been affected as shown in figure 2: After 1 year of PBM, 56% of clinicians stated that they clinically reassess the patient and analyze hemoglobin following each single RBC unit compared to only 38% stating this in 2013. These results show that change is taking place, but there is still potential for future improvement.

Conclusion

The task of synthesizing up-to-date, evidence-based knowledge and conveying it to clinicians is challenging. The sustainable implementation of new standards of care into daily routine, however, is even daunting. We found that especially the inertia of previous practice often hinders compliance along with skepticism that au-

tonomy will be eroded by new standards. The obstacles to tackle are paucity of knowledge as well as lack of self-efficacy and outcome expectancy. Furthermore, medicine is not just facts applied to problems, but an art of combining scientific evidence, knowledge, and clinical judgment to the best possible care of our patients! This is important to keep in mind when trying to design a method for change of behavior. Shifting a paradigm takes a long breath, but PBM will make clinicians more knowledgeable and better skilled in caring for their patients and hence result in improved clinical outcomes. Looking down the line, PBM programs will certainly evolve as a main quality indicator for hospitals.

Additionally, our results show that our implementation strategy was effective in changing physicians' risk perception, attitude, and knowledge on PBM principles, and our experience highlights key success factors for the implementation of a comprehensive PBM program.

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