

COMMENTARY

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# Patient blood management programs: how to spread the word?

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## Abstract

Red blood cell (RBC) transfusions save lives and improve health; however, unnecessary transfusion practice exposes patients to immediate and long-term negative consequences. Indirect consequences of unnecessary transfusions are the reduced availability of RBC units for patients who are in need. Accumulating evidence shows that *restricting* RBC transfusions improves outcomes and current guidelines suggest limiting RBC transfusion to the minimum number of units required to relieve symptoms of anemia or to return the patient to a safe hemoglobin range (7–8 g/dl in stable, non-cardiac inpatients). Still, studies show that there is over-utilization of RBC transfusion, partly due to low level of knowledge of physicians regarding restrictive RBC transfusion policy across a broad range of professions and specialties. Patient blood management (PBM) programs have been developed to promote clear hospital transfusion guidelines, strive for optimization of patient hemoglobin and iron stores and, most importantly, improve education regarding restrictive RBC policy. Understanding what and where the gaps of knowledge are, as was done in the study by Dr. Koren and his colleagues, is an important step for developing effective PBM programs.

## Background

Restrictive blood management policy is a relatively new concept. For many decades, red blood cell (RBC) transfusion was used liberally, without specific threshold triggers and with no evidence based data of benefits or risks. With the accumulating evidence that *restricting* RBC transfusions improves patients' outcomes the policy has gradually changed. Pooled results from 3 trials with 2364 participants showed that a restrictive hemoglobin (Hb) transfusion trigger of Hb < 7 g/dl resulted in reduced mortality and hospital-related morbidity compared with a more liberal strategy; the number needed to treat (NNT) with a restrictive strategy (Hb < 7 g/dl) to prevent 1 death was 33 [1]. Transfusion strategies showing the benefit of *restricting* RBC transfusions have been evaluated in various settings including adult critical care [2, 3], pediatric critical care [4] and in patients with acute upper gastrointestinal bleeding [5]. However, it is important to emphasize that given that the risks and benefits from blood transfusion are not straightforward, it is plausible that optimal

transfusion thresholds may vary based upon the level of risk and underlying medical disorder.

Guidelines for RBC transfusion in stable, non-bleeding patients were developed and published based on a synthesis of existing clinical evidence, practice guidelines, and institutional preferences [6]. Stable, non-bleeding medical and surgical inpatients are considered candidates for RBC transfusion when the Hb level is  $\leq 7$  g/dl. Transfusion should be considered for inpatients with active, acute coronary syndromes with a Hb level  $\leq 8$  g/dl, with exceptions including low oxygen saturation, end-organ ischemia, ongoing bleeding, and hypotension [7]. Critical care medical and surgical adult inpatients being treated for sepsis during the first 6 h of resuscitation may be transfused with a Hb level  $\leq 10$  g/dl. All RBC transfusions in non-bleeding inpatients should be ordered as single units. If transfusion is indicated based on Hb level, post-transfusion Hb must be obtained before ordering additional units [6]. One of the five first recommendations of The American Society of Hematology (ASH) Choosing Wisely® committee focused on avoiding liberal RBC transfusion [8]. The specific recommendation was that in situations where transfusion of RBCs is necessary, transfusion should be limited to the minimum number of units required to relieve symptoms of anemia or to return the patient to a safe hemoglobin range (7–8 g/dl in stable, non-cardiac inpatients).

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## Patient blood management

Patient blood management (PBM) programs have been developed worldwide in order to optimize the utilization of blood components and, as a result, an up to 40% reduction in RBC units transfused per patient has been achieved [9–17]. Lack of such hospital PBM programs results in an extensive liberal RBC transfusion practice, as was shown in a large Danish study [18] and in a study we performed in three hospitals in Jerusalem, Israel [19]. In order to succeed with reducing the utilization of RBC units, the PBM program needs to include several important elements:

1. Clear hospital transfusion guidelines including single unit transfusion policy, laboratory “gatekeeping” and the use of an electronic ordering system for blood products (identifying the clinician who ordered blood products is important for feedback and audit).
2. Optimization of patient hemoglobin and iron stores by appropriate diagnosis and treatment of anemia (especially prior to surgeries/procedures), optimization of hemostasis, and minimization of iatrogenic blood loss (i.e. reduction of patient blood sampling, reduction of surgery-related blood loss)
3. Implementing a comprehensive information and consent form outlining the risks and benefits of RBC transfusion, and requiring signatures from both patient and clinician, thus enhancing general awareness among clinicians regarding the adverse events associated with allogeneic blood transfusions.
4. Education.

## Clinicians’ knowledge of patient blood management

In their interesting paper which was recently published in *IJHPR*, Dr. Koren and his colleagues address the issue of clinicians’ knowledge regarding RBC use, specifically the knowledge concerning restrictive blood management policy [20]. As correctly stated by the authors, the lack of knowledge in the field of transfusion medicine may play an important role in over-utilization of RBC transfusion. Understanding what and where the gaps of knowledge are is an important step for developing an effective educational program for PBM. In their cohort of 79 physicians working in the surgical and internal medicine department at the Galilee Medical Center in Israel, the overall transfusion-related knowledge was found to be average (mean score was  $47.8 \pm 18.6$ ) and to differ between fields of specialty, i.e. internal medicine physicians showing a greater level of knowledge compared to surgeons, and by level of seniority. No differences in response score was found regarding indications for transfusion. Knowledge regarding familiarity with restrictive blood management was similarly low and again differed between fields of specialty, i.e.

internal medicine physicians demonstrating a higher level compared to surgeons, and senior physicians a higher level than juniors. Interestingly, in a study we performed in three hospitals in the Jerusalem area, the results were similar; Familiarity with the term “restrictive transfusion” was greater among senior physicians compared to interns/residents [OR 3.95 (95% CI 2.09–7.47)] and among inter-nists compared to surgeons [OR 2.35 (95% CI 1.26–4.37)]. Inadequate knowledge regarding the principals of PBM was also reported among clinicians working in seven European hospitals [21], 1242 physicians from Iran [22], and 474 residents from 23 programs in the USA [23]. Importantly, the majority of residents (65%) stated that additional transfusion medicine training may be “very” or “extremely” helpful [23]. Although RBC transfusion is one of the most common procedures performed in hospitals [24], it is surprising and disappointing that the training of medical students and residents in the field of transfusion medicine is lacking [25, 26].

## So what should and can be done now?

The first step is to achieve nationwide agreement to adopt a *restrictive* RBC transfusion policy. This was recently done when the Hematology Choosing Wisely® committee of the Israel Medical Association adopted a statement similar to the ASH document, encouraging the use of no more than the minimum number of RBC units necessary to relieve symptoms of anemia or to return a patient to a safe hemoglobin range (7 to 8 g/dL in stable, in-patients) ([www.ima.org.il](http://www.ima.org.il)).

The next step is to establish PBM programs. The Ministry of Health has issued a call to open a Blood Bank Committee in all Israeli Hospitals with the aim to write and follow in-house RBC transfusions guidelines. These committees could be the base for in-hospital PBM program using a recently published comprehensive working template encompassing over 100 different measures [27]. Implementation of these programs requires a team approach that can be promoted by hematologists and transfusion medicine specialists; however, the involvement of specific specialties, mainly anesthetics, surgery, and intensive care, is essential. The programs should be proactive, patient-centered, and led by hospital key leaders, who should play a central role in domains of communication, education, and documentation.

Extensive educational programs of lectures, workshops, E-learning course, etc. at the undergraduate and post-graduate levels of both medical and nursing staff is the main component of success; and as was shown by Koren, et al. and others, a component that is currently significantly lacking. This educational effort may be undertaken locally (i.e. in and by the hospital or university), but would probably achieve better results if done on a national basis. Introduction of a validated exam can be used to determine

knowledge deficits and assist in the design of curricula to improve blood product utilization [28].

In conclusion, the knowledge of physicians (and nurses) regarding restrictive RBC transfusion policy is still a major issue across a broad range of professions and specialties. The need to establish a PBM in hospitals and the need for improved education is clear. Since restrictive RBC transfusion improves survival and reduces cost, the investment needed in education of medical personal will likely also be prove to be cost-effective.

#### Abbreviations

NNT: Number needed to treat; PBM: Patient blood management; RBC: Red blood cell

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#### Authors' contributions

SR-V wrote the first version of the manuscript. MN reviewed the manuscript. The manuscript was finalized together. Both authors read and approved the final manuscript.

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#### References

- Salpeter SR, Buckley JS, Chatterjee S. Impact of more restrictive blood transfusion strategies on clinical outcomes: a meta-analysis and systematic review. *Am J Med.* 2014;127:124–31.
- Walsh TS, Boyd JA, Watson D, Hope D, Lewis S, Krishan A, Forbes JF, Ramsay P, Pearse R, Wallis C, Cairns C, Cole S, Wyncoll D. Restrictive versus liberal transfusion strategies for older mechanically ventilated critically ill patients: a randomized pilot trial. *Crit Care Med.* 2013;41:2354–63.
- Hebert PC, Wells G, Blajchman MA, Marshall J, Martin C, Pagliarello G, Tweeddale M, Schweitzer I, Yetisir E. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion requirements in critical care investigators, Canadian critical care trials group. *N Engl J Med.* 1999;340:409–17.
- Lacroix J, Hebert PC, Hutchison JS, Hume HA, Tucci M, Ducruet T, Gauvin F, Collet JP, Toledano BJ, Robillard P, Joffe A, Biarent D, Meert K, Peters MJ. Transfusion strategies for patients in pediatric intensive care units. *N Engl J Med.* 2007;356:1609–19.
- Villanueva C, Colomo A, Bosch A, Concepcion M, Hernandez-Gea V, Aracil C, Graupera I, Poca M, Alvarez-Urturi C, Gordillo J, Guarner-Argente C, Santalo M, Muniz E, Guarner C. Transfusion strategies for acute upper gastrointestinal bleeding. *N Engl J Med.* 2013;368:11–21.
- Szczepiorkowski ZM, Dunbar NM. Transfusion guidelines: when to transfuse. *Hematology Am Soc Hematol Educ Program.* 2013;2013:638–44.
- Kilic A, Whitman GJ. Blood transfusions in cardiac surgery: indications, risks, and conservation strategies. *Ann Thorac Surg.* 2014;97:726–34.
- Hicks LK, Bering H, Carson KR, Kleinerman J, Kukreti V, Ma A, Mueller BU, O'Brien SH, Pasquini M, Sarode R, Solberg L Jr, Haynes AE, Crowther MA. The ASH choosing wisely campaign: five hematologic tests and treatments to question. *Blood.* 2013;122:3879–83.
- Oliver JC, Griffin RL, Hannon T, Marques MB. The success of our patient blood management program depended on an institution-wide change in transfusion practices. *Transfusion.* 2014;54:2617–24.
- Leahy MF, Roberts H, Mukhtar SA, Farmer S, Tovey J, Jewlchow V, Dixon T, Lau P, Ward M, Vodanovich M, Trentino K, Kruger PC, Gallagher T, Koay A, Hofmann A, Semmens JB, Towler S. A pragmatic approach to embedding patient blood management in a tertiary hospital. *Transfusion.* 2014;54:1133–45.
- Verdecchia NM, Wisniewski MK, Waters JH, Triulzi DJ, Alarcon LH, Yazer MH. Changes in blood product utilization in a seven-hospital system after the implementation of a patient blood management program: a 9-year follow-up. *Hematology.* 2016;21:490–9.
- van Gammeren AJ, Haneveer MM, Slappendel R. Reduction of red blood cell transfusions by implementation of a concise pretransfusion checklist. *Transfus Med.* 2016;26:99–103.
- Meybohm P, Richards T, Isbister J, Hofmann A, Shander A, Goodnough LT, Munoz M, Gombotz H, Weber CF, Choorapoikayil S, Spahn DR, Zacharowski K. Patient blood management bundles to facilitate implementation. *Transfus Med Rev.* 2017;31:62–71.
- Tim Goodnough L, Andrew Baker S, Shah N. How I use clinical decision support to improve red blood cell utilization. *Transfusion.* 2016;56:2406–11.
- Wintermeyer TL, Liu J, Lee KH, Ness PM, Johnson DJ, Hoffman NA, Wachter PA, Demski R, Frank SM. Interactive dashboards to support a patient blood management program across a multi-institutional healthcare system. *Transfusion.* 2016;56:1480–1. 621
- Borgert M, Binnekade J, Paulus F, Vroom M, Vlaar A, Goossens A, Dongelmans D. Implementation of a transfusion bundle reduces inappropriate red blood cell transfusions in intensive care - a before and after study. *Transfus Med.* 2016;26:432–9.
- Yeh DD, Naraghi L, Larentzakis A, Nielsen N, Dzik W, Bittner EA, Chang Y, Kaafarani HM, Fagenholz P, Lee J, DeMoya M, King DR, Velmahos G. Peer-to-peer physician feedback improves adherence to blood transfusion guidelines in the surgical intensive care unit. *J Trauma Acute Care Surg.* 2015;79:65–70.
- Norgaard A, De Lichtenberg TH, Nielsen J, Johansson PI. Monitoring compliance with transfusion guidelines in hospital departments by electronic data capture. *Blood Transfus.* 2014;12:509–19.
- Revel-Vilk S, Karavany B, Saban R, Zelig O, Naamad M, Turniansky M, Savitsky B, Hochner H. Are we choosing wisely with blood use? An assessment of transfusion practices (abstract). *Blood.* 2016;128:1003.
- Rahav Koren R, Suriu C, Yakir O, Akria L, Barhoum M, Braester A. Physicians' lack of knowledge - a possible reason for red blood cell transfusion overuse? *Isr J Health Policy Res.* 2017;6:49.
- Manzini PM, Dall'Omo AM, D'Antico S, Valfre A, Pendry K, Wikman A, Fischer D, Borg-Aquilina D, Laspina S, van Pampus ECM, van Kraaij M, Bruun MT, Georgsen J, Grant-Casey J, Babra PS, Murphy MF, Follia G, Aranko K. Patient blood management knowledge and practice among clinicians from seven European university hospitals: a multicentre survey. *Vox Sang.* 2017; <https://doi.org/10.1111/vox.12599>.
- Gharehbaghian A, Javadzadeh Shahshahani H, Attar M, Rahbari Bonab M, Mehran M, Tabrizi Namini M. Assessment of physicians knowledge in transfusion medicine, Iran, 2007. *Transfus Med.* 2009;19:132–8.

23. Haspel RL, Lin Y, Mallick R, Tinmouth A, Cid J, Eichler H, Lozano M, van de Watering L, Fisher PB, Ali A, Parks E, Investigators B-T. Internal medicine resident knowledge of transfusion medicine: results from the BEST-TEST international education needs assessment. *Transfusion*. 2015;55:1355–61.
24. Pfuntner A, Wier LM, Stocks C. Most frequent procedures performed in U.S. hospitals, 2011. 2013.
25. Karp JK, Weston CM, King KE. Transfusion medicine in American undergraduate medical education. *Transfusion*. 2011;51:2470–9.
26. Vasconcelos Vaena MM, Cotta-de-Almeida V, Alves LA. Transfusion medicine in medical education: an analysis of curricular grids in Brazil and a review of the current literature. *Rev Bras Hematol Hemoter*. 2016;38:252–6.
27. Meybohm P, Froessler B, Goodnough LT, Klein AA, Munoz M, Murphy MF, Richards T, Shander A, Spahn DR, Zacharowski K. Simplified international recommendations for the implementation of patient blood management. *Perioper Med*. 2017;6:5.
28. Haspel RL, Lin Y, Fisher P, Ali A, Parks E. Biomedical excellence for safer transfusion C. Development of a validated exam to assess physician transfusion medicine knowledge. *Transfusion*. 2014;54:1225–30.

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