Original article

Patient Blood Management in 2023: a Nationwide Survey of Anesthesiologists in Romania following the 2018 Guidelines

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Background - In 2018, Romania established national guidelines for patient blood management (PBM), endorsed by the Romanian Society of Anesthesia and Intensive Care (SRATI) and approved by the Ministry of Health. These guidelines emphasize managing anemia, coagulation issues, and the cautious use of allogeneic transfusions to improve patient outcomes.

Materials and methods - A national survey was conducted among Romanian anesthesiologists to assess PBM guideline adoption. It included 38 questions addressing PBM strategies, resources, transfusion practices, and barriers to implementation. The survey was distributed via email to the SRATI database.

Results - Out of 512 professionals who opened the survey, 74% had adopted some PBM measures, and 97% recognized PBM's efficacy in improving outcomes. However, only 33% of anesthesiologists worked in hospitals with formal PBM groups, and 39% had attended PBM-related educational events. Preoperative anemia management was inconsistent, with only 33.5% routinely treating anemia. Access to diagnostic and therapeutic tools was limited; transferrin saturation testing was available in 27% of cases, and erythropoietin was used in 24%. Despite these limitations, 72% of respondents treated anemia with intravenous iron.

The main challenges to implementation included insufficient time for pre-surgical assessments, lack of standardized procedures, and difficulties in surgeon-anesthetist collaboration.

Discussion - The survey highlights the need for systemic improvements in PBM adoption. Recommendations include enhancing organizational structures, standardizing protocols, and improving interdisciplinary collaboration to boost PBM implementation in Romania. While progress has been made, a national program with dedicated funding and auditing could facilitate widespread PBM integration into clinical practice.

Keywords: *Patient Blood Management (PBM) guidelines, anesthesiologists, Romania, healthcare implementation, survey study.*

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INTRODUCTION

In 2018, a collaboration between the Romanian Society of Anesthesia and Intensive Care (SRATI) and the Ministry of Health (MoH) led to the establishment of national guidelines for patient blood management (PBM) in Romania[1]. This initiative was undertaken by a multi-disciplinary team, including anesthesiologists, transfusion medicine physicians, surgeons, orthopedists, and nephrologists. The guidelines were endorsed by SRATI and first published in SRATI's official journal in 2017[2]. The goals of these guidelines were to improve patient outcomes by assessing and treating perioperative anemia and coagulation disorders, avoiding unnecessary blood transfusion and delivering blood products to those in real need, while decreasing the cost of hospital stay[2]. Allogeneic transfusions, while life-saving in some cases, are often a scarce resource that must be managed wisely and recent data suggests that PBM implementation reduces allogeneic transfusion, while improving outcomes[3,4].

The guidelines address the entire process of perioperative blood management, emphasizing the importance of patient's own blood management pre-, intra-, and postoperatively, through the adequate treatment of anemia, as well as the improvement of conservation strategies. By implementing these guidelines, healthcare providers are encouraged to evaluate each case carefully, considering treatment alternatives and keeping the main focus on the patient's individual needs. This approach not only helps in maintaining a sustainable blood supply but also reduces the risk of transfusion-related complications, thus enhancing the overall safety and quality of healthcare. Based on these guidelines, audits have been published on anemia treatment and transfusion practice[5,6].

Despite these positive factors, national PBM implementation is challenging due to various logistical, cultural and local institutional causes, each dependent on individual country or region specificities[7-10]. The aim of this study is to assess the progress and current practices of PBM in Romania five years after guidelines were officially established and identify the challenges and difficulties hindering its implementation.

MATERIALS AND METHODS

Study design

A working group assigned by the Board of the SRATI developed this survey comprising 38 themes. These questions were designed to gather insights on the adoption of PBM, strategies in place, resources at hand, and the transfusion practices employed across varied clinical environments and patient groups with differing health complexities. We also sought to identify the obstacles faced in the implementation of PBM protocols. The questions were agreed upon after several rounds of discussions via e-mail and were established after consensus of the group. Demographic data regarding the respondents' practice setting (type of hospital, private or public practice, geographical origin) were collected. 37 questions were multiple-choice and 1 question gathered qualitative data through an open-ended response. All the questions can be consulted in the *Online Supplementary* **Table SI**.

Ethics and subjects

This survey received the ethical approval from the Department of Medical Education and Research of the SRATI (No. 5/3 March 2023). It was distributed to the SRATI database via email on the 9th of March 2023. Anonymity of the participants was ensured to encourage candidness and transparency. In order to paricipate, respondents were required to give consent, being assured of proper ethical standards and respect for their privacy. To bolster participation, reminder emails were dispatched at regular intervals. The initiative spanned six months, concluding on the 9th of September 2023, which allowed sufficient time for thorough engagement from the anesthesiologist community. The survey was performed using the platform SurveyMonkey.

Statistical analysis

Statistical analysis was performed using Microsoft Excel® (Microsoft Corporation, Redmond, WA, USA). Results are reported as absolute numbers and percentages (%) and using visual description. The open-ended answers were thoroughly analyzed, and relevant opinions were selected based on author evaluation and relevance in the population.

RESULTS

A total of 512 anesthesiologists started the survey, and 331 answered all applicable multiple-choice questions (64.6%). This represents a ratio of 17.5% of an estimated 1,884 anesthesiologists active in Romania, as estimated by the Romanian College of Physicians)[11]. Of this total, 74%

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(375/507) reported implementing at least some aspects of PBM in their daily practice, and 97% (493/508) thought that PBM was useful for improving the outcome of surgical patients. However, only 33% work in a hospital with a formal PBM implementation group, and only 39% have taken part in educational events at a hospital level in the preceding three years.

More than a quarter (28%) stated that they learned about PBM from the Romanian guidelines, 47% from a scientific congress, and 7% from a paper: only 9% did not know what PBM was.

Demographic data

The demographic distribution of respondents is shown in **Table I**. The majority of them were employed in public hospitals (89.5%), with a substantial representation from institute/teaching hospitals (39%), followed by county hospitals (27.3%) and city hospitals (20.1%). A smaller segment reported working in other types of hospitals (13.5%). Few anesthesiologists were engaged in private practice (5.1%), and an equivalent proportion (5.4%) indicated involvement in both public and private sectors.

The main types of surgical activity which responders were involved in were general surgery (71.4%), orthopedics (54.5%), and obstetrics-gynecology (44.9%). Other specialties represented included ear-nose-throat (29.5%), trauma (29.5%), vascular (24.7%), and neurosurgery (24.4%). Cardiac anesthesiology was less common, involving 12.1% of respondents, and 17.2% indicated involvement in other surgical areas not listed. With respect to clinical experience, the respondents spanned from physicians in training (13.3%) to specialist physicians (33.8%). Senior consultants constituted a notably high percentage (52.9%), indicating a wide range of experience levels.

The geographical distribution of respondents, stratified according to the 8 development regions of Romania, is shown in **Table II**. Almost a third of respondents were from Bucharest-Ilfov (32.7%), while two of the regions (South and South-West) were significantly under-represented, with 5.25% each: the rest of the regions had a fairly even distribution of around 10% of respondents. This skewed distribution of respondents is not unexpected, as, according to recent sources, 523/1,884 anesthesiologists practice in Bucharest, while some counties and regions are dramatically understaffed[11].

Table I - *Demographical data*

	No.	%
Type of hospital		
Institute/Teaching hospital	130	39
County hospital	91	27.3
City hospital	67	20.1
Other	45	13.5
Type of practice		
Public	298	89.5
Private	17	5.1
Both	18	5.4
Surgical activity		
General	237	71.4
Orthopedics	181	54.5
Obstetrics-gynecology	149	44.9
Ear-nose-throat	98	29.5
Trauma	98	29.5
Vascular	82	24.7
Neurosurgery	81	24.4
Cardiac	40	12.1
Other	57	17.2
Clinical experience		
Physician in training	175	13.3
Specialist physician	112	33.8
Senior consultant	44	52.9

Preoperative anesthetic visit

Regarding the self-reported practices of preoperative anesthetic consultation among Romanian anesthesiologists, our investigation stratified the timing of consultations into four distinct periods: more than seven days before surgery, within one to seven days prior,

Table II - *Geographical distribution of respondents*

Region	No.	%
Bucharest-Ilfov	106	32.72%
North-East	36	11.12%
South-East	32	9.89%
South	17	5.25%
South-West	17	5.25%
West	38	11.73%
North-West	39	12.04%
Center	39	12.04%

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on the day before surgery, and on the morning of the operation.

Analysis of the survey data (**Figure 1**) reveals a limited number of anesthesiologists who regularly engage in consultations well in advance of the operative date. In contrast, there was a much higher frequency of consultations in the period spanning one to seven days before surgery, suggesting that this was the preferred interval for preoperative evaluation. A large proportion of respondents indicated that consultations are "Usually" performed on the eve of surgery, though less often in comparison to the "Always" approach. The morning of the surgery exhibits a diverse range of practices, with no single frequency dominating the responses, reflecting a spread across more occasional consultations.

Management of perioperative anemia

Notably, a substantial proportion of respondents indicate sporadic treatment, reflective of a non-uniform approach to preoperative anemia care; only 33.53% declare that they treat anemia routinely (**Figure 2**). Complementing this, the pie chart depicts the division of healthcare entities with and without established local standard operating procedures (SOPs) for anemia management, revealing a near-equitable split (46% yes and 54% no).

In terms of diagnostic and therapeutic capabilities, the data shows a near-universal availability of full blood count testing, a somewhat lower availability of C reactive protein (CRP) tests (87%), but significantly lower access to important etiological markers of anemia (79% ferritin, 51% reticulocyte count, 27% transferrin saturation coefficient, and only 4% transferrin soluble receptor). Therapeutically, high-dose intravenous iron is most commonly stocked (72%), whereas erythropoietin is least available (only 24%), indicating a preference for iron supplementation over erythropoiesis-stimulating agents in the treatment arsenal.

Perioperative bleeding management

The diagnostic and procedural aspects of hemostasis management in surgical settings are available in **Figure 3**. The upper left bar graph delineates the array of preoperative diagnostic tools utilized for hemostasis assessment, with platelet count and activated partial thromboplastin time (aPTT) being the most common tools employed, at 97% and 95% respectively. A total of 21% of responders indicated that they use a standardized preoperative questionnaire for the triage of coagulation disturbances. The usage of coagulation factor analysis is rare preoperatively (14%), as is the use of viscoelastic tests (18%). As for intraoperative diagnostic tools, there is a predominant reliance on clinical experience (85%) and standard coagulation tests (93%), while 18% of responders reported making use of viscoelastic tests in intraoperative management of bleeding. Just over half of anesthesiologists (53%) include these tools in standard operating procedures for acute surgical bleeding.

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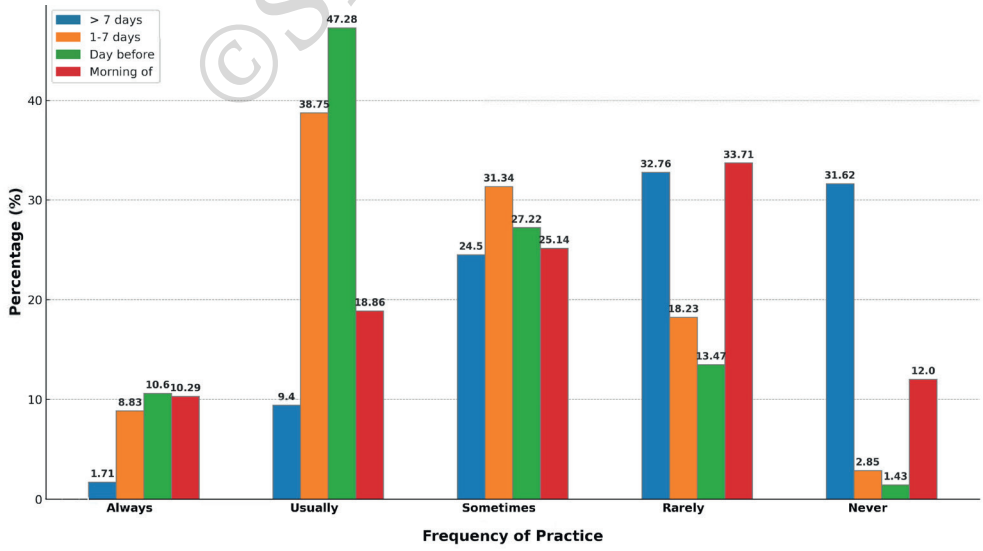


Figure 1 - Self-reported interval between pre-anesthetic visit and surgery

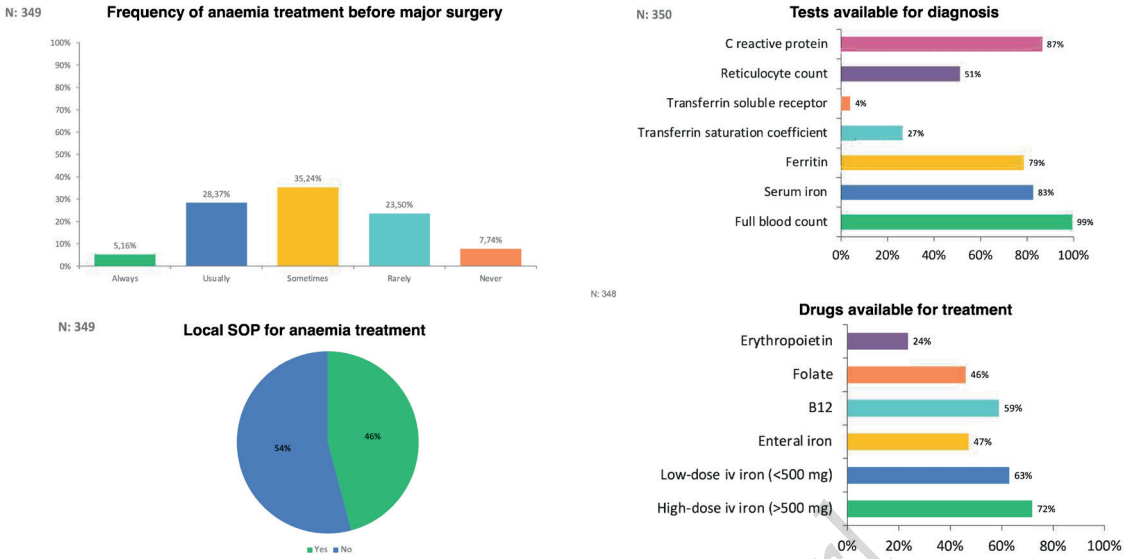


Figure 2 - Data on preoperative anemia diagnosis and treatment
SOP: standard operating procedure.

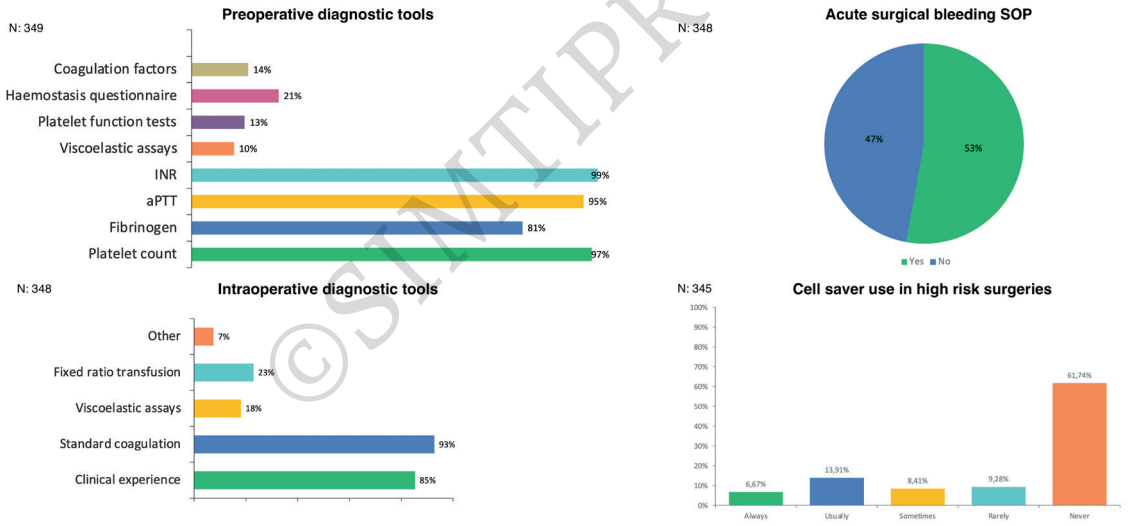


Figure 3 - Perioperative bleeding management tools and procedures
SOP: standard operating procedure.

Adjacent to this, the lower right bar graph depicts the frequency of cell saver device utilization in high-risk surgeries. A significant portion of respondents (61.74%) report "Never" employing cell savers, while a small fraction (6.67%) state that they use them consistently.

Tranexamic acid is another bleeding management method recommended in the guidelines for patients undergoing major surgery; 28.6% of Romanian anesthesiologists reported using it routinely in their current practice, while 48.8% said they used it prophylactically in patients with a high bleeding risk, and 38.1% used it therapeutically in patients with suspected hyperfibrinolysis (38.1%): only 12.4% said they never used it due to lack of availability.

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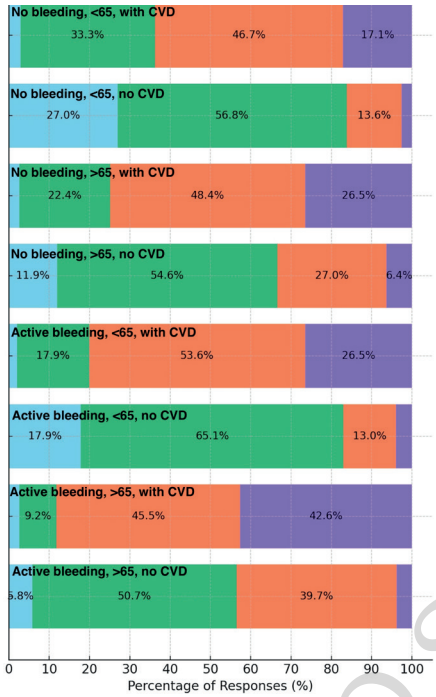


Figure 4 - Self-reported transfusion practice in stable and bleeding patients, with and without cardiac co-morbidities

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Transfusion practice

The survey data sheds light on the varied approaches to red blood cell (RBC) transfusion decisions by anesthesiologists in Romania across a range of clinical situations (**Figure 4**). When considering the transfusion thresholds for anemic patients devoid of active bleeding and cardiac issues, a large majority indicated a preference for a threshold of 7 g/dL or lower. This was notably the case for patients younger than 65 years, with 83.8% adhering to this standard, while the figure stood at 66.5% for the more elderly patients. The criteria for transfusion were more conservative in presence of patients with cardiac conditions, with a higher hemoglobin threshold of 8 g/dL or more being favoured. This was the case for 63.7% of the younger cohort and an increased proportion of 74.9% for those aged 65 and above. For patients undergoing surgery with concurrent active bleeding, the threshold of 7 g/dL or lower was maintained by 83% of practitioners for patients under 65 but dropped to 57.5% for older patients. The incorporation of cardiac disease into the scenario resulted in a marked shift, with only 17.9% of clinicians opting for a hemoglobin threshold of 7 g/dL or less for younger patients and a mere 11.8% for older individuals.

Perceived barriers in multiple choice questions and proposed solutions in open-ended questions

The most important perceived barriers in implementation are (**Figure 5**) the short time between patient assessment and surgery (77.5%), the lack of organizational framework and procedures (53.1%) and the difficulties involved in cooperation between anesthesiologist and surgeon (48%).

Of our respondents, 207 anesthesiologists provided a response to the open-ended question, offering suggestions for how to solve those problems that they see as representing the biggest obstacles to PBM implementation. Some of these answers were lengthy and expressed with great feeling; due to a lack of space, we have tried to summarize those opinions expressed most often by respondents.

"Better information among the staff regarding the evaluation of anemia, making the routine pre-anesthetic consultation compulsory at least 14 days before scheduled interventions", "courses and procedures", "the creation of ambulatory preanesthetic consultation offices by central government decision, "establishing standard procedures for all institutions", "adequate equipping of hospitals with equipment necessary for the complete determination of

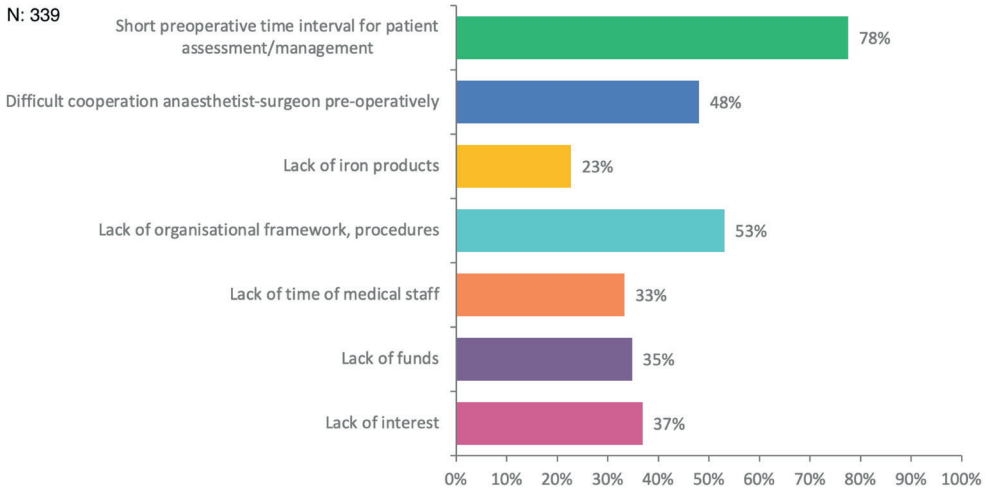


Figure 5 - Perceived barriers to PBM implementation

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the coagulation status", and "better access to funds for intravenous iron, coagulation factors, viscoelastic tests and cell-savers" are just some of the most representative answers, and they provide a good summary of what Romanian anesthesiologists view as the best pathways towards improving care.

DISCUSSION

This is the first survey on PBM implementation in Romania. The results show that a significant percentage of anesthesiologists try to implement PBM measures (74%), but as the overall results make very clear, this implementation is not uniform and generalized. Although it difficult to measure the impact of the guidelines themselves, the responses suggest that there has been some effect, whether this be direct or indirect, in the course of medical conferences and educational events[1].

Our data comes from a fairly large sample of active anesthesiologists in Romania (17.5%), with a good representation among different types of surgical activities, and an important proportion of consultant physicians among those responding to the questionnaire. While most of those responding are physicians working in the public system (thus making private practice extrapolation of these results less reliable), there is a good spread between academic/teaching hospitals and others, enhancing the representativity of the responses.

One barrier which emerges from these responses is the difficulty in ensuring a timely pre-anesthetic visit. While both PBM and safety guidelines issued by the MoH recommend pre-operative evaluation at least one week before surgery[1,12], the implementation of this recommendation is low (**Figure 1**). Most anesthesiologists reported that the common practice ("usually" and "always") is to see the patient either the day before (57.88%) or the actual morning of surgery (29.15%). This obviously makes it more difficult to guarantee preoperative optimization of the patient's RBC mass, as recommended in multiple national and international guidelines[13-16].

Other perceived barriers to PBM implementation derive from the sequence of inadequate access to tests for diagnosing anemia etiologically, incomplete access to the necessary drugs and low frequency of institutional standard operating procedures for this purpose (**Figure 2**). This is not a commonly cited barrier in implementation, which suggests that there is uneven access to medical care due to both lack of awareness, and to lack of resources[17,18]. In our survey, only 27% of anesthesiologists said they had access to transferrin saturation coefficient, which, according to the latest international literature and consensus statements for the management of perioperative anemia[19,20] makes complete diagnosis of iron deficiency and iron deficiency anemia unlikely in a substantial proportion of patients. Furthermore, while access to intravenous iron products is more common (72%), only 46% have a local standard operating procedure

for the preoperative treatment of anemic patients. It is not surprising, then, that this treatment is uncommon for most of our respondents. This was a very important finding for us, since audit data from other health systems has found that in major surgery, failure to manage pre-operative anemia is associated with worse outcomes[21,22].

With regard to perioperative bleeding management, another essential component of PBM, the same combination of inadequate resources and absence of standard operating procedures leads to incomplete implementation of this recommendation in the perioperative period. Irrespective of resources, there was only a 21% implementation of a standardized hemostasis abnormalities questionnaire, even though recent reports cite it as an independent negative predictor of RBC transfusion[23]. Intraoperatively, most anesthesiologists use standard coagulation tests and clinical experience to guide bleeding management, while only 53% reported using a standard operating procedure for acute bleeding, also recommended by the guidelines. This overall picture is completed by an almost generalized lack of access to cell-salvage devices for high-risk surgeries (more than 70% rarely or never use it, and only 6.6% always use it). This makes it extremely difficult to implement the most recent recommendations from scientific societies, despite the awareness of the indication[16].

Moreover, only 18% of respondents reported actually having access to viscoelastic testing, despite the fact that a significant proportion of anesthesiologists said they worked in surgical settings where such testing is by now increasingly recommended - cardiac (12%), trauma (30%), obstetrics-gynecology (45%)[24].

Transfusion practice, a very important part of the third pillar of PBM, was also uneven and only partly evidence-based among respondents. This is not a surprise, as other pan-European audit data has indicated a need for continuous education among anesthesiologists in order to attain more uniform, evidence-based practice[25]. In our survey, both among stable, anemic patients and surgical, actively bleeding patients, the common practice among Romanian anesthesiologists was to follow guideline recommendations and use 7-8 g/dL (higher for patients with cardiac co-morbidities and lower for those without) as thresholds for RBC transfusion. There was, however, a wide variation in responses based on the patient's age, leading to most practitioners using a higher Hb threshold for patients aged over 65, irrespective of clinical setting and co-morbidities (**Figure 4**). This is contrary to recent evidence from randomized clinical trials, which has shown that in patients undergoing cardiac surgery, lower RBC transfusion thresholds are safer for elderly patients than for younger patients, and potentially lead to better clinical outcomes[26,27].

As mentioned above, the most common suggestion provided by those anesthesiologists who made the effort to answer the open-ended question was to have a better organizational framework by using uniform PBM protocols but also by adopting a top-down institutional approach in order to obtain more widespread implementation of the standardized, ambulatory, pre-anesthetic examination. Remarkably, when our respondents were asked what the main problem of the system was, although the problem of lack of funds was commonly mentioned in the open-ended answers, it did not figure among the top three barriers to implementation (**Figure 5** [34.8% of respondents]). This suggests that better standard operating procedures, which would also help with the related issue of surgeon-anesthesiologist collaboration, could lead to improved patient outcomes, despite imperfect access to resources, due to uneven funding of PBM throughout various hospitals in Romania.

There have been other surveys of implementation of PBM published. In the field of cardiac surgery, a survey of eight European countries published by Klein and colleagues has found that PBM guidelines have not been implemented as per the expectations of their authors, and various measures differ depending on the country[28]. A nationwide survey from Neef and colleagues, in Germany, focused on physician awareness with regard to perioperative anemia and rational transfusion, and reported a subjective increase in most components of PBM[29]. While not directly comparable in terms of its questionnaire, our survey too showed a reasonably satisfactory awareness of PBM measures, thereby supplementing and confirming the data from a Western European country with those from an Eastern European one.

A recent survey from Italy had more encouraging findings, suggesting more widespread adoption of PBM measures, at least as regards the diagnosis and treatment of

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anemia[10]. Older data from Manzini et al, had shown poor knowledge of PBM measures in a European-wide cohort of 788 clinicians in seven university hospitals[30]. This should indicate that continued educational efforts have led to greater awareness among anesthesiologist of the benefits of a PBM program for patient outcomes.

Monitorization and feedback programs have been proven to have a positive effect, leading to reductions in allogeneic blood transfusions and lower hospital costs, when done as part of an audit[31]. Although less ambitious in scope than a true audit, our survey aimed to get feedback on the implementation of national guidelines, which might hopefully lead to further improvement in national procedures, advocacy for access to adequate funding and the fine-tuning of future recommendations to better fit the practical needs of both physicians and patients. What we think would be of great help in the future would be the introduction of a standardized tool with which to assess the implementation of PBM programs[32].

Limitations

Our study has the inherent limitations of any survey-research, and there is some residual uncertainty regarding the validity of the data, given the self-evaluation pattern in many of questions asked. However, this uncertainty regarding validity might be counteracted by the completely anonymous nature of our survey. Secondly, our sample size of Romanian anesthesiologists may not seem very large as a percentage of the actual total active cohort: however, it is representative, given its balanced distribution in terms of type of surgical practice, type of hospital, clinical experience, and geographical spread. Thirdly, there is the limitation that in the absence of a validated PMB survey, our survey items had to be crafted specifically for this study, and this might limit the external validity of the results.

The future of the PBM program in Romania needs to follow two distinct paths:

Stakeholders (Ministry of Health, Hospital Managers and Scientific Societies) must be involved in the sustained, uniform, financing of the program, so as to address all three pillars of the PBM model and overcome the barriers to implementation already described in our paper; perhaps the important part of this development would be for elective surgical patients with a transfusion risk of more than 10% to be seen mandatorily by the anesthesiologist at least 7 days prior to surgery.

A real audit of the program must be performed, as an integral and compulsory part of participating in the program, in order to obtain information regarding real practice and the results of PBM implementation - the percentage of anemic patients treated per procedure, the use of antifibrinolytics, the use of cell saving, and Hb threshold and transfusion rates per procedure and per hospital.

CONCLUSIONS

This survey of Romanian anesthesiologists provides useful insight into practices surrounding PBM since the establishment of national guidelines. Our results show that there has been partial adoption of PBM with some variations in preoperative consultation timing, diagnostic test availability, and anemia management procedures. Despite adherence to the guidelines as regards transfusion thresholds, we found that practice with regard to older patients was unnecessarily conservative, indicating the need for more up-to-date training in evidence-based practices.

The key barriers to PBM implementation had more to do with poor structural organization than limited funding. Chief recommendations from our respondents included improving the quality of surgeon-anesthetist collaboration, creating standardized pre-anesthetic protocols, and increasing access to diagnostic and therapeutic tools. These measures could improve patient outcomes even within existing resource constraints.

Even while recognizing the limitations of self-reported surveys, the substantial and diverse sample size lends credibility to these findings. In order to see continued progress in PBM in Romania, the focus should be on systemic improvements to the system, and on education and optimization of resources, with the aim of ensuring a uniform, evidence-based approach to patient care.

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AUTHORS' CONTRIBUTIONS

DF and MGS conceptualized and designed the study, collected the data, conducted the formal analysis, and wrote the original draft. All the Authors reviewed the paper and took part in editing the final version. All the Authors approved the final version of the paper.

The Authors declare no conflict of interest.

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