

Call to Action – Closing the Gap to Make Patient Blood Management the New Norm(al) as Viewed by Implementors in Diverse Countries

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Abstract

Background

Millions of hospitalized patients are anemic. However, anemia is an independent risk factor for adverse outcomes including morbidity and mortality. In combination with blood loss, anemia is the main driver for transfusion, thus adding risk for adverse outcomes. Patient Blood Management (PBM) is a concept to identify and correct anemia and to minimize blood loss. Evidence demonstrates that PBM significantly improves outcomes and safety while reducing cost by macroeconomic magnitudes. Despite its huge potential to improve healthcare systems, PBM is not yet adopted broadly. By gathering the experiences of a diverse group of PBM implementors across countries with different healthcare contexts, we aimed to identify the drivers, barriers, measures, and stakeholders regarding the implementation of PBM. The synthesis of this information should provide a matrix of complementary measures, allowing PBM stakeholders from diverse professional backgrounds to initiate and orchestrate PBM implementation.

Methods

Semi-structured interviews were conducted with 1-4 PBM implementors from 12 countries in Asia, Latin America, Australia, Central and Eastern Europe, the Middle East, and Africa. Responses were summarized per country, and key observations extracted. By defining the levels of intervention for PBM implementation and applying the Donabedian Quality Framework, we created and populated a matrix of key measures and outcomes as identified from the interviews.

Results

We were able to extract a set of structural and procedural PBM implementation measures from interviews with the implementors. We created a matrix addressing six levels of implementation including government, healthcare providers (HCP), funding, research, training/education and patients and identified structural and procedural measures on each level.

Conclusion

This matrix helps to decompose the complexity of PBM implementation into concrete measures on each implementation level. It provides guidance for diverse stakeholders to independently initiate and develop strategies to make PBM a national standard of care, thus closing current practice gaps and matching this unmet public health need.

Background

Of the millions of patients hospitalized yearly, a large proportion is anemic at admission. Preoperative anemia rates range from 20-75% (1), and hospital acquired anemia often adds to the problem (2). In most cases, anemia is not considered a clinically significant condition, remains unnoticed, and therefore uncorrected in hospitalized patients. When patients become moderately to severely anemic, many clinicians simply administer transfusions. High prevalence of anemia combined with surgical and iatrogenic blood loss drives most of the 112 million blood donations each year (3).

However, a large body of evidence shows that anemia, blood loss, and transfusion are independent risk factors for adverse outcomes including morbidity, mortality and average length of hospital stay (4–7). Patient Blood Management is a concept to reduce and preempt the detrimental impact of this triad, defined as “an evidence-based bundle of care to optimize medical and surgical patient outcomes by clinically managing and preserving a patient's own blood”(8). This multi-professional, multimodal and individualized approach to systematically identify, evaluate, and manage a patient's own blood involves general practitioners, hematologists, anesthesiologists, intensive care specialists, surgeons, and others. It aims at pre- and perioperative anemia correction by means of intravenous iron, erythropoietin and other agents, systematic minimization of blood loss and bleeding and several other clinical strategies (7,9–13). The term ‘Patient Blood Management’ was coined in 2005(14), but the concept has been emerging since a much longer time (15,16). Meanwhile, large multicentric observational studies and randomized controlled trials demonstrated that Patient Blood Management significantly improves morbidity, mortality, and average length of hospital stay, while reducing overall cost of care (17–20). Clinical thought leaders urge that Patient Blood Management should be implemented as standard of care, and reduction of allogeneic blood product utilization should serve as a marker for success (21,22). In 2010, the World Health Organization (WHO) endorsed Patient Blood Management (23) and the fourth Strategic Objective of the ‘WHO Action framework for blood products 2020-2023’ released in February 2020 calls for ‘Effective implementation of patient blood management’(24).

However, despite compelling evidence and ongoing WHO policy drive, practical guidance for healthcare providers (HCPs) and national authorities(21,25–27) and clinical guidelines and recommendations across numerous specialties and national health systems(22,28–36), implementation of Patient Blood Management is far behind the expectations for good and safe clinical practices. Ignoring the cumulative evidence puts life, well-being and safety of millions of hospitalized patients at risk. Delaying Patient Blood Management implementation also means that healthcare systems forego savings of macro-economic magnitudes from a system-wide implementation of Patient Blood Management (20). This is even more alarming in countries striving towards Universal Healthcare Coverage and with severe resource constraints. In 2016, Eichbaum et al compared the Patient Blood Management implementation status in four countries using a six-questions survey and observed considerable variation between countries driven both by differences in health contexts and disparities in resources (37). They concluded that comparing Patient Blood Management strategies across low-, middle-, and high-income countries should foster mutual learning and implementing innovative, evidence-based strategies for improvement.

By gathering the experiences of a diverse group of implementors in Patient Blood Management across countries with different economic and healthcare contexts, and with track records of success in implementing Patient Blood Management regionally or locally, we aimed to identify the status-quo and approach of the implementation in each of the surveyed countries, and the drivers, barriers, measures, and stakeholders regarding the implementation of Patient Blood Management.

Synthesis and analysis of this information serves to provide an implementation framework for Patient Blood Management, including structural and procedural measures at various levels of intervention to improve patient outcomes at a large scale.

Methods

Semi-structured interviews mostly lasting 45-60 minutes were conducted between November 2019 and May 2020 with a multi-disciplinary group of 36 Patient Blood Management implementors leading the implementation of Patient Blood Management in their respective environment. The twelve countries from Latin America, Central and Eastern Europe, Asia-Pacific, Middle East and Africa reflected experiences from high income and Low- and Middle-Income Countries (LMIC), different levels and types of healthcare resources and system (national/ private funders, public / private providers), and different developmental stages of Patient Blood Management (from early stage to fully integrated on policy level). The interviewees differed by clinical discipline (e.g., hematologists, anesthesiologists, surgeons) and perspectives (e.g., clinical specialists, blood bank, policy, Patient Blood Management coordinator, industry). The interviews followed a newly developed questionnaire (*Additional File 1*). One question required rating of predefined barriers between 0 (not important) and 4 (very important), all other nine questions were formulated open without prompting specific answers. The survey was first piloted with eleven interviewees. Most interviews were conducted via web-communication (GoToMeeting™) by a single interviewer (AP Holtorf, Dr. rer. nat, female) in English language, two interviews were conducted by a second qualified male interviewer in Chinese language after detailed briefing by the main interviewer. The interview questionnaire was provided to the interviewees at least one week before the interviews. During the interviews, the interviewees consented to note-taking, recording, and publication of the results. The notes were revised using the recordings and the interviewees had the opportunity to review, correct or complement their initial responses.

The synthesis and analysis to provide the implementation framework followed six steps: (1) Responses per country were consolidated in a structured summary document (from two to four interviews per country except for Switzerland with one). (2) Responses from all countries regarding status-quo, approach of the implementation, and (3) drivers, barriers, measures, and stakeholders for Patient Blood Management were categorized and transferred in an electronic spreadsheet. (4) The categorized responses from step three were ranked for the frequency of mentions. (5) Accelerating and inhibiting factors were pooled and translated into implementation measures. (6) The measures were grouped by the interventional levels (policy/government, funding, research, healthcare provision, training/education, and public / patients). Steps 1 to 5 were conducted by the main interviewer.

Results

Demographics

Thirty-six Patient Blood Management implementors, named “Patient Blood Management Implementation Group” with 15 women and 21 men from 12 countries, were interviewed following eleven pilot interviews (total of 47). The respective perspectives are depicted in Table 1.

Current Status and Approach in Implementing Patient Blood Management

The country-level responses for the current level of Patient Blood Management implementation and the approaches (top-down, bottom-up, or both approaches simultaneously) are summarized in Table 2. Australia, after initial bottom-up implementation in several leading public and private institutions, has fully implemented Patient Blood Management with the support of national institutions including the National Blood Authority (NBA), the Australian Commission on Safety and Quality in Healthcare (ACSQHC), the Western Australia Department of Health (DoH) and also with the Australian Red Cross Blood Service. In South Korea, Patient Blood Management was implemented in few institutions about a decade ago, followed by a broader strategic approach supported by national authorities. In China, Turkey and Mexico, Patient Blood Management implementation originated with leading clinicians (“champions”) of large national institutions and is now increasingly recognized by the authorities. In South Africa, the implementation of Patient Blood Management is led by the South African National Blood Service and supported by a national Patient Blood Management expert group (27).

Croatia, Greece and Lebanon seek the dual pathway, although the current political situation in Lebanon has put all governmental support to a halt. Brazil, Saudi Arabia, and Switzerland currently rely on local clinician-led initiatives (bottom-up).

Drivers for the implementation of Patient Blood Management – Why should it be done?

In Figure 1, the most prominent of the eleven drivers spontaneously mentioned during the interviews were patient outcomes (26 mentions), cost savings (23 mentions), preventing or better dealing with blood shortages (16 mentions from KOR, TUR, MEX, CHN, BRA), improving patient safety or reducing complications (15 mentions from BRA, CHN, LBN, KOR, SAU, TUR). Several experts mentioned national policy (8), education and awareness (concerning the risks of transfusion and benefits of Patient Blood Management) (7), and a quality assurance system (6).

Shorter length of hospital stays, better use of resources, and reduction of waste were only mentioned once each. *Patient demand* was considered to become a driver once the risks related to transfusion and the benefits Patient Blood Management were recognized more broadly in the general population.

Barriers for the Implementation of Patient Blood Management

Except for Australia, where Patient Blood Management is already widely adopted into practice, the need to *change work practice* was rated as the most prominent barrier for the implementation of Patient Blood Management as shown in Table 3. The need for *collaboration and communication* was rated equally important across the countries, followed by the *lack of experience with Patient Blood Management, the feasibility to integrate Patient Blood Management into the current processes, and strong belief in transfusion*.

Accelerators and inhibitors for the implementation of Patient Blood Management

The responses for factors accelerating or supporting Patient Blood Management implementation fell into 24 categories as shown in Figure 2. *Generation of local data and evidence, education and training for Patient Blood Management, a national Patient Blood Management policy, and strong thought leadership*, were the most frequently mentioned factors. *Blood scarcity, funding, awareness of transfusion risks, incentives for Patient Blood Management engagement, belief and commitment of care personnel, and quality assurance obligation* were also frequently mentioned. During the final six interviews between February and May 2020, the COVID-19 pandemic was newly mentioned as potential accelerator due to increased blood scarcity and potential blood safety issues.

The inhibitors or delaying factors fell into 22 categories (see Figure 2). with the most frequently mentioned being low awareness, no funding for set-up cost, education gaps, and stickiness of the old practice (even stronger if combined with the responses for the closely related *resistance against change*), *lack of interdisciplinary commitment*, and *resistance against change*.

Stakeholders

Sixty-three percent of the interviewees (29 of 46) included policy makers (National Health Council, Ministry of Health (MoH), etc.) as important stakeholders in Patient Blood Management implementation. As shown in Figure 3, the majority also listed either specialists in general (22), or specific specialists (12 x anesthesiologists, 7 x hematologists, 5 x surgeons), 35% (16 of 46) included the hospital management. Other stakeholders (professional societies, national or regional blood banks, payers, nursing staff, enthusiastic champions, hospital pharmacists, patients/patient organizations, pharmaceutical companies, researchers/academics, hospital champion, general practitioners (GP) were mentioned less frequently or only in other parts of the interview (Medical schools, non-governmental organizations, or the public at large).

The Patient Blood Management Implementation-Matrix

After translating accelerators and inhibitors into actionable measures, six levels for intervention were identified: government/policy, funding, research, HCPs, education/training, and public/patients. Each of the six levels contributes with level-specific relevant measures to the implementation of Patient Blood Management as reflected in Table 4 with reference to the concrete examples reported by the implementors. Some of these measures are structural elements, while others relate to procedural activities. A fully structured and detailed 18-field implementation matrix in which all measures are differentiated by their nature into structure and process and where target outcomes are defined for each level – following the Donabedian model for evaluating quality in healthcare (38,39) – can be downloaded as additional online material (Additional File 2).

Government: Patient Blood Management was expected to improve quality of care, reduce dependency on donor blood, and contribute to better access to healthcare and equity (evidence-based blood preservation for all patients/citizens in the country). National policy makers and senior representatives of the MoH were considered important to disseminate the information and implement Patient Blood Management nationally (see Figure 3). Reporting and incentivization of key performance indicators, Patient Blood Management accreditation of HCPs, Patient Blood Management certification of clinicians, and funding and facilitating the development of multi-disciplinary national Patient Blood Management guidelines form essential structural elements for driving Patient Blood Management implementation nation-wide.

HCPs: Implementors expected HCPs to benefit from Patient Blood Management through improved outcomes at reduced cost. The identification of local champions and allies, the securing of funding, information technology (IT) infrastructure and support to enable Patient Blood Management data collection, reporting and benchmarking was deemed equally necessary as establishing multi-professional teams, Patient Blood Management committees, program coordinators and nurses. Many preferred a piloting approach (“harvest low hanging fruit”), accompanied by the development of internal capability, to gain practical experience and to optimize the Patient Blood Management processes in the local context. The stepwise approach also included developing Patient Blood Management standard operating procedures, defining key performance indicators, and measuring outcomes. Electronic clinical decision support systems for administering transfusions were deemed effective, also if combined with systems to incentivize, ‘nudge’, and reward the progression towards Patient Blood Management.

Training and Education: Implementors agreed that clinical Patient Blood Management knowledge and skills must be embedded in both under- and postgraduate education (curricula in medical schools, accredited continuous medical education (CME), Patient Blood Management academies, and e-learning- and information-platforms).

Research: Generating local evidence (prove of outcomes and cost-effectiveness in the local context at local cost structures) was deemed essential by the implementors, but also Patient Blood Management practice improvement through new research. Again, supporting IT architecture was seen essential for capturing and linking local outcomes data (morbidity, mortality, blood utilization/transfusion, cost). International exchange programs for Patient Blood Management research were reported to foster international collaboration and best practice development.

Funders: Implementors expected cost containment for public funders and improved profitability for private funders. Solutions for appropriate reimbursement of Patient Blood Management and anemia management were requested and several implementors proposed to incentivize Patient Blood Management for HCPs and facilitation of campaigns for increasing the awareness around Patient Blood Management.

Patients: Implementors mentioned multiple benefits for patients including improved patient satisfaction. Successful implementation of Patient Blood Management would support shared clinical decision making, and individualized treatment plans, finally leading to increased demand for Patient Blood Management and decreased demand for blood. Some implementors saw patient advocates as potential ambassadors for Patient Blood Management, reaching out to government and funding level stakeholders as well as liaising with the patient communities concerned.

Discussion

The Challenge

The implementation of Patient Blood Management is hampered by barriers mostly related to the difficulty of changing traditional “physician’s attitudes” towards transfusion(40) and “transfusion behavior”.(41–43) Even hard-hitting crises such as the HIV-pandemic in the 1970s and 1980s with tens of thousands infected from contaminated donor blood, the huge death toll, billions of dollars in financial losses from lawsuits and compensations and criminal charges (44) only had a transient impact on changing long standing transfusion practice(45). What was called at the time “transfusion alternative strategies” showed compelling results and could have been helpful to reduce overall blood utilization with similar outcomes, (46–49), but went largely unnoticed (4). Instead, the focus remained solely on improving blood product safety through introducing donor blood testing methods with unprecedented cost per quality adjusted life year (QALY) between 4.7 and 11.2 million US-\$, representing 94-224 times the then commonly accepted threshold in public health decision making (50,000 US-\$/QALY) (50,51). Meanwhile, and despite rapidly accumulating clinical evidence for adverse transfusion and favorable Patient Blood Management outcomes (52), numerous Patient Blood Management guidelines (22,28–36), WHO endorsement (23) and call for Patient Blood Management (24), and several national policy recommendations, the global implementation of Patient Blood Management is still alarmingly slow. Huge inter-center and inter-country transfusion variability indicates, that blood utilization is rather driven by culture and behavior than evidence (42,43,53–55).

An essential challenge in replacing this long-standing, well-organized, product-centered culture by a patient-centered treatment model is that most diverse stakeholders need to communicate, collaborate and overcome the complexity of the Patient Blood Management implementation process. This starts with their specific contribution to the systemic implementation as exemplified in Table 5 and presented in more detail in the additional online material (Additional File 2).

Using the Implementation Matrix to Develop Patient Blood Management Strategies

Unless translated into the daily routine and organizational culture, evidence is of limited value (56). To bridge the gap and effectuate the necessary culture change, it is essential to understand the drivers and barriers for Patient Blood Management as well as the stakeholders’ roles and responsibilities. The Patient Blood Management-implementation matrix, as derived from the interviews, guides Patient Blood Management implementors in systematically identifying effective measures for Patient Blood Management implementation depending on the economic and healthcare context in their country. These measures will be discussed in more detail along six implementation levels.

Government Level

The focus of Patient Blood Management is to improve patient outcomes by managing and preserving the patient’s hematopoietic system in surgical and medical settings. Corollaries of Patient Blood Management are decreased demand for blood products and significant reduction in average length of hospital stay. In Western Australia, hospital stays were reduced by almost 70,000 days over 5 years (20). Suchlike improvement enhances capacity of care and consequently, patient access, and resource utilization. Reduced morbidity, mortality, and improved patient safety related to Patient Blood Management are likely to increase life-expectancy, health-related quality of life, and national productivity. Massive savings due to Patient Blood Management allow for better allocation of scarce resources, thus increasing productivity of the healthcare sector. The multiple-win advantage of Patient Blood Management (57) support national healthcare priorities such as better equity, access, and affordability. This should motivate national policy makers to sharpen the national policies by prioritizing Patient Blood Management.

A national Patient Blood Management policy, as suggested by some of the implementors, needs to address the broad scope of Patient Blood Management with a bundle of measures as described earlier(58). Introducing Patient Blood Management through local Patient Blood Management pilot programs can happen more rapidly than a full national policy and program, and may serve as a prototype proving feasibility, success, and effectiveness in the local context.

Structural changes on government level usually require long time. One implementor stated “it takes more than seven years to introduce a policy in our country”. Creating a sense of urgency through multiple stimuli can help to overcome the inertness for introducing a new medical model perceived as being complex(15).

Healthcare Provider Level

Patient Blood Management offers the rare opportunity to improve patient outcomes while reducing resource utilization and cost (20,59,60). The HCP related measures reported by the implementors start with the identification of local champions and allies from clinical and non-clinical departments but also encompass establishing multi-disciplinary teams including IT and administration, Patient Blood Management committees, program coordinators and other dedicated staff, and securing of funding, reinforcing the recommendations by previous experts (25,58).

Introducing Patient Blood Management practically via piloting accompanied by internal capability building through training and gaining practical experience, also is aligned with published approaches to change (61,62). Developing Patient Blood Management standard operating procedures helps tailoring the general guidance to the local context, and electronic transfusion decision support systems can effectively reduce transfusion rate and index in the daily routine(63,64) and serve as a ‘nudging’ mechanism. ‘Nudging’ denotes “non-regulatory and non-monetary interventions for changing behavior that steer people in a particular direction while preserving their freedom of choice”(65,66). This includes automated or targeted reminders, individual performance reviews based on local data collection and analysis, or Patient Blood Management dashboards as reported elsewhere(67).

Training and Education Level

In all surveyed countries, except for Western Australia, Patient Blood Management is currently not included in the undergraduate curriculum of medical students. Like Patient Blood Management preceptorships, educational and training activities for Patient Blood Management, including accredited CME, are organized for post-graduates, often initiated by the implementors and local Patient Blood Management champions, and mostly industry sponsored. To accelerate the national uptake of Patient Blood Management and for enabling sustainability, implementors should liaise with the leadership of academia and medical schools to firmly integrate Patient Blood Management into the undergraduate education in alignment with the federal MoH and Ministry of Education, where applicable.

To avoid asymmetry of information and conflicting behaviors within the hospital, training, and communication on Patient Blood Management needs to include the entire clinical staff including nurses, pharmacists, and others influencing decisions related to managing patients’ blood.

Research Level

Patient Blood Management offers a broad spectrum of new experimental, clinical, epidemiological, and health-economic research opportunities, as evidenced by the growing number of research publications. Benchmarking and reporting of Patient Blood Management key performance indicators are contributing valuable insights concerning clinical and economic outcomes related to Patient Blood Management. Further research will help to improve Patient Blood Management techniques and was also highlighted by international thought leaders (35,58,67,68).

Funder Level

Public funders may benefit from Patient Blood Management through reduced average length of hospital stay and lower resource consumption, resulting in cost containment and better resource use. Private funders may expect higher profitability, in particular with diagnosis related groups (DRG) or value-based reimbursement systems (e.g., accountable care): in DRGs with high anemia prevalence and potentially high blood loss such as obstetrics, cardiovascular surgery or oncology, the total cost per episode of care have shown to

decrease over time, thus leading to reduced tariffs (69). For Germany, overall yearly cost-savings with elective surgery were calculated to be €1,029 million - almost 1.58% of the total national hospital budget(70).

Even in fee-for-service settings, funders may benefit from Patient Blood Management: currently, they might reimburse hospitals for the number of transfusions administered, while patients pay for their anemia treatment out-of-pocket. Where transparent, implementors in the interviews reported increasing cost of blood components (per unit) due to increasing measures for quality and safety testing. Once funders stop to incentivize transfusion and begin incentivizing (pre-operative) anemia management as an essential part of Patient Blood Management, they foster better outcomes, fewer complications, and shorter hospital stays, thus reducing the overall reimbursement cost per episode of care. This principle holds even true in healthcare systems where allogeneic blood products are covered by national funds and are considered 'free', because the cost of quality assurance and administering these blood products is a multifold of their actual acquisition cost and therefore represents a substantial cost volume for the hospital and consequently for the funder (71,72).

Given the documented savings potential with Patient Blood Management (20,70,73–76), it should be a priority for implementors to inform, educate and engage funders on this important issue. Following the example of the German health insurance BARMER (69), insurers might even help underpinning the Patient Blood Management value using their own data to demonstrate savings with improved outcomes.

Patient Level

According to the implementors, Patient Blood Management and its benefits are largely unknown to patients, despite being the 'big winners' from Patient Blood Management with significantly improved clinical outcomes, safety, and reduced average length of hospital stay. Patients usually seek medical treatment based on a proper diagnosis and expect 'their problem to be fixed' with safe and effective medical or surgical interventions. Unless being informed by their treating physician or alerted by credible public information, they would not know that Patient Blood Management improves their chances for earlier discharge from hospital and reduces their risk for hospital acquired infection or even mortality. Patient advocates could contribute by creating Patient Blood Management awareness, but also by educating, and defending patients' rights. Collaborating and likewise, supporting national campaigns to emphasize safety and the beneficial outcomes of Patient Blood Management, could foster shared clinical decision making and informed consent. Some implementors also saw the potential for patient advocates to approach funders to incentivize and support Patient Blood Management.

However, one implementor apprehended that entering the public domain too early might carry the risk of creating demand before physicians would be sufficiently familiar with Patient Blood Management and its benefit. Another implementor cautioned, that too much information on transfusion risks may negatively impact on the willingness to donate blood. Improving patient outcomes and using donated blood more effectively should always remain the priority objective of Patient Blood Management. Involvement of patients or patient advocates should happen thoroughly and be planned within the country culture and context. However, the aim to *involve patients more in their own care*(77), the strive for '*Person-centered healthcare*'(78), and the priority of increased patient safety(79–81) conforms to physicians' obligations towards educating and informing patients about all risks and benefits of available treatment options. Medico-legal experts increasingly caution that widespread disregard of transfusion associated risks for adverse outcomes may result in litigation against those physicians and specialists (82). Informing the public and the patients in collaboration with patient advocacy groups can be a powerful element of the Patient Blood Management implementation strategy. Engaging the public and patients will not only result in more demand for Patient Blood Management as best practice but also improve patient satisfaction and foster participatory medicine.

Guided Implementation

In some of the countries described in this survey, Patient Blood Management was implemented simultaneously from bottom-up (e.g., from a department level or hospital/clinical level) and top-down (driven by policy and/or hospital administrative leadership) (see Table 2) with large variation in the closeness of the interaction between policy and operational levels. In other countries, implementation still progresses just through the bottom-up pathway, predominantly initiated, and led by individuals or small groups with different clinical background or innovation managers. To effectively coordinate and execute a statewide or even national implementation project across six diverse but interdependent layers requires governance, a pivotal element for bundling the power, control, bureaucracy, organization and legislative initiative(20,26,83). The example of Western Australia (20,83) and the EU Guide for Health Authorities (26) suggest that

National Patient Blood Management Steering Committees, preferably under the authority of the MoH, should oversee subcommittees to coordinate planning and provisioning of Patient Blood Management resources, structural requirements, and national and international Patient Blood Management research efforts. Transitional tasks forces were proposed to develop national Patient Blood Management reimbursement schemes and managing Patient Blood Management transition costs (i.e. costs to manage the 'paradigm shift'). National Patient Blood Management Steering Committees accompanied by a Patient Blood Management Guidelines Standard Committee and a Patient Blood Management Data Collection, Benchmarking and Analytics Committee could facilitate broad and homogeneous adoption.

The experiences and expectations of the implementors confirmed how important the implementation into the local healthcare and cultural context and alignment with the local / national healthcare priorities and funding situation is. Implementation success depends on good change processes; pushback from the old transfusion paradigm due to ignorance and conflicting incentives needs to be overcome, and the Patient Blood Management paradigm must be anchored in the healthcare delivery culture.

Kotter's model for managing change embraces eight essential accelerators: establishing a sense of urgency, creating a guiding coalition, developing a change vision, communicating the vision for buy-in, empowering broad-based action, generating short-term wins, never letting up, and incorporating changes into the culture(84,85). Concurrent action, well adapted to the local context, across all eight change accelerators while rapidly building a network of change agents should maximize its adoption and impact(85).

Adaptation to the local context depends on the access to the key stakeholders and influencers within the own healthcare environment. Implementors need to identify the stakeholders in implementing Patient Blood Management and understand what motivates each of them to support, engage, or contribute(25–27).

The full implementation matrix (Additional File 2) may serve as a guidance in planning, even if starting with a small pilot. In creating the own path with clear aims, the user should, on each level, assess what works (best) in the local context, when, and which stakeholders should be involved (following Realist Evaluation approach(86)).

Limitations

The following limitations should be considered for this research. The selected countries cannot be fully representative for all countries and healthcare systems across the world. However, they were from five continents and represented healthcare systems of high or lower income, and the interviewees were professionals leading and/or promoting Patient Blood Management in the healthcare sector of their respective environment. The impact of the various implementation measures across six levels could not be determined. Once Patient Blood Management will be established in more countries and healthcare systems, certain key performance indicators might be linked to specific measures and rated, thus showing their relative importance.

Conclusion

With the objective of learning from the practical experiences with the implementation of Patient Blood Management, structured interviews were conducted with a multi-disciplinary group of Patient Blood Management implementors in twelve countries reflecting initial, advanced, and full level of implementation. The implementors rated drivers and barriers for Patient Blood Management and identified accelerators and inhibitors for Patient Blood Management. After converting this information into actionable implementation measures, six levels for intervention were identified, including government, HCPs, education, funders, research, and patients. This, in combination with the three quality dimensions of the Donabedian quality model, yielded an 18-field matrix, describing all measures and expected outcomes as reported by the implementors. There was consensus that patients would benefit most from Patient Blood Management, with improved outcomes including morbidity, mortality, quality of life, average length of hospital stay, and patient safety. Likewise, these outcomes are in the interest of the other implementation stakeholders.

Governance bundling the power, control, bureaucracy, and organization is pivotal to effectively coordinate and execute a statewide or national implementation. A validated implementation methodology helps to overcome the resistance of the old transfusion paradigm while anchoring the culture of the new paradigm. Governance combined with a validated implementation methodology allows to fully exploit the opportunities offered from the implementation matrix and to broadly improve patient outcomes while saving resources.

Abbreviations

Countries:

AUS Australia
BRA Brazil
CHN Peoples Republic of China
HRV Croatia
GRC Greece
KOR Republic of Korea
LBN Lebanon
MEX Mexico
SAU Kingdom of Saudi Arabia
ZAF South Africa
CHE Switzerland
TUR Turkey

Other:

CME Continuing Medical Education
GP General Practitioner
LMIC Low- and Middle-Income Country
MoH Ministry of Health
PBM Patient Blood Management
QoL Quality of Life
SoC Standard of Care

Declarations

Ethics approval and consent to participate

No ethical approval was sought because the research did not entail systematic collection or analysis of data in which human beings are exposed to manipulation, intervention, or observation (WHO Manual (Section XV.2)). All interviewees were professionals who were informed about and agreed to the purpose of the interviews before and at the beginning of the interview. No personal data beyond the interviews with the implementors were used. The interview guide underwent internal compliance review by the pharmaceutical company interviewee in each of the participating countries.

Consent for publication

All interviewees consented to and supported the use of the information for this research and publication. All main authors have consented to the publication.

Availability of data and materials

The results are presented in aggregated form. The original data are accessible through the corresponding author on reasonable request. The interview questionnaire is available as additional online material (Additional File 1).

Competing interests

AH received honoraria and/or travel support from Celgene (Belgium), Instrumentation Laboratories/Werfen (USA), G1 Therapeutics (USA), the South African National Blood Service and Vifor Pharma, Switzerland.

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Authors' contributions

APH and AH conceptualized the research plans. DRS played a critical role in testing and improving the interview flow. APH conducted and evaluated all interviews. APH, AH and DRS were major contributors in writing the manuscript. All authors read and approved the final manuscript.

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Tables

Due to technical limitations, table 1, 2, 3, 4 and 5 is only available as a download in the Supplemental Files section.

Figures

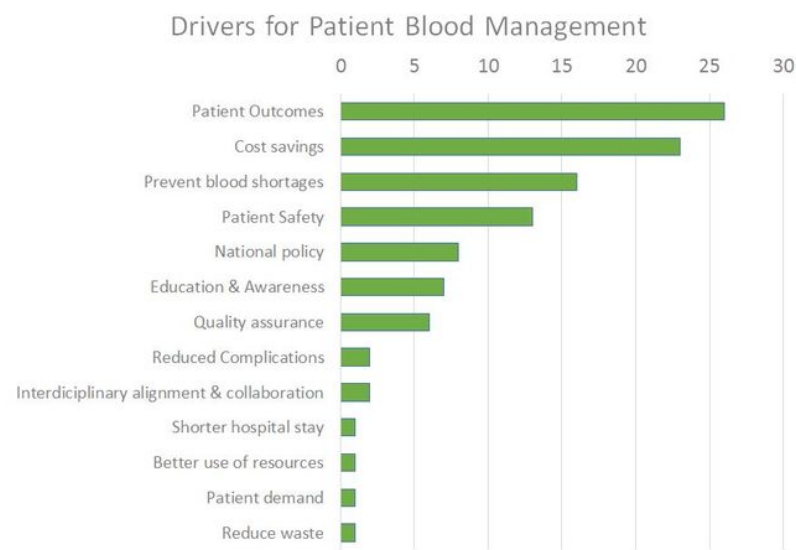


Figure 1

Drivers for Patient Blood Management Legend for Figure 1: Quantitative evaluation of all drivers mentioned by the interviewees when asked " What could be the main drivers for Patient Blood Management – Why is Patient Blood Management needed?". The responses were spontaneous and unprompted. (N = 46) The driving factors were sorted by the total number of mentions (top to bottom decreasing). Education & Awareness is abbreviated for 'education and awareness relating to the risks of transfusion and the benefits of Patient Blood Management'.

Accelerators and Inhibitors for Patient Blood Management

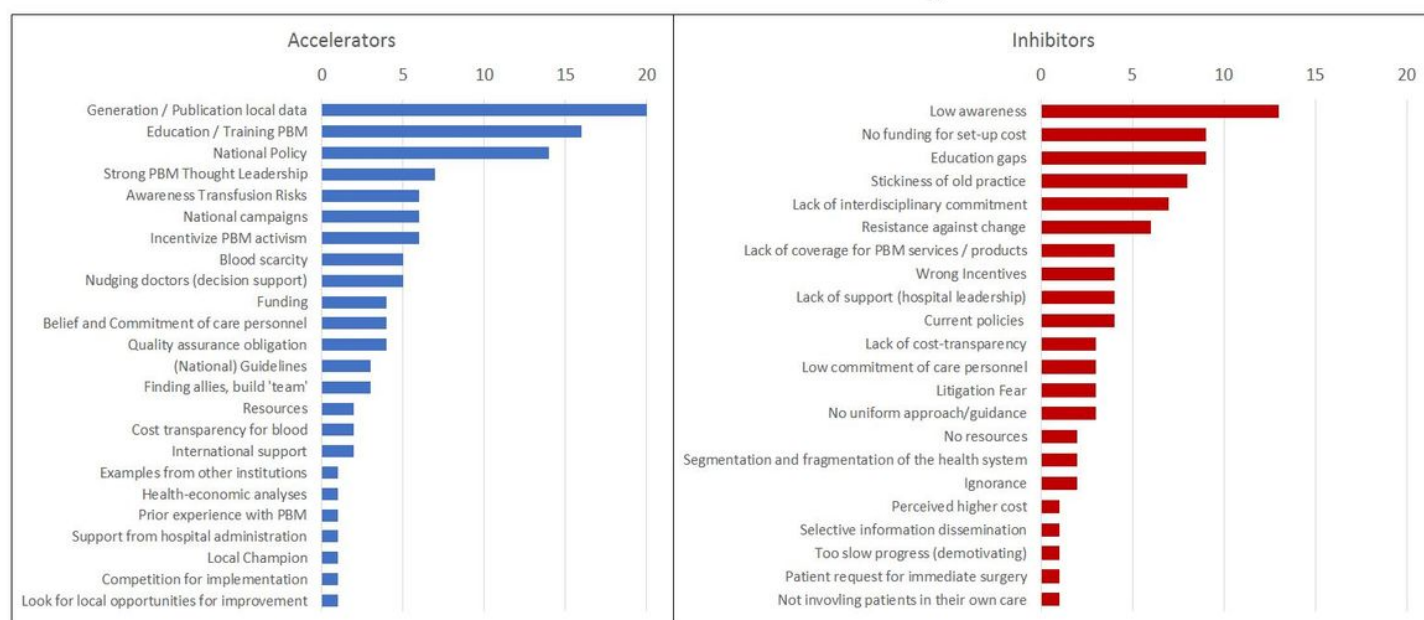


Figure 2

Accelerators and Inhibitors for Patient Blood Management Legend for Figure 2: Quantitative evaluation of factors mentioned by the interviewees when asked for the factors which would accelerate (Accelerators) or delay or inhibit (Inhibitors) the implementation of Patient Blood Management from their perspective. The responses were spontaneous and unprompted. (N = 46) The items were sorted by the total number of mentions (top to bottom decreasing).

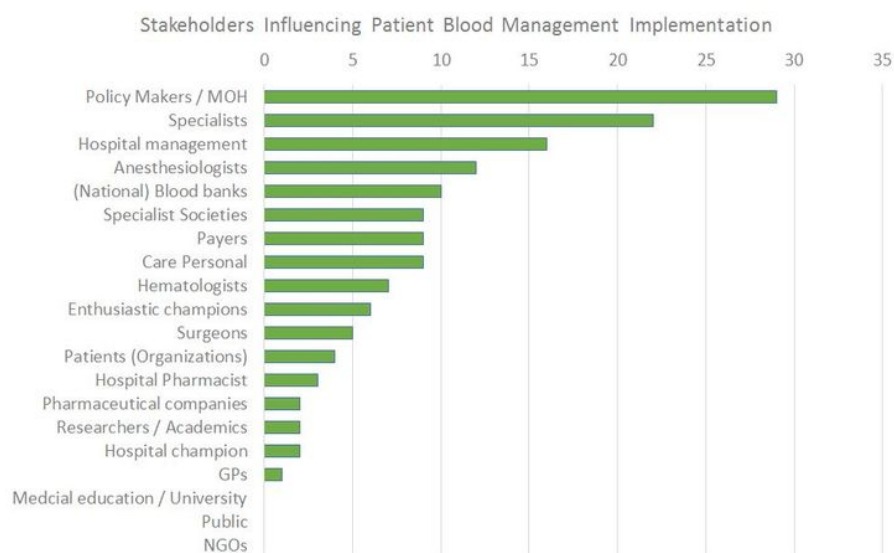


Figure 3

Stakeholders Influencing Patient Blood Management Implementation Legend for Figure 3: Quantitative evaluation of categories mentioned by the interviewees to the question "Who in your opinion will be the essential stakeholders who will have to be involved / convinced?". The responses were spontaneous and unprompted. (N = 46) The stakeholder types were sorted by the total number of mentions (top to bottom decreasing). Medical education, Non-governmental organization (NGO) and the Public were not mentioned as important stakeholders specifically, but they were mentioned in other parts of the interview as important groups and therefore were added for completeness.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

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- [Table420020919.docx](#)
- [Table220200914.pptx](#)
- [Table320200914.pptx](#)
- [Table520200914.pptx](#)