World Health Organization

POLICY BRIEF

# THE URGENT NEED TO IMPLEMENT PATIENT BLOOD MANAGEMENT

## 1. Introduction

In the past four decades, increased awareness of the inherent risks of transfusion has resulted in major initiatives to mitigate those risks through improvements in blood component safety. The realization that the intense focus on product safety had not been matched with a similar focus on improving transfusion decisions at the bedside led to the concept of "optimal blood use". The practice of transfusion medicine now emphasizes the judicious use of transfusion, only when clinically indicated. The concept that "our own blood is still the best thing to have in our veins" *(1)* has given rise to various surgical "blood conservation" techniques (for example, minimization of blood loss, blood salvage and acute isovolaemic haemodilution). Underlying these efforts is the broader concept of "patient blood management" (PBM). This is a patient-centred approach that addresses iron deficiency, anaemia, coagulopathy and blood loss, in both surgical and nonsurgical patients, as risk factors for adverse medical outcomes. Under PBM, anaemia and iron deficiency are recognized as serious global health issues in their own right, affecting billions of people worldwide. Yet, globally, there is still a gap in awareness and implementation of **PBM as an overall framework to address the risks of iron deficiency, anaemia, blood loss and coagulopathy.** This policy brief focuses on the urgent need to close that gap and the steps needed to achieve that goal.

## 2. Purpose of this policy brief

This policy brief aims to:

- **create awareness** about the enormous, but greatly under-appreciated global disease burden of **iron deficiency, anaemia, blood loss and bleeding disorders**;
- **create a sense of urgency** for health care entities to implement **PBM**, a systematic, multidisciplinary, multiprofessional concept to routinely minimize these risk factors, and, in so doing, **significantly and cost-effectively improve health and clinical outcomes for hundreds of millions of medical and surgical patients, pregnant women, neonates, children, adolescents, elderly people, and the population as a whole**;
- **announce the upcoming World Health Organization (WHO) initiative to develop PBM Implementation Guidelines** that will serve as a framework for health care leaders of all Member States;
- **alert health ministries, social security services, health departments and policy-makers** about this global initiative and **call on them** to prepare for and foster the rapid dissemination and implementation of PBM in their jurisdiction;
- **coordinate these efforts** with existing initiatives pertaining to improved patient-centred care, patient safety and quality of care, including maternal, prenatal and child care, and nutritional supplementation programmes;
- **act as an accelerant for change** by educating the readers about what PBM is and is not, why PBM implementation is critical, and calling attention to the barriers to implementation.

## 3. The challenges of anaemia and blood loss to population health

**Anaemia** affects 1.95–2.36 billion people *(2–4)*, of whom an estimated 1.24–1.46 billion are iron deficient *(3–6)*. Another 0.98–1.18 billion are estimated to have isolated **micronutrient deficiency**, mostly of iron, which can lead to anaemia *(7)*. Anaemia, including iron deficiency anaemia (IDA), and iron deficiency without anaemia are negatively affecting the lives of billions of many otherwise relatively healthy people. This results in reduced work productivity, impaired neurocognitive development in neonates, infants and children *(8–11)*, increased maternal and child morbidity and mortality *(12–15)*, negative impacts on women's health *(16)* and diminished quality of life *(17–19)*. Chronic anaemia is common in elderly people, but should not be considered a normal consequence of ageing *(20)*. WHO plays a major role in addressing these population health challenges *(21)* and, thanks to its efforts, the global prevalence of anaemia has dropped slightly over the past two decades. However, few countries are on course to reach the WHO 2025 targets outlined in the 2014 anaemia policy brief ( ). In addition, the global burden of disease due to anaemia, expressed in years lived with disability (YLD), remains high (Fig. 1) *(22)*.

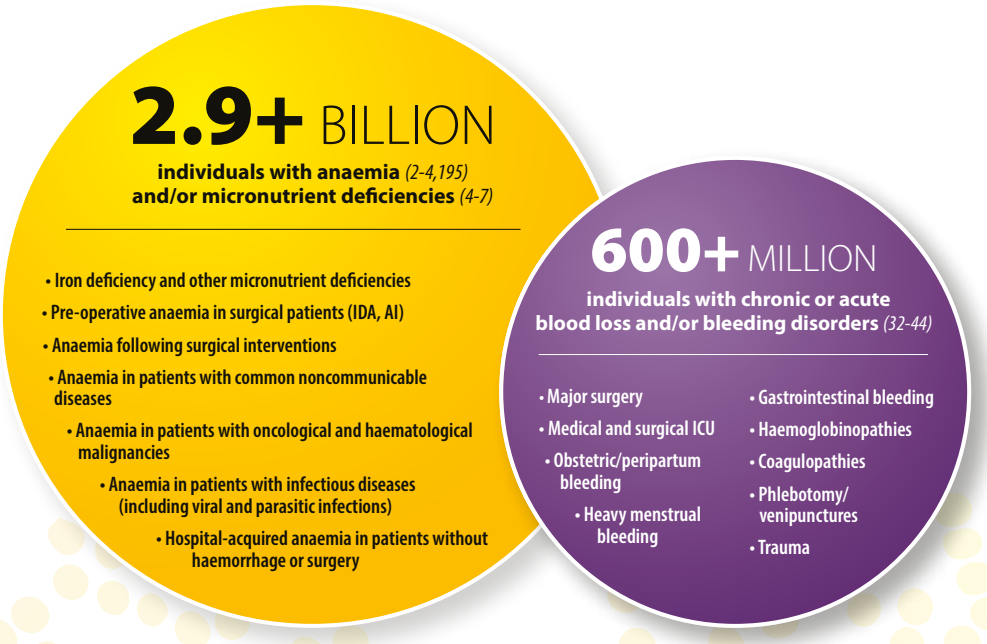
Too often, the high prevalence of anaemia, including IDA, anaemia of inflammation and iron deficiency without anaemia in most medical, surgical and obstetric populations, is underrecognized by health system leaders and most clinicians *(22, 23)*. These conditions are associated with significantly increased morbidity, mortality, and intensive care unit (ICU) and hospital length of stay *(23–25)* as well as additional costs to the health care system *(26)*. In surgical populations, preoperative anaemia rates can reach 75% *(23)*. The incidence of hospital-acquired anaemia is reported to be between 35% and 74% *(27, 28)*. In patients who have ICU stays of more than 7 days, the prevalence of anaemia is up to 100% *(29, 30)*. Anaemia is a major predictor of the administration of perioperative allogeneic blood transfusion *(24, 31)*.

Partially overlapping with these populations, an estimated 600+ million people with **acute or chronic blood loss and coagulopathies** (bleeding disorders) add to the population at risk for anaemia *(32–44)*. Blood loss and coagulopathy with bleeding are also independent risk factors for significantly increased morbidity, mortality, and ICU and hospital length of stay *(45–47)*. Taken together, they represent one of the world's biggest, largely preventable, yet greatly underestimated public health and health-economic burdens.

## Adverse outcomes associated with anaemia, blood loss, coagulopathy with bleeding and transfusion

**Anaemia** symptoms **in otherwise healthy individuals** include, but are not restricted to, cognitive dysfunction, weakness, fatigue, headache, shortness of breath, emotional instability, depression and restless leg syndrome *(48)*. Symptoms of isolated iron deficiency, the most common micronutrient deficiency, are mostly the same as those of anaemia *(7, 48–50)*. Importantly, **iron deficiency alone** is associated with poor functional status in patients with cancer, and decreased functional status as well as increased morbidity and mortality in patients with chronic heart failure and those who have had cardiac surgery *(17, 21, 51–57)*. **In pregnant women**, anaemia is linked to reduced physical activity as well as alterations of cognitive performance and immunological function. Other effects include an increased risk of antepartum, intrapartum, and postpartum maternal morbidity and mortality secondary to peripartum haemorrhage. There is also an increased risk of hypovolaemic shock, fluid overload, dilutional coagulopathy, surgical intervention and transfusion *(13–15, 58, 59)*. Anaemia as well as isolated iron deficiency during pregnancy is linked to adverse outcomes in **neonates**, including poor feeding, neonatal infection, intensive care unit (ICU) admission, transfusion, neurocognitive alterations, increased risk of attention deficit and hyperactivity disorder, increased risk of autism spectrum disorder, preterm births, low birthweight and perinatal mortality *(8, 10–12, 14, 60)*. Anaemia prior to surgery in neonates is associated with significantly increased mortality *(61)*. **In children and adolescents**, anaemia and iron deficiency without anaemia are also associated with impaired cognition and cognitive development *(8, 62, 63)*. As a comorbidity in **surgical and medical patients**, anaemia is associated with adverse outcomes including increased morbidity, mortality, average length of stay in hospital and in the ICU, and diminished quality of life *(17, 23–25, 51, 53, 64–71)*. **Severe bleeding** due to peripartum haemorrhage, trauma, surgery and heavy menstrual bleeding is associated with adverse outcomes including increased morbidity, mortality and average length of stay in hospital and the ICU. Disease-related and medication-induced **coagulopathy with bleeding**, largely a result of the increased use of anticoagulant and antiplatelet medications, is also associated with adverse outcomes *(40, 45–47, 72)*. **The multiple missed opportunities to appropriately manage and preserve the patient's own blood is also the main driver for transfusion** of red blood cells and other blood components. The literature suggests that transfusion per se, after risk adjustment, is independently associated in a dose-dependent manner with adverse outcomes including increased morbidity, mortality and average hospital and ICU length of stay. This includes patients with trauma and critical bleeding *(73–83)*, for example, those who are critically ill or in the ICU *(84–90)*, patients who have cardiac surgery *(91–108)*, and many other surgical and medical patients, including paediatric and burns patients *(109–128)*. Randomized controlled trials have demonstrated lack of benefit, and sometimes harm of liberal transfusion *(129–131)*. Immunomodulation and storage lesion are considered to play key causative roles in adverse transfusion outcomes *(132–137)*.

**Fig. 1. Global prevalence of anaemia, blood loss and bleeding disorders and their etiologies**



## 4. What is PBM, how did it develop and what are the underlying principles?

PBM was originally developed to improve outcomes in surgical patients *(138)*. An example of an early, jurisdiction-wide, large-scale PBM programme that included all patients, medical and surgical, is that of Western Australia. PBM was implemented in Western Australia from 2008 to 2012 as a government sponsored, state-wide standard of care across all tertiary hospitals, including all emergency and elective medical and surgical patients. This programme was associated with significantly improved outcomes, cost-savings of many millions of dollars and a significant reduction of blood product usage (Fig. 2) *(139)*. From its origins as a strategy for surgical patients, PBM has evolved into a comprehensive care paradigm to manage anaemia and preserve a patient's own blood. It is being applied in the care of medical and surgical patients, pregnant women, neonates, children, adolescents, elderly people and the population as a whole. **The overarching aim of PBM is to improve patient outcomes, while saving health care resources and reducing costs.** In 2010, PBM was endorsed by World Health Assembly Resolution WHA63.12 *(140)*.

PBM's central tenet is the use of every appropriate measure to protect and manage a patient's own blood, in a manner that is tailored to the needs of the individual patient. The underlying principles are known as the "three pillars of PBM" *(138, 140)*:

**Three pillars of patient blood management**

**Pillar 1: Detection and management of anaemia and iron deficiency**

Routine detection, evaluation, diagnosis as to cause and management of anaemia and iron deficiency, as clinically appropriate to the diagnosis. This includes treating the underlying cause(s). Anaemia treatment may include the use of appropriate pharmacological agents and nutritional supplements.

**Pillar 2: Minimization of blood loss and optimization of coagulation**

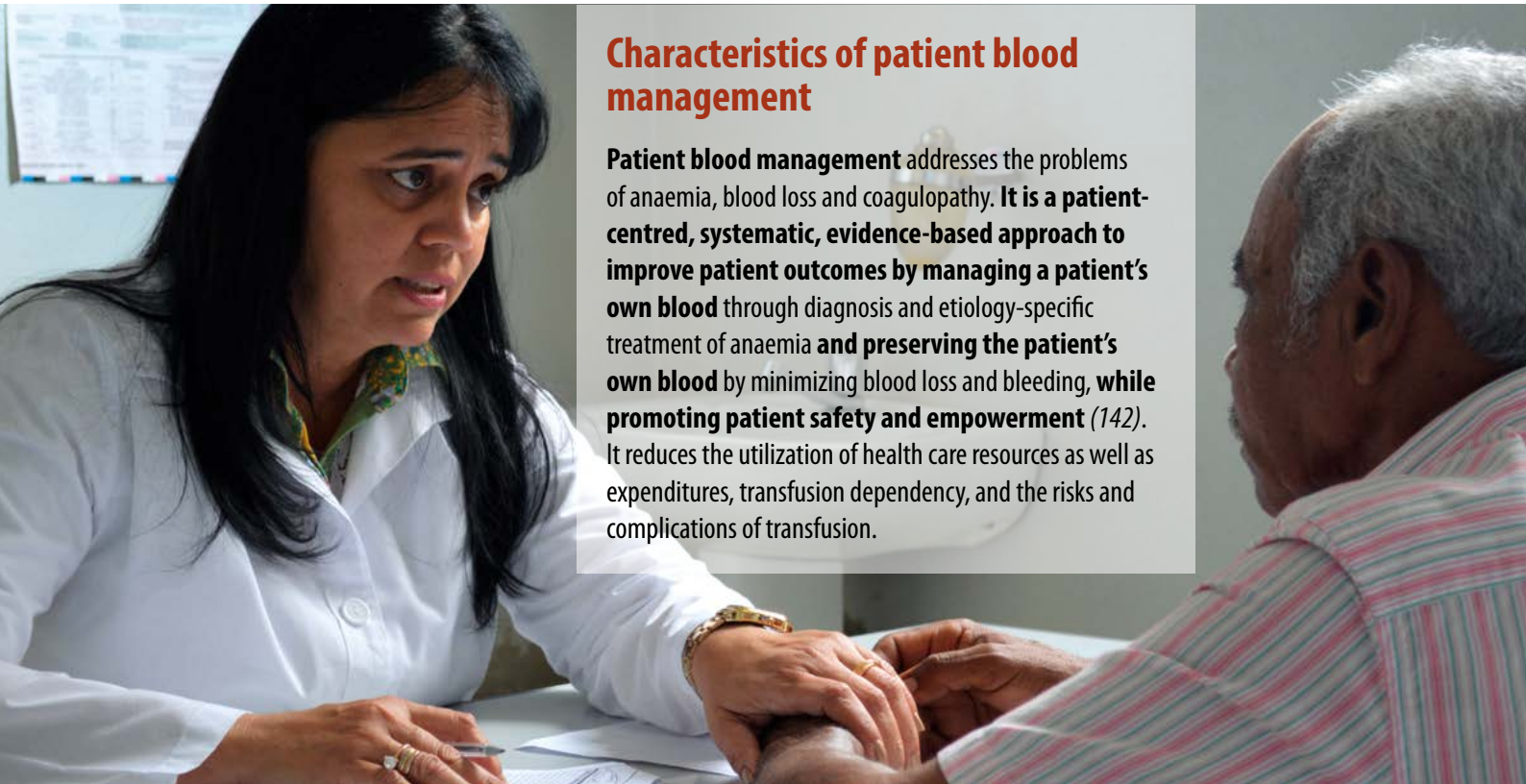
Systematic and timely identification and management of risk factors for bleeding and minimization of blood loss, and the impact of coagulopathy that results in bleeding through anaesthesiologic, haemostaseologic, surgical and other appropriate measures and interventions.

**Pillar 3: Leveraging and optimizing the patient specific physiological tolerance of anemia**

Use of all appropriate measures to leverage and optimize the patient-specific physiological tolerance of severe anaemia.

Several additional principles apply to PBM *(141)*:

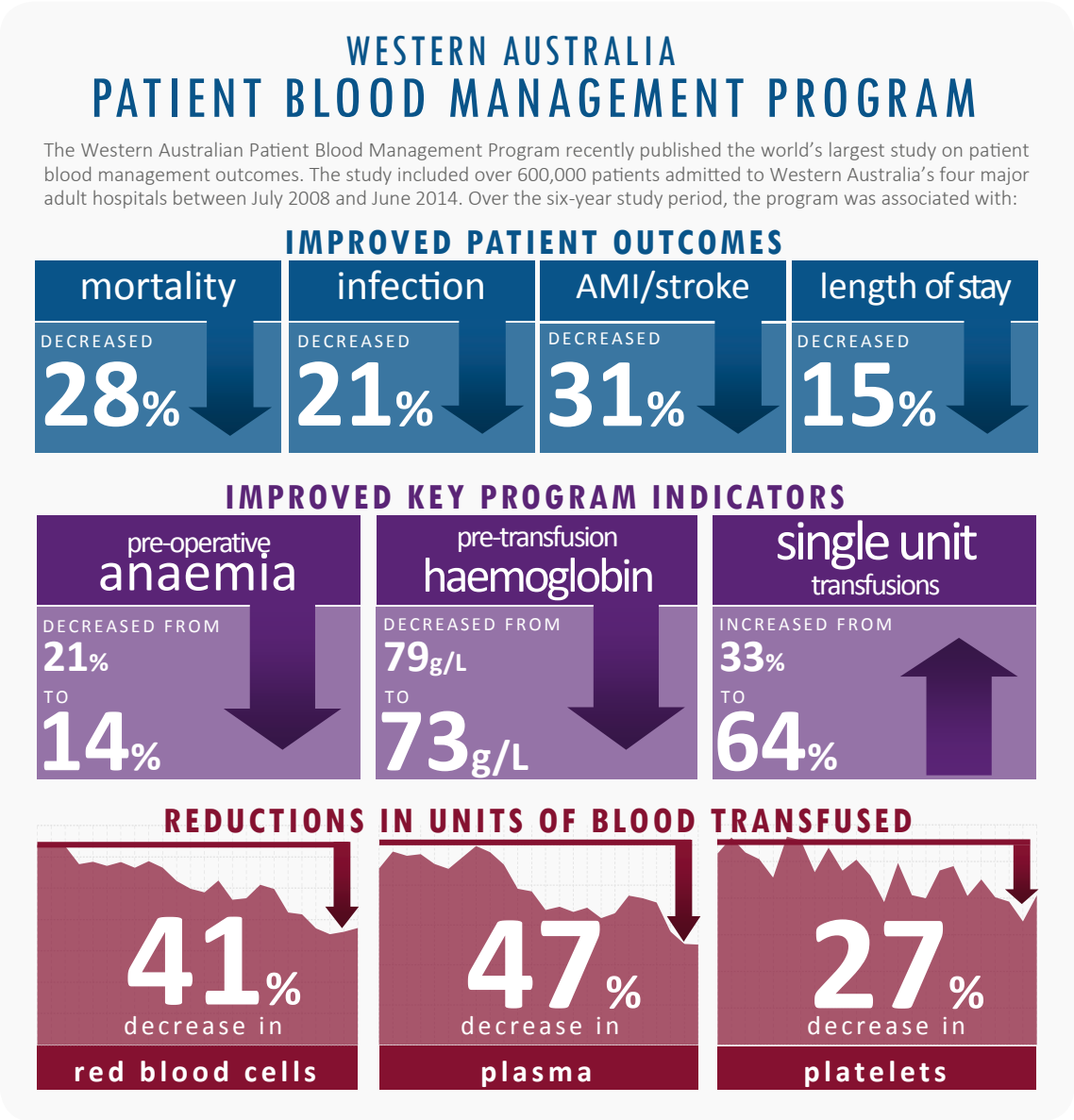
- patient education and empowerment, informed consent and shared decision-making;
- use of multiprofessional, patient-specific protocols throughout the entire continuum of care; and
- development of systems to ensure seamless interaction between primary care physicians, family doctors, specialists and hospital-based health care professionals.



### Characteristics of patient blood management

**Patient blood management** addresses the problems of anaemia, blood loss and coagulopathy. **It is a patient-centred, systematic, evidence-based approach to improve patient outcomes by managing a patient's own blood** through diagnosis and etiology-specific treatment of anaemia **and preserving the patient's own blood** by minimizing blood loss and bleeding, **while promoting patient safety and empowerment** *(142)*. It reduces the utilization of health care resources as well as expenditures, transfusion dependency, and the risks and complications of transfusion.

**Fig. 2. Clinical and economic outcomes of the Western Australia patient blood management programme, 2008–2014**




**PRODUCT COST SAVINGS**

Over the six-year study period blood product cost savings were:

**$18.5M**

**ACTIVITY BASED COST SAVINGS**

...however with the hospital costs of administering a transfusion added, the gross savings are estimated to be between:

**$80M–$100M**

For more information see: Leahy MF et al. Improved outcomes and reduced costs associated with a health system-wide Patient Blood Management Program. *Transfusion*.

## 5. What does PBM offer and what are some of the challenges to its implementation?

PBM has the potential to significantly improve global population health and the clinical outcomes of hundreds of millions of surgical, medical and obstetric patients and the population at large, while reducing health care costs by billions of US dollars *(139, 143)*. This potential exists throughout the lifecycle, from infancy to old age, including a significant impact on maternal health and pregnancy. Interventions occur at the population health level as well as at the level of individual patient interactions with the health care system. PBM promotes patient safety and advances patient education and empowerment. It significantly reduces the demand for allogeneic blood components, and thus the national dependency on transfusion *(144)*. Particularly in low-income countries (LICs) and lower middle-income countries (LMICs), it helps to mitigate some of the resource constraints in health care *(145)*.

Based on the WHO's broad endorsement, the scientific and economic evidence in support of PBM, and respect for the fundamental principles of ethics, it is essential that health care systems worldwide implement PBM as a standard of care. However, most countries have not yet succeeded in doing so. One barrier to adoption of PBM as a standard of care has been a lack of awareness among both patients and health care professionals. Awareness of PBM and its multiple benefits should be promoted among all stakeholders: patients, patient organizations, health authorities including those responsible for universal health coverage, public health experts, health economists, the vast community of health care professionals, hospital administrators and others.

More challenging than the dissemination of knowledge about PBM is its implementation. Current patterns of practice are long-standing and deeply ingrained. Implementation of PBM[1] involves an unusually large number of disparate stakeholders whose interactions need effective management. PBM implementation requires a change in culture and behaviour, structural adjustments in health services delivery and redirection of scarce resources. Hospital transfusion committees that are product-centred should be restructured as hospital PBM committees with a focus on patient management. Robust data collection and reporting of outcomes is essential to support this change.

PBM initiatives may be met with resistance by some stakeholders *(146)*. Therefore, and with support from a large group of diverse international experts, WHO will create PBM implementation guidelines over the next 2 years. These guidelines will serve as a framework for health care leaders of all Member States to develop their own Regional clinical PBM guidelines, that will take into account geographical differences in epidemiology, etiology of anaemia and blood loss, resources and other socioeconomic determinants of health. This will also help link PBM to public health agendas and other quality improvement initiatives at all levels of health care from primary to quaternary.

[1] The implementation of PBM supports six of the seventeen Sustainable Development Goal (SDG) 3 targets: 3.1, 3.2, 3.4, 3.6, 3.8 (indirectly) and 3D. It also supports the first of the Triple Billion Targets (benefiting from universal health coverage) indirectly and the other two directly as well as many of the priorities formulated at WHO's Global Forum for Blood Safety: Patient Blood Management in Dubai 2011.

## 6. Why is it important to distinguish between PBM and the concept of "optimal blood use"?

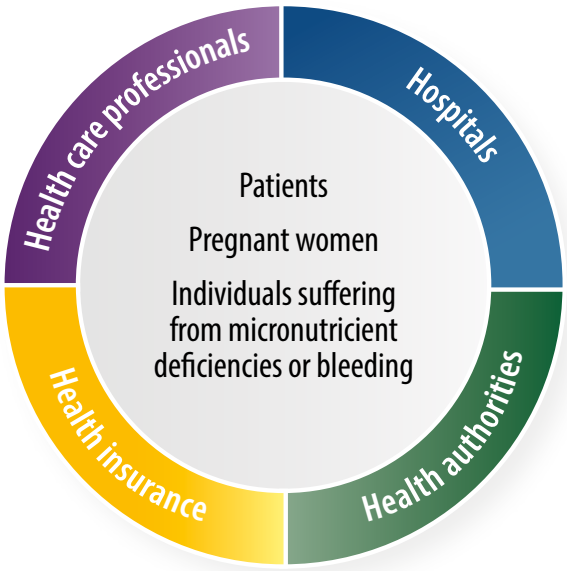
The goal of PBM is not reducing blood transfusions or restricting the use of transfusion or any other therapy per se. Rather than transfusion being a default decision based on a specified haemoglobin concentration, PBM may pre-empt the use of blood transfusion by placing importance on the patient's own blood as a valuable resource, long before transfusion is even considered *(147)*. A reduction in the numbers of transfusions simply follows as a direct result of PBM. Strict adherence at the bedside to the principles of "optimal blood use", that is, clinically indicated transfusions at the minimal effective dose, helps to further minimize transfusion. However, these "optimal blood use" programmes, designed to reduce "the need for transfusion," have a narrow focus compared with the broader clinical approach of PBM to overall patient care and outcomes.[1] A thorough understanding of the difference between PBM and optimal blood use will help shift the focus "from the product to the patient" and sustain efforts to implement PBM.

## 7. Who will benefit from PBM and how?

There are five main groups of beneficiaries from PBM:

- individuals living with anaemia or at risk for developing anaemia, including individuals with isolated iron deficiency, and those with bleeding or blood loss;
- health care professionals including general practitioners, family doctors and nurses, specialty consultants, surgeons and hospital-based clinicians;
- health care institutions and hospitals;
- health insurers and insurance organizations;
- health authorities at the federal and jurisdictional levels, including public health care systems in general (Fig. 3).

**Fig. 3. Beneficiaries of PBM**




PBM has benefits not only for people who have anaemia or are at risk for anaemia, bleeding or blood loss, but also for otherwise healthy individuals *(9, 17, 148–150)*. These include:

- improved cognitive and productive performance while engaged in education, work and leisure;
- fewer symptoms such as fatigue, weakness or headache, leading to improved quality of life;
- reduced maternal, neonatal and child morbidity and mortality;
- improved outcomes and health care related quality of life for anaemic patients in the community whether or not they have comorbidities.

The benefits of PBM for surgical, medical and obstetric patients include *(54, 59, 139, 143, 151–168)*:

- improved outcomes including lower morbidity, mortality and reduced length of stay in hospital and the ICU;
- fewer complications;
- recognition of patients' rights (patient education and empowerment, and shared decision-making);
- improved experience of care as a result of patient-centredness;
- depending on the health care system, decreased private "cost covering" (out-of-pocket expenses including deductibles).

1 The *Aide-memoire for national health programmes: clinical use of blood* (https://www.who.int/bloodsafety/clinical_use/en/Aide-Memoire_23.3.04.pdf) proposed policies and strategies to reduce the need for transfusions. Besides transfusion strategies, this included the prevention, early diagnosis and effective treatment of conditions that could result in the need for transfusion, the use of good surgical and anaesthetic techniques, pharmaceuticals and medical devices to reduce blood loss, the availability and use of simple alternatives for volume replacement, including intravenous replacement fluids (crystalloids and colloids). An earlier document (https://www.who.int/bloodsafety/clinical_use/en/who_bct_bts_01_3.pdf?ua=1), on *Developing a national policy and guidelines on the clinical use of blood* includes a recommendation that blood loss should be minimized to reduce the patient's need for transfusion, and that patients with acute blood loss should receive effective resuscitation (e.g. intravenous replacement fluids and oxygen) while the need for transfusion is being assessed.

The benefits of PBM for health care professionals include *(139, 143)*:

- better clinical outcomes;
- improved clinical key performance indicators and quality metrics;
- more satisfied patients and potentially higher staff retention rates.

The benefits of PBM for health care institutions and hospitals include *(139, 141, 143, 169–173)*:

- reduced costs and resource utilization;
- improved hospital key performance indicators in terms of complication rates, average lengths of stay in hospital, readmissions and mortality;
- improved patient safety and quality of care;
- reduced institutional dependency on transfusion.

The benefits of PBM for health insurance systems include *(26, 174–176)*:

- improved cost containment;
- less morbid customer base.

The benefits of PBM for health authorities at the federal and jurisdictional levels include *(139, 144, 177)*:

- improved community and population health status in terms of
  - work productivity,
  - educational status,
  - years lived with disability,
  - neonatal and infant health outcomes,
  - maternal mortality;
- improved and more effective resource allocation;
- improved productivity in health care;
- improved access to health care;
- reduced national dependency on transfusion;
- improved pandemic response.

## 8. Why is there an urgent need for PBM?

The exceptional scope and magnitude of the unmet need to manage and preserve patients' own blood, the reality of the ageing of society with the likelihood that it will further increase this magnitude (), and WHO's repeated calls to implement PBM, beginning in 2010 with WHA63.12, speak to the urgent need for implementation of PBM. The drivers are the three "E's" of evidence, economics and ethics:

1. Scientific **evidence**, including "real world evidence" *(139, 177, 178)* from case–control and cohort studies *(179–181)*, propensity score matched analyses *(182)*, randomized controlled trials of the therapeutic strategies of PBM *(181, 183–187)* and a meta-analysis *(143)* show improved clinical outcomes with PBM.

2. A strong **economic** argument can be made in terms of cost-effectiveness, alleviated cost constraints and almost immediate returns on investment *(139, 188, 189)*.

3. There is an **ethical** obligation not to ignore and withhold a medical model that is beneficial not only for society at large, but also for highly vulnerable populations, individual patients and blood donors *(190)*.

A response from the global health care community is needed. Delaying the implementation of PBM translates into increased morbidity and mortality. There is no doubt that "our own blood is still the best thing to have in our veins" *(1)*. Taken together, these considerations demonstrate the urgent need for the implementation of PBM as a global standard of care. Efforts to implement PBM should be coordinated with existing initiatives to improve patient safety and quality of care, including maternal, prenatal and child care, and nutritional supplementation programmes to name but a few.

PBM provides a rare opportunity in health care of "getting more for less" by reducing overall treatment cost and improving patient outcomes while simultaneously improving overall population health status. This justifies making PBM a global priority. The scope and magnitude of the need and the promise of an immediate return on investment in terms of patient outcomes and economic benefits demands that PBM implementation initiatives be supported by comprehensive data collection to facilitate and guide optimal reallocation of human and financial resources.

# The unmet need to manage and preserve the patients' own blood

For millions of patients facing anaemia, blood loss and/or coagulopathy, **transfusion of allogeneic blood components is still the default therapy**. This is despite evidence that the efficacy and safety of transfusions is suboptimal in many clinical settings. **PBM results in significant reductions and pre-emption of transfusion** of red blood cells, fresh frozen plasma and platelets **with similar or improved outcomes** including *(139, 143, 179, 191–193)*:

- reduced mortality *(139, 143, 179)*
- a reduction in major morbidity, for example acute myocardial infarction and stroke *(139, 143)*
- a reduction in the incidence of complications *(143, 193)*
- decreased overall length of stay in hospital and the intensive care unit *(139, 143, 179)*
- decreased costs *(139, 172, 193, 194)*.

**Many populations benefit from PBM as described below.**

❶ **Anaemia in the general population** affects an estimated 1.95 to 2.36 billion individuals worldwide, with the highest prevalence in low- and lower middle-income countries (LICs and LMICs) *(2, 3)*. Iron deficiency anaemia (IDA) alone affects an estimated 1.24 to 1.46 billion people *(3–6)*. Twice that number may suffer iron deficiency without anaemia or other micronutrient deficiencies that can lead to anaemia *(7)*. Anaemia of inflammation is the second most common anaemia worldwide and often coexists with IDA, particularly in people living in LICs and LMICs with a high prevalence of nutritional deficiencies and infectious diseases *(195, 196)*. Anaemia is most prevalent in **neonates and children, women of reproductive age especially during pregnancy, and in elderly people** (4). The global disease burden of anaemia is huge and is associated with:

- significantly increased child morbidity and mortality *(12)*;
- impaired neurocognitive development of infants, children, and adolescents *(8–11)*;
- significantly increased maternal morbidity and mortality *(13–15)*;
- social costs and loss of work productivity *(197–200)*;
- reduced quality of life *(17)*.

The macro-economic dimension of anaemia measured in years lived with disability corresponds to 8.8% of all conditions worldwide, and it causes cognitive and productive gross domestic product losses of up to 4.05% *(22, 197)*. Detection and management of anaemia in the general population, and particularly in more vulnerable subgroups, remains an unmet need *(22)*.

❷ **Preoperative anaemia** in **surgical patients** is more prevalent than in the general population and is associated with a highly significant increase in morbidity, mortality and average hospital length of stay (ALOS) associated with most types of surgery *(23–25)*. With an estimated global volume of 313 million surgeries (2010), and even though anaemia is easy to detect and its underlying causes are generally readily correctable, more than 100 million surgeries are likely to be performed on anaemic patients *(34)*. Isolated iron deficiency, a treatable and potentially preventable condition, is also associated with higher morbidity and mortality in surgical patients *(201)*. Also, despite being largely preventable, many surgical patients suffer from hospital-acquired anaemia, particularly in intensive care settings *(202, 203)*.

## The unmet need to manage and preserve the patients' own blood (continued)

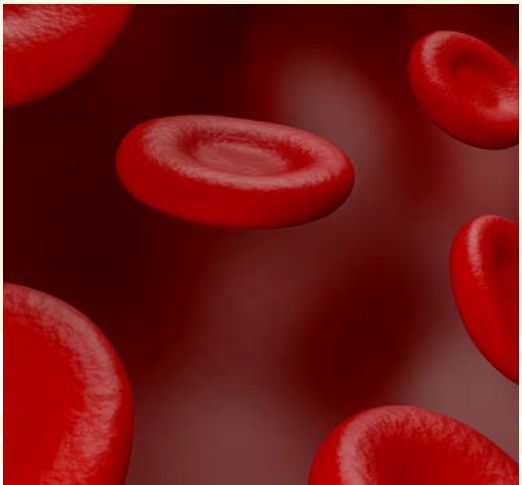
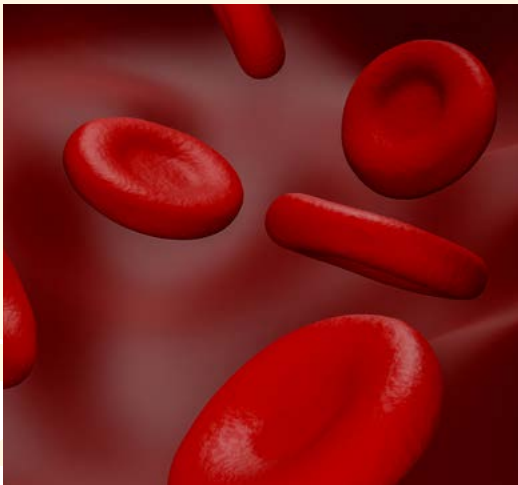
❸ **Anaemia** is often a comorbidity in **patients** with **common noncommunicable diseases**. Of 700 million patients with chronic kidney disease worldwide, with prevalence estimates for anaemia in this population between 14% and 64%, 100 million or more are likely to suffer from anaemia *(204–208)*. Among the 420 million patients with cardiovascular disease (CVD) *(209)* and in the 476 million patients with diabetes *(210)*, anaemia is common. Its prevalence in the subset of CVD patients with chronic heart failure (CHF) is approximately 26 million worldwide *(211)*. It occurs in approximately 30% of stable and 50% of hospitalized CHF patients *(64)*. In addition, overall, 50% of CHF patients with or without anaemia have iron deficiency *(65)*. The overall prevalence of anaemia in people with type 2 diabetes is estimated at 30% *(212)*. Anaemia as a comorbidity of CHF and diabetes affects at least 170 million people. Anaemia in these populations is associated with a highly significant increase in morbidity *(64–66)*, mortality *(64–66)*, hospitalizations and ALOS *(53, 67)*, but remains underrecognized and undertreated *(206, 213–215)*.

❹ **Anaemia in patients** with **oncological** or **haematological malignancies** has a prevalence of between 26% and 53% *(216)*, and is reported to be as high as 75% in patients with solid tumours who are receiving chemotherapy *(217)*. With more than 19 million new cancer patients every year, a minimum of 5 to 10 million are suffering from concomitant anaemia *(218)*. The evidence suggests that anaemia in these patients is associated with increased morbidity and mortality as well as poorer functional status and health care related quality of life *(17, 51, 68, 69)*. Although guidelines are available on measures to pre-empt or minimize anaemia in these patients *(219)*, the clinical application of these guidelines in direct patient care is underutilized.

❺ **Anaemia** is highly prevalent in patients with **infectious diseases** including **viral and parasitic infections** *(22)*. Prevalence varies significantly from region to region: it is highest in the LICs of Asia and sub-Saharan Africa and lowest in the high-income countries of Asia, Australia, Europe and North America *(22)*. Globally, the prevalence of anaemia attributable to infectious diseases, including hookworm, malaria, schistosomiasis, other infectious diseases and neglected tropical diseases is estimated as 12 000 per 100 000 population *(220)*. Pregnant and lactating women are at greater risk of anaemia from hookworm infection *(22)*. Of people living with HIV infection, it is estimated that 18–32% of those without AIDS and 48–85% of those with clinical AIDS have at least mild anaemia *(221)*. The severity of anaemia is an independent risk factor for predicting mortality from HIV *(22, 71)*. Anaemia as a comorbidity in patients with infectious diseases is associated with increased mortality *(70, 71)* and increased morbidity, including poorer pregnancy outcomes *(220)* and increased years lived with disability *(222)*.

❻ **Hospital-acquired anaemia** is highly prevalent in hospitalized patients. Between 35% and 75% of patients admitted to hospital develop anaemia during their stay *(27, 28)*, and the prevalence is up to 100% in patients with ICU stays of more than 7 days *(29, 30)*. Of those who are anaemic when discharged from hospital, about half are still anaemic up to 12 months later *(29)*.

❼ **Acute major blood loss** due to **pregnancy, surgery** and **trauma** affects millions of patients. The global incidence of postpartum haemorrhage (PPH) is 6%, or an estimated 8.4 million events per annum, and severe PPH occurs in 1.86% of all deliveries, or an estimated 2.5 million events *(32)*. Recent evidence suggests an association between a low prepartum haemoglobin concentration and an increased risk of PPH *(13, 223)*.

## The unmet need to manage and preserve the patients' own blood (continued)

About 80–90% of patients are anaemic following surgery *(33)*. The total number of surgical procedures each year is estimated at 313 million *(34)*. The global burden of severe haemorrhage associated with trauma is difficult to estimate, but road traffic accidents alone account for at least 50 million cases. Of these, LMICs in the African Region and South-East Asian Region account for greater than 50% of the total *(35)*. More than 56 million people sustain injuries each year that are severe enough to warrant inpatient care *(36)*. Massive blood loss is associated with increased mortality, major morbidity and increased length of stay in ICUs and overall hospital length of stay. Although guidelines are available on how to minimize and pre-empt blood loss in these populations, and to manage anaemia and support haemodynamics and oxygenation,*(160)* clinical application of these guidelines in direct patient care is underutilized.

❽ **Major disease-related blood loss** affects millions of **gastroenterology** patients *(37, 38)*. Acute upper gastrointestinal bleeding alone represents a significant clinical and economic burden, with a reported incidence of 48–160 cases per 100 000 adults each year *(39)*. Acute lower gastrointestinal bleeding from such causes as ischaemic colitis, diverticulosis and angiodysplasia may be equally common, with a crude incidence of 87 per 100 000 population *(40)*. Chronic gastrointestinal bleeding, especially from lower gastrointestinal neoplasms, contributes significantly to iron deficiency anaemia. Chronic gastrointestinal blood loss without overt bleeding is a common cause of unexplained anaemia with iron deficiency *(41)*. Gastrointestinal bleeding – acute, chronic and occult – is frequently exacerbated by the use of anticoagulant and antiplatelet medications, and is associated with increased mortality *(40, 72)*, morbidity *(40, 72)*, and persistent anaemia and iron deficiency *(41)*.

❾ Excessive **blood loss from heavy menstrual bleeding** affects an estimated 400 million women *(42, 43)* and is associated with reduced quality of life, lost productivity at work and interruption of girls' education. Anaemia, IDA and iron deficiency in this population are highly prevalent and often persistent. International guidelines for the management of IDA and iron deficiency in these patients are not adequately addressed and adopted in guidelines for management of heavy menstrual bleeding *(42)*.

❿ **Acquired** and **medication-induced coagulopathies** are increasingly prevalent. Early trauma induced coagulopathy (TIC) is common, occurring in over 15% of patients admitted with trauma. It is also reported in up to 11% of mildly injured patients without physiological derangement or blood product administration *(44)*. Use of anticoagulants, including vitamin K antagonists and other direct oral anticoagulants is increasingly common in ageing societies that have a high prevalence of cardiovascular comorbidities. Use of platelet inhibitory drugs is also increasing, including dual antiplatelet therapy in patients with cardiac stents. The risk of major bleeding is significant: it is estimated to be as high as 2.1 per 100 patient years *(162)*. Acquired and medication-induced coagulopathies and medication-induced platelet dysfunction are associated with increased mortality, major morbidity including haemorrhagic stroke, and increased ICU and overall length of stay *(162, 224–226)*.

## 9. Who should take the lead in implementing PBM?

The implementation of PBM as standard of care should be viewed as a community and population health initiative that encompasses everyone. Successful implementation of PBM helps to improve the national health status through health protection, health promotion and disease prevention, the most essential public health services. **The primary responsibility for a system-wide implementation of PBM lies with ministries and departments of health**, whereas the involvement of key members of parliament or comparable legislative bodies, supported by medico-legal experts, might be advisable to legally ensure patient empowerment and full informed consent related to PBM. Implementation should involve all relevant legal entities and regulatory bodies under their jurisdiction. Because PBM implementation requires educational efforts and affects economic affairs as well as national finances and budgets, it might be advisable to involve the respective ministries. The public health authorities might choose to provide direct or, through nomination and funding of a multiprofessional body of external experts, indirect governance.

**Under national governance**, and to develop national PBM policies and guidelines that will integrate PBM into health care, the stakeholder groups listed below (partly mirrored by the PBM beneficiary groups listed in Section 7) need to be consulted, coordinated and organized:

- **Patient advocacy and support groups:** Individuals and patients suffering from anaemia and at risk of blood loss are at the core of PBM and should be represented through patient advocacy, patient organizations, patient support groups and community health centres. They need to be proactively informed about PBM and its benefits before being encouraged to express their demands and expectations. Professional support from medico-legal experts and ethicists might be advisable.

- **Medical, nursing and pharmacy school faculty:** Universities and their schools for medicine, nursing and pharmacy play a key role in educating informed practitioners of PBM.

- **Medical and other professional societies:** To effectively present, disseminate and incorporate evidence relating to PBM, health care professionals should be represented through key members of the professional medical societies that are most relevant to PBM. Professional societies of nurses, perfusionists, nutritionists, pharmacists, laboratory scientists and technicians should also be represented. Those responsible for developing and updating undergraduate and postgraduate curricula for medical training and training of allied health professionals must be involved.

- **Administrative leadership in key departments:** Hospital administrators, medical directors, nursing directors, data analysts, IT experts and quality and safety managers should be involved to represent the economic and business interests of health care institutions.

- **Health insurance organizations and public hospital pricing authorities:** Key representatives of health insurance systems should help optimize incentives, remove disincentives and ensure outcome-based reimbursement schemes. For the public sector, involvement of the "architects" of universal health care coverage is advisable.

- **Public health experts, epidemiologists, and health care regulators:** The participation of public health experts, supported by epidemiologists and health economists, is necessary to quantify and validate the overall impact of PBM on population health status. Quality and safety regulatory and accreditation organizations as well as other accreditation bodies (for example drug and medical regulators, and standards agencies) should be invited to contribute. Agencies for pandemic and disaster response and national blood services should also be involved.

## 10. How can PBM be integrated into health care?

As demonstrated by successful PBM programmes, the use of a proven implementation methodology, supported by local epidemiological and patient-level hospital data for reporting and benchmarking purposes, is pivotal *(139, 227)*. Ideally, reporting and benchmarking is done at hospital level and at an individual physician level. The pace of change in medicine is historically slow and adoption of new practices often lags several decades behind discovery of new evidence. This delay is even more marked with PBM implementation, where the challenge lies in changing clinical culture and physician behaviour. Physicians and others must unlearn and abandon some old practices to enable them to adopt the broad, integrated approach of scientifically based PBM. Also, the effective management of the unusually broad range of different stakeholder groups needs to be well supported through formal implementation methodology (Fig. 4). These are all important aspects that will be covered in the *PBM implementation guidelines* being developed by WHO.

**Fig. 4. Stakeholders in multidisciplinary and multiprofessional PBM**

## 11. What needs to be considered when integrating PBM into health care?

The regional differences in the prevalence and etiologies of anaemia, blood loss and coagulopathy with bleeding and, more importantly, the differences in health care structure and socioeconomic determinants, require PBM strategies and policies that are specific to the needs and possibilities of each region. Although the principles of PBM are universally applicable, the severe economic constraints of LICs and LMICs might restrict access to highly effective pharmaceuticals and devices that support PBM. These constraints should not preclude PBM implementation. Instead, they are a strong argument in favour of PBM implementation, since the status quo places unsustainable economic burdens on LICs and LMICs. For instance, in Zimbabwe, the overall cost of producing one unit of red blood cells is US$ 131, which is equivalent to 13.7% of the country's annual gross domestic product per capita, not even including the additional activity-based cost of administering red blood cell transfusions *(228, 229)*. A multidisciplinary PBM expert group that fosters the implementation of PBM in South Africa, and in the whole of sub-Saharan Africa, cautioned:

> "The decision to allocate more resources to supporting the product-focused transfusion model rather than the patient-centric PBM model could be likened to the establishment of landlines in a geographical area bare of communication infrastructure rather than setting up highly effective and much less costly mobile phone networks de novo *(145)*."

## Key points

**Beneficiaries of PBM**

- **Almost every individual can benefit from PBM** during their lifetime. This benefit is even more pronounced given the ageing society and the increase in noncommunicable chronic diseases such as chronic kidney diseases, chronic heart diseases and diabetes. Patients and populations that benefit include **people with chronic anaemia or micronutrient deficiencies, women of reproductive age and children, patients with chronic diseases, surgical, medical and obstetric patients and patients in general, due to education and empowerment**. Benefits include improved quality of life, work productivity, cognitive performance and cognitive development; decreased adverse outcomes including morbidity and mortality; improved health and health-related quality of life; reduced hospital admissions; greater patient empowerment through shared decision-making.

**Impacts on health care delivery and universal health coverage**

- PBM improves national health status through health protection, health promotion and disease prevention, the most essential public health services. It facilitates access to health care by reducing average length of stay in hospital and resource utilization. PBM also improves community health and wellness, including that of individuals who might not have even been considered as in need of transfusion.
- Providing PBM can reduce health system costs by improving health outcomes, preventing secondary health conditions and incurring fewer costs. This supports the target of universal health coverage by reducing the intensity of resource utilization. By reducing the role for blood transfusion, PBM decreases institutional and national dependency on blood transfusions, including the demands on blood banks, blood centres and the donor population.
- Since PBM reduces national and institutional dependency on transfusions, it leads to an improved pandemic response when blood shortages occur as a result of emerging or re-emerging infectious diseases in the blood pool, or when there is a reduction in donors or donations due to social distancing, business or school closures, among others.

## Key points (continued)

**Barriers to implementation**

- Adoption of PBM as a standard of care remains an unmet, but urgent need. There is a persistent lack of awareness about PBM on the part of patients, health authorities including those responsible for universal health coverage, health care professionals such as doctors, nurses and pharmacists, professional societies, public health experts, health economists, hospital administrators and others.
- The implementation of PBM is challenging due to the level of complexity and the need for managing an unusually large number of diverse stakeholder groups.
- Inclusion of PBM in universal health coverage is key to increasing and centralizing health investments in PBM. Such investments are often fragmented, siloed and inefficient.
- Despite the evidence for improved patient outcomes with PBM, its economic advantages, the ethical imperative in favour of PBM and WHO's endorsement, culture and behaviour including existing medical dogma are the main obstacles to the implementation of PBM.
- The long-established position of transfusion as "usual care" for anaemia and bleeding continues to hamper the adoption of PBM.

**Alignment with WHO initiatives**

- PBM supports six of the thirteen targets of SDG 3 goal.
- PBM supports the first of the Triple Billion targets (benefiting from universal health coverage) indirectly and the other two directly.
- PBM is consistent with resolution WHA63.12 (2010) and with several priorities of WHO's Global Forum for Blood Safety: Patient Blood Management in Dubai 2011.
- By pre-empting transfusion and reducing reliance on a donated blood supply, PBM supports the action framework to advance universal access to safe, effective and quality-assured blood products 2020–2023.

# 12. Call to action

**All Member States should act quickly through their ministry or department of health to adopt their national PBM policy, install the necessary governance, and reallocate resources to improve the population health status and individual patient outcomes while reducing overall health care expenditures.**

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