The WHO PBM Policy Brief and PBM Implementation Guidance - Implementing Patient Blood Management to Improve Global Blood Health Status

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Steering Committee Western Australia Patient Blood Management Group
International Foundation for Patient Blood Management

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THE UNIVERSITY OF WESTERN AUSTRALIA

Royal Perth Bentley Group
East Metropolitan Health Service

Disclosures

International Committee of Medical Journal Editors

- World Health Organization (WHO) External SC Guidance for Implementation of PBM
- National Blood Authority (NBA) PBM Guidelines CRG
- Jurisdictional Blood Committee Working Group PBM Guidelines
- Executive Section Editor, *Anesthesia & Analgesia*
- CI on NBA research grant funded clinical trials and study
- Johnson & Johnson/ETHICON Biosurgery
- World Anemia Awareness
- International Anesthesia Research Society
- International Foundation for Patient Blood Management
- Author of two books on Blood Health
- Potential patient
- Not providing advice on individual patient treatment


Who are the intended audiences for this guidance document?
Awareness and a basic understanding of blood health and PBM across a broad range of stakeholders and constituencies are key to its successful implementation.
Note:
To make best use of this guidance document, readers should first familiarize themselves with the WHO Policy Brief: The urgent need to implement patient blood management (1).
Health ministers
Senior staff of health departments
Chief medical officers
Directors of health
Executives of health insurance systems
Members of health councils
Health commissioners
Heads of regulatory bodies
Health economists
PBM implementation experts
General practitioners
Quality & safety managers
Data collection benchmarking & reporting experts
Hospital administrators
Haematologists
Critical care specialists
Transplant surgeons
Nurses
Oncologists
Neonatologists Paediatricians
Cardiac surgeons
Cardiologists
Women's health specialists
Nephrologists
Non-cardiac surgeons
Anaesthesiologists
Patient representatives
Gastro-enterologists
Ethicists
Medicolegal experts
Perfusionists
Nutritionists
Transfusion medicine specialists
Clinical pharmacists
Laboratory medicine specialists

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Chapters 1 and **2** are aimed at all leaders, policy-makers, enablers and pri
system. This includes, but is not limited to, federal and jurisdictional ministers,
of health or the analogous governmental agency for the respective country,
councils, health commissioners, directors of health, chief medical office
insurance systems, heads of regulatory bodies including the centres of di
similar legislative bodies, and heads of national and regional academies or s
and/or recognized health research institutions. Depending on how public he
system are organized and administered, it might also be advisable to includ
and senior representatives of the respective ministries.

The highest-ranking official of the respective health authority is responsible
jurisdictional implementation of PBM and should therefore also have an ov

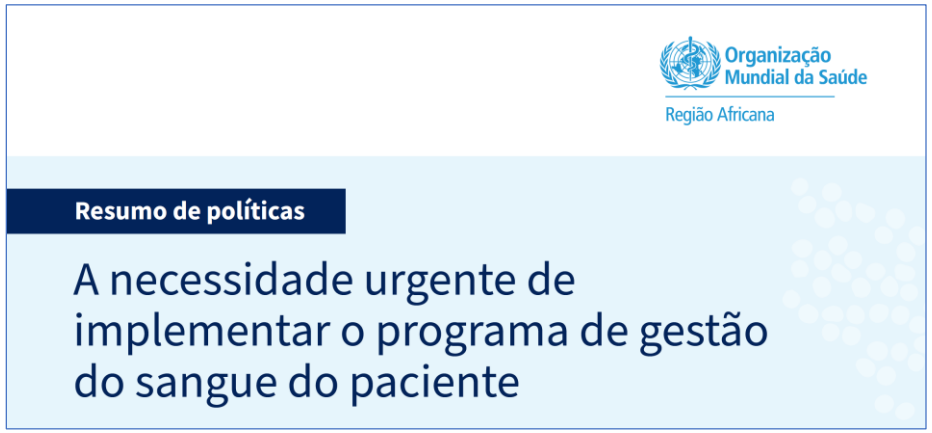
It is recommended that medical professionals from all levels of care, and p
referred to as members of the **national/jurisdictional PBM implementatio**
care organization (HCO) implementation task forces, study the entire c
iron deficiency, anaemia, blood loss and coagulopathy play major roles in their daily practice. An appreciation of the full content of the document is also important for quality and safety managers, chief administrators of HCOs, health economists, epidemiologists, ethicists, patient advocates and medico-legal experts. The guidance also addresses faculty members of medical, nursing, pharmacy, public health and health management schools, and board members of medical and, where appropriate, other professional societies. Editors of medical, public health and medico-legal journals, media professionals specialized in health care and the interested public are also invited to engage with the content.

Manufacturers of pharmaceuticals, medical devices and equipment, biotechnology companies, blood services and laboratory services should also consider how they could contribute to blood health through technological innovation and improved cost-effectiveness of their products and services.


Organisation mondiale de la Santé
NOTE D'ORIENTATION
LA NÉCESSITÉ URGENTE DE METTRE EN ŒUVRE LA GESTION DU CAPITAL SANGUIN

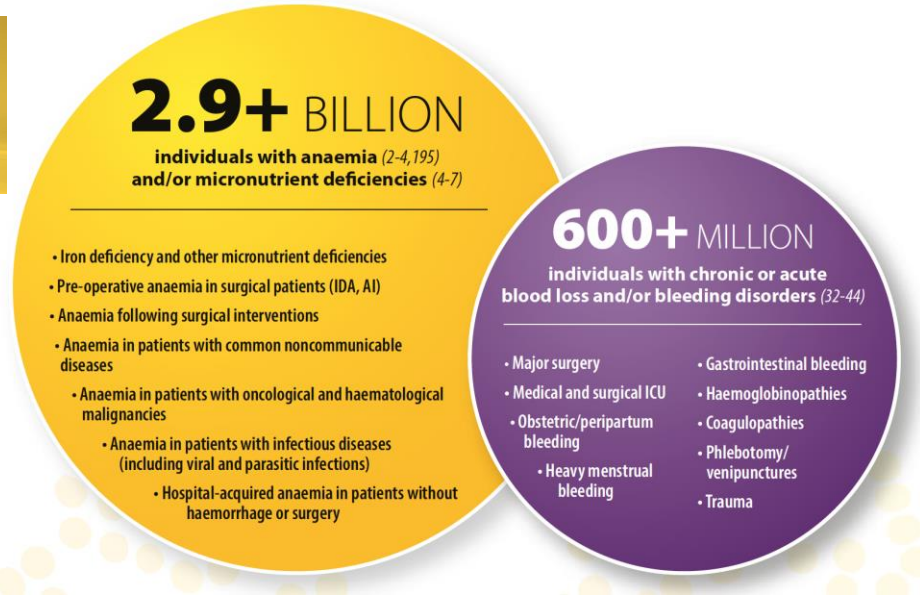

世界卫生组织
政策简报
迫切需要实施患者血液管理


World Health Organization
POLICY BRIEF
THE URGENT NEED TO IMPLEMENT PATIENT BLOOD MANAGEMENT


Organização Mundial da Saúde
Região Africana
Resumo de políticas
A necessidade urgente de implementar o programa de gestão do sangue do paciente


Organización Mundial de la Salud
DOCUMENTO DE INFORMACIÓN NORMATIVA
LA NECESIDAD URGENTE DE PONER EN PRÁCTICA LA GESTIÓN DE LA SANGRE DEL PACIENTE

8. Why is there an urgent need for PBM?



$$TTDR = \frac{P_{ND}}{P_D} \times 100$$

TTDR = Total transfusion dependency ratio

P_{ND} = *Population non-donating*
P_D = *Population donating*

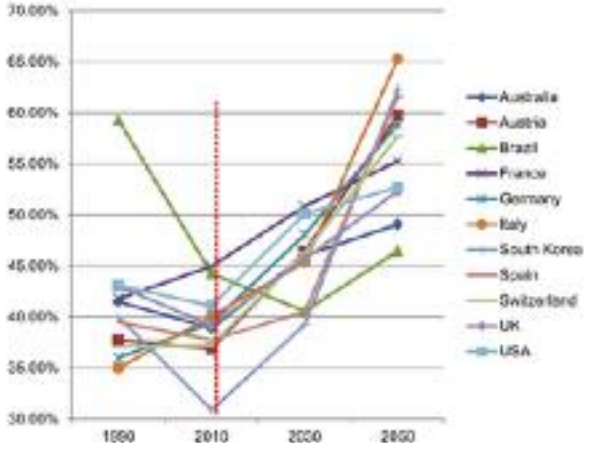
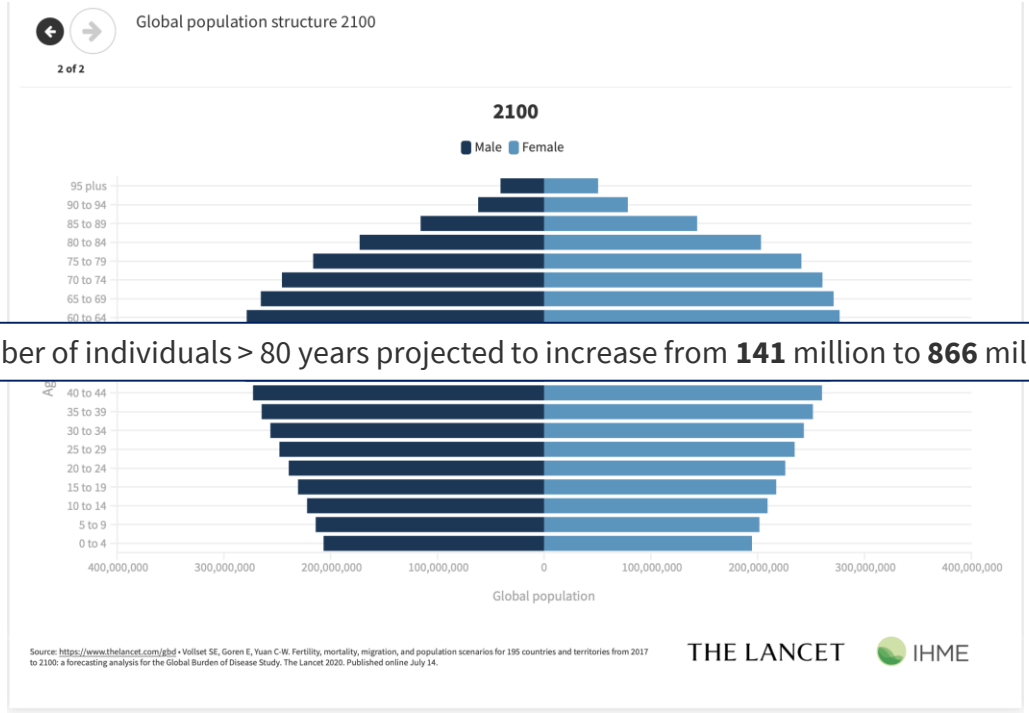


Fig. 1. Modelling of the total transfusion dependency ratio (TTDR) [35] in selected countries demonstrating the potential impact of the ageing population on blood supply. Population data extracted August 23, 2010 from www.census.gov/ipc/www/idb/country.php.

S.L. Farmer et al. / Best Practice & Research Clinical Anaesthesiology 27 (2013) 43–58



Number of individuals > 80 years projected to increase from **141** million to **866** million.

Barriers to implementation

STATUS QUO →

"…culture and behaviour including existing medical dogma are the main obstacles to the implementation of PBM"

"Current patterns of practice are long-standing and deeply ingrained"

"Implementation requires a change in culture and behaviour, structural adjustments in health services delivery, and redirection of scarce resources"

← CHANGE

PBM vs PBM Program

- **PBM** = a clinical concept or approach to managing and preserving a patient's own blood to improve patient outcomes
- **PBM Program** = "a systematic, multidisciplinary, multimodal, organized, programmatic approach utilizing implementation science and change management methodology **to embed this clinical approach as a standard of care** across a whole institution or local, regional, or national healthcare system(s)"

Farmer SL et al et al. Patient Blood Management Program Implementation and Assessment Tool: Measuring Compliance With Guidelines and World Health Organization 2021 Policy Brief. Anesth Analg. 2025:10.1213/ANE.0000000000007364.

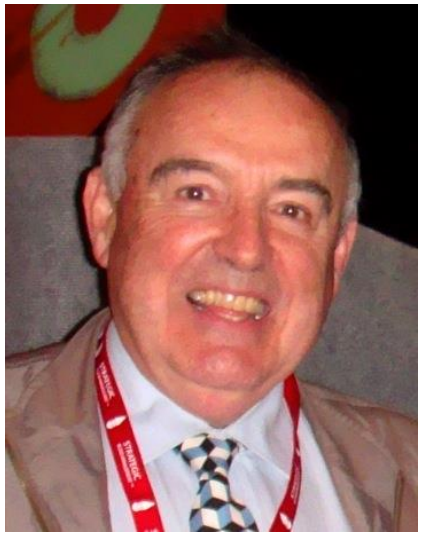
HOW?

200 pages
1,094 references

2005

Term proposed
Patient Blood Management

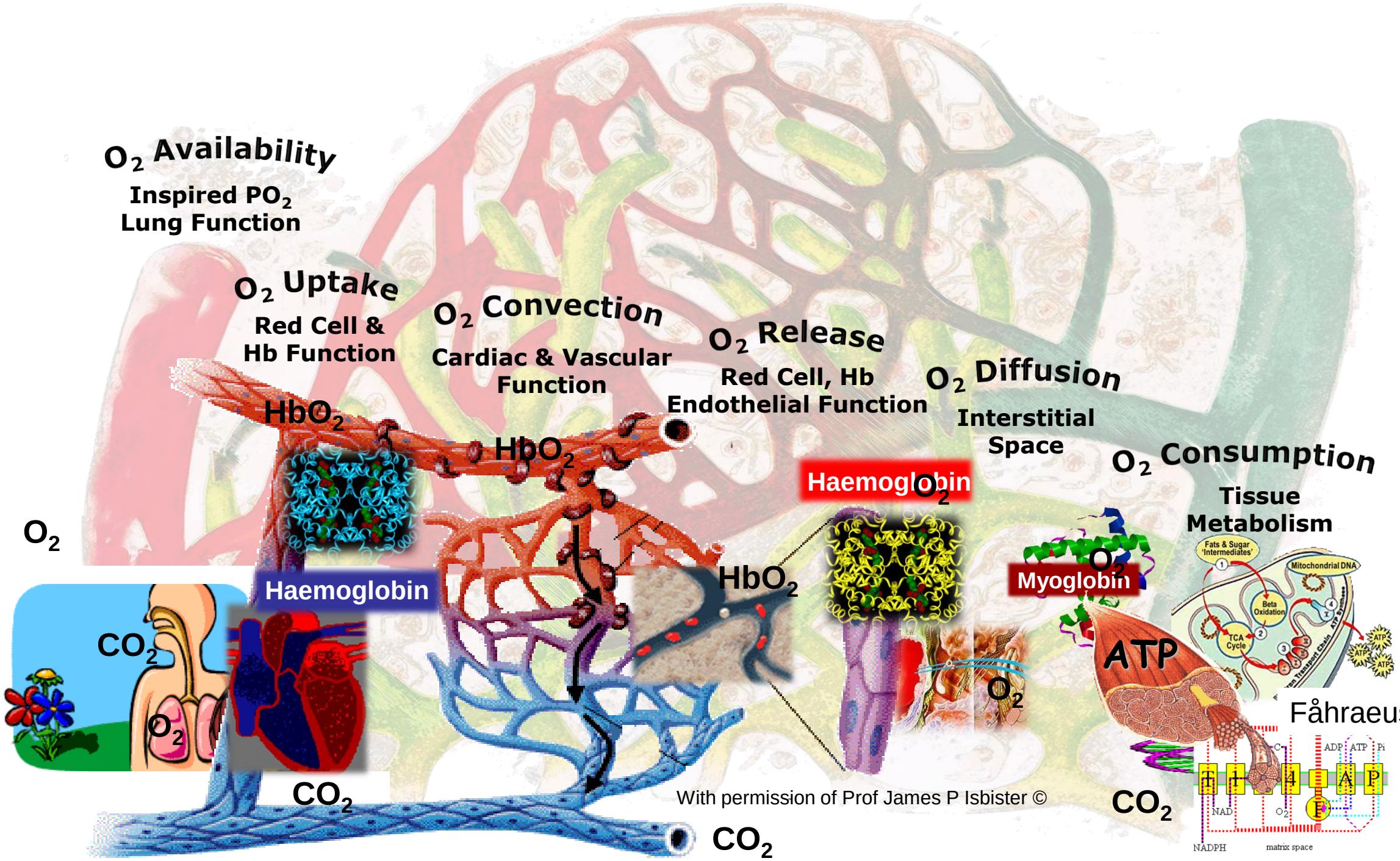
Clinical concept: improving the patient's clinical outcomes by "managing and preserving the **patient's own blood like any other organ or organ system"**



Originator of the term PBM

Clinical Professor James Isbister BSc(Med), MB BS, FRACP, FRCPA
Emeritus Consultant, Haematology & Transfusion Medicine, Royal North Shore Hospital, Sydney, Australia
Clinical Professor of Medicine, University of Sydney, Australia
Adjunct Professor, University of Technology, Sydney, Australia
Adjunct Professor, Monash University, Melbourne, Australia

Farmer SL, **Isbister JP,** Leahy MF. History of Blood Transfusion and Patient Blood Management. In: Jabbour (Second Edition). Malden, Mass.: Blackwell Pub.; 2015.
* National Blood Authority Standard 7 and the Patient Blood Management (PBM) Guidelines



Fåhraeus effect

With permission of Prof James P Isbister ©

Blood Health: The Ultimate Aim of Patient Blood Management

Sherri Ozawa, RN,[1] James P. Isbister, MBBS,[2] Shannon L. Farmer, DHSc,[1,3] Axel Hofmann, Dr rer medic,[1] Joshua Ozawa-Morriello, FNP-BC,[4] Irwin Gross, MD,[1] and Aryeh Shander, MD[5]

"It is now understood that **the blood** with its hematological, respiratory, immunological, and hemostatic components, in concert with the cardiovascular system with its intricate macrovascular and microvascular circulatory networks lined with versatile endothelial cells, **constitutes the largest integrated organ system in the body**."

Ozawa S, **Isbister J**, Farmer S, Hofmann A, Ozawa-Morriella J, Gross I, Shander A. Blood Health: The Ultimate Aim of Patient Blood Management *Anesthesia & Analgesia*. 2025

"**Blood Health**" analogous to "heart health," "gut health," "brain health," etc, and a comprehensive approach to protection and preservation of the organ.

"…**blood failure** occurs as the most frequent organ failure. Given the complexity of blood and the organ systems it interacts with, it can fail in many ways."

"…the patients' blood is **the most neglected organ**"
- default treatment has been an organ transplant (blood transfusion)


ANESTHESIA & ANALGESIA 2025

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Box 1

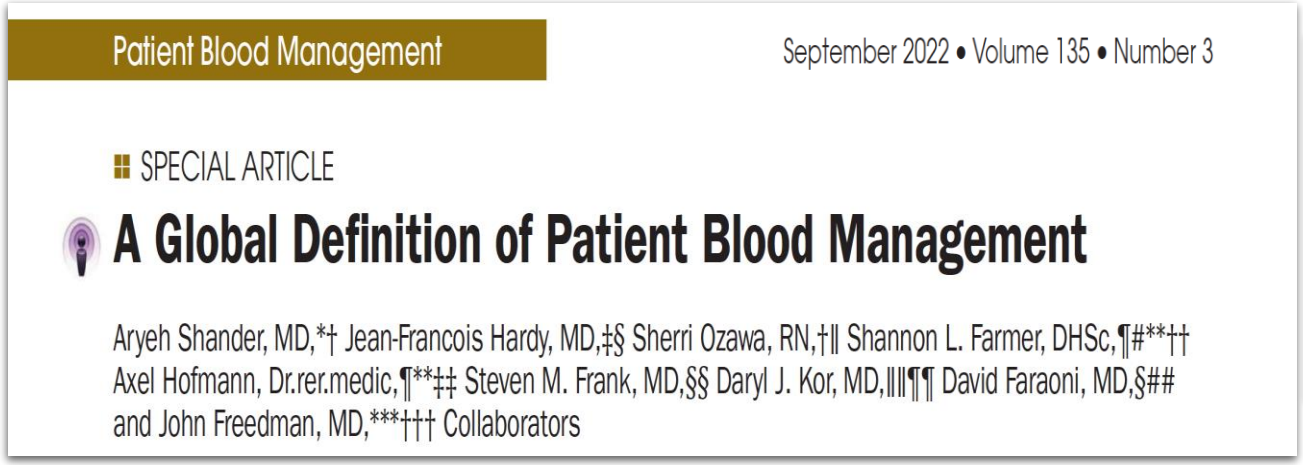
Definitions of patient blood management (PBM) and blood health and how they relate

Patient blood management is a *patient-centred, systematic, evidence-based approach to improve patient outcomes by managing and preserving a patient's own blood, while promoting patient safety and empowerment (2).*

Blood health[1] *is the optimal function of individual elements of blood, and their associated interactions with all other organs and organ systems (3).*

Blood is an organ. Although it is often treated or viewed as a connective tissue, a commodity, a medicine or a replacement fluid, circulating human blood fits every criterion that defines an organ of the human body. In fact, no other organ system can survive without properly functioning blood and, uniquely, markers in the blood provide information on the health of every other part of the body. Given this distinctive, or even principal role that blood plays in overall human well-being, striving for blood health through PBM is an ethical and societal imperative in every corner of the globe *(3)*.

PBM is a medical model that manages the patient's own circulating blood with the same consideration as should be given to any other organ or organ system. This includes prevention, diagnosis, treatment and follow-up while aiming for maximal blood health as the therapeutic goal. Health care professionals must understand PBM and integrate it as the standard of care. The public and patients need to understand the concept of blood health, and health authorities must declare blood health a public health priority. Addressing blood health holistically, including its relationship to the heart and the vasculature, will even translate into a significant beneficial impact on cardiovascular health.


Patient Blood Management

September 2022 • Volume 135 • Number 3

SPECIAL ARTICLE

A Global Definition of Patient Blood Management

Aryeh Shander, MD,*† Jean-Francois Hardy, MD,‡§ Sherri Ozawa, RN,†‖ Shannon L. Farmer, DHSc,¶#**†† Axel Hofmann, Dr.rer.medic,¶**‡‡ Steven M. Frank, MD,§§ Daryl J. Kor, MD,‖‖¶¶ David Faraoni, MD,§## and John Freedman, MD,***††† Collaborators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Blood Health: The Ultimate Aim of Patient Blood Management

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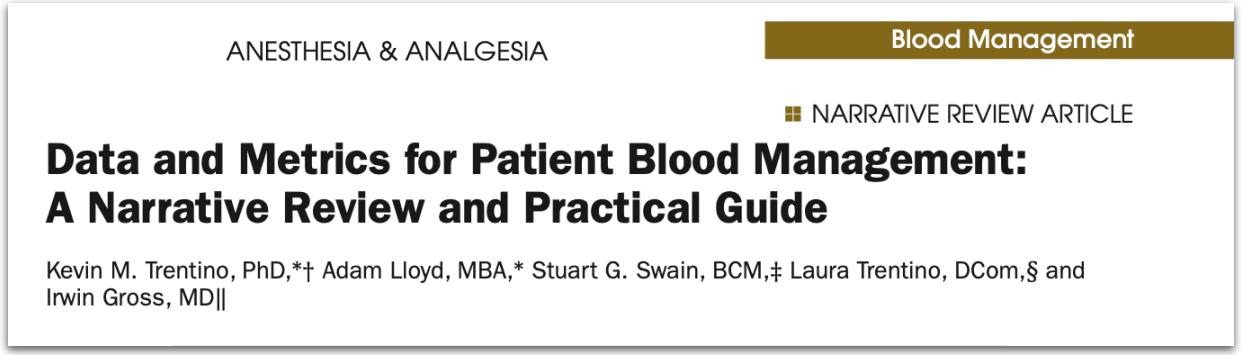
ANESTHESIA & ANALGESIA 2025

Patient Blood Management Program Implementation and Assessment Tool: Measuring Compliance With Guidelines and World Health Organization 2021 Policy Brief

Shannon L. Farmer, DHSc,*† Carleen Ellis, MEd,* Jeffrey M. Hamdorf, MD,* Darren Falconer, PhD,‡ Kylie Symons, BNsg,§ Claire McNally, MNsg,‖ Angie Monk, RM, RN,¶ Michael F. Leahy, MBChB,†# Nolan McDonnell, MD,** and Axel Hofmann, Dr rer medic*


ANESTHESIA & ANALGESIA

Blood Management

NARRATIVE REVIEW ARTICLE

Data and Metrics for Patient Blood Management: A Narrative Review and Practical Guide

Kevin M. Trentino, PhD,*† Adam Lloyd, MBA,* Stuart G. Swain, BCM,‡ Laura Trentino, DCom,§ and Irwin Gross, MD‖

Complementary articles referenced in the WHO Guidance on Implementing Patient Blood Management

2 Overview

How this document helps to overcome the challenges of global PBM implementation

To overcome the challenges of global PBM implementation, this document provides two essential aids:

- a pathway for national/jurisdictional PBM implementation that engages the most relevant stakeholders; and
- PBM toolkits for specific patient populations and diverse resource levels.


Guidance on implementing
patient blood management
to improve global blood
health status
World Health Organization

3P∞3E

“3 Ps”

Guidance on implementing **patient blood management** to improve global **blood health** status

World Health Organization

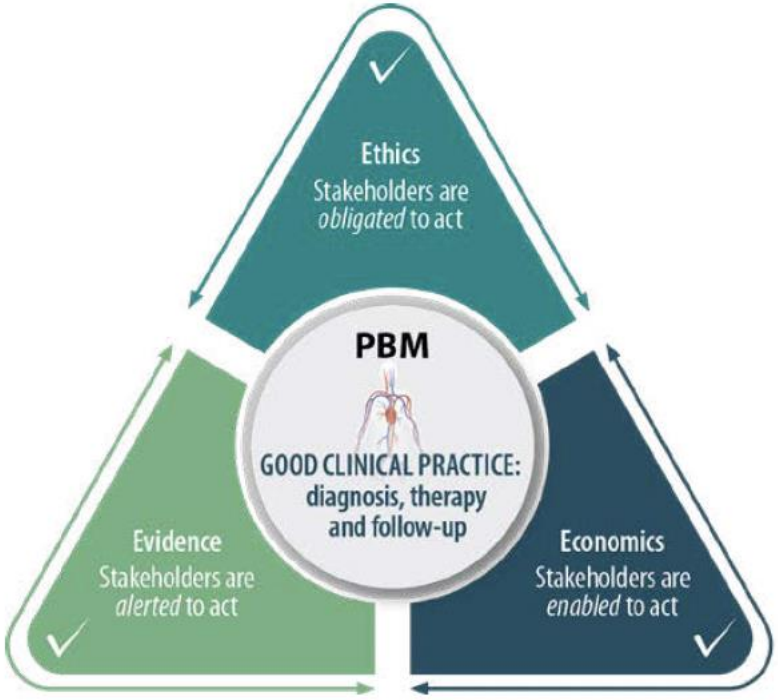
Fig. 1. Improved population health status through PBM

“3 Es”

Guidance on implementing **patient blood management** to improve global **blood health** status

World Health Organization

Fig. 2. The “3Es” to drive implementation of patient blood management on the health care organization level



Self-evident ethical obligations:

- Respect patient autonomy
- Manage patients’ own blood with with the same respect as any other organ
- Improve equity and access to care
- Respect donors by ensuring their blood donation will be requested and used only when clinically essential to meet the needs of patients

Sufficient peer-reviewed evidence:

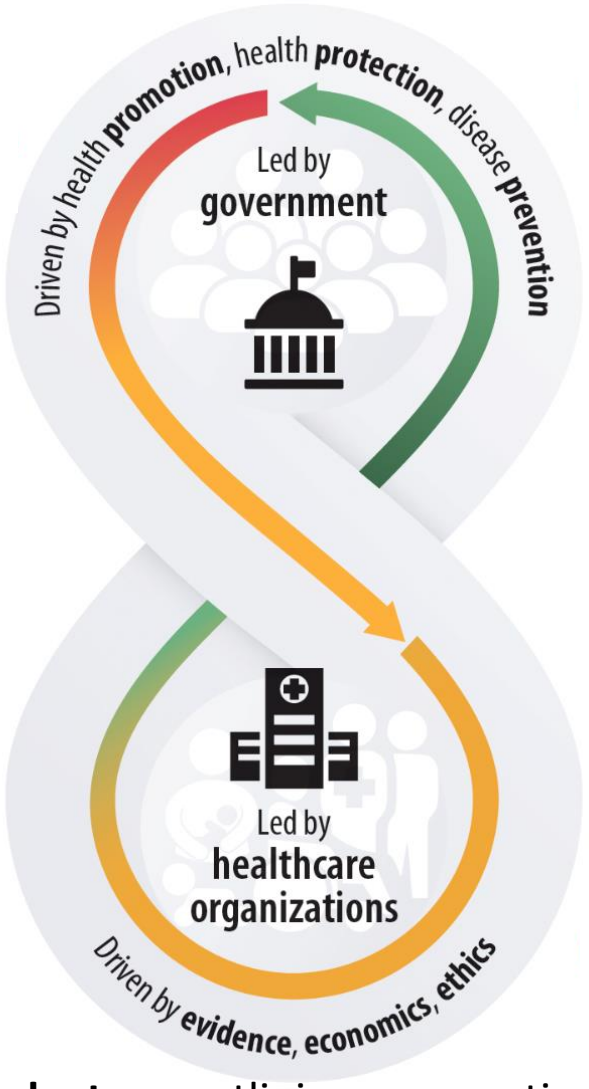
- Clinicians should adopt PBM
- Health authorities should mandate PBM

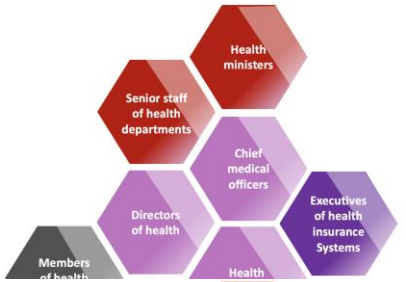
Savings potential of a macroeconomic magnitude:

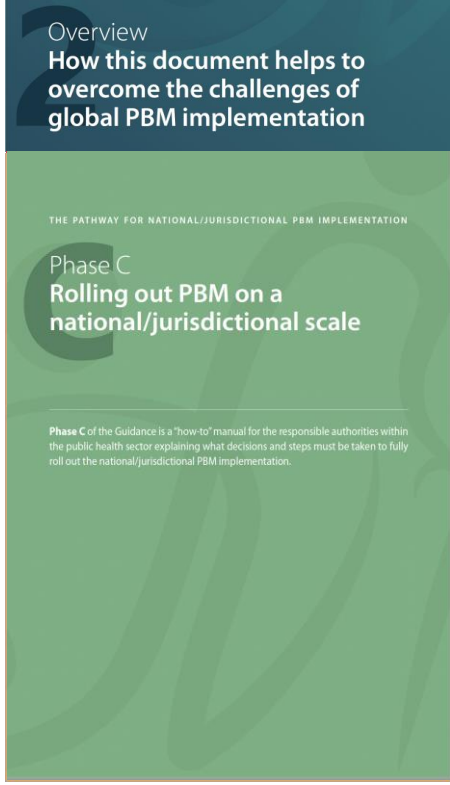
- Reducing global burden of disease by millions of YLDs
- Reducing transfusion related cost by tens of billions of dollars
- Decreasing significant overall treatment costs
- Costs to enable can be obtained by re-allocating funds from blood acquisition budgets

YLD, years lived with disability.
Source: Hofmann A. et al. (2022) *(4)*.

The 8-model to implement patient blood management

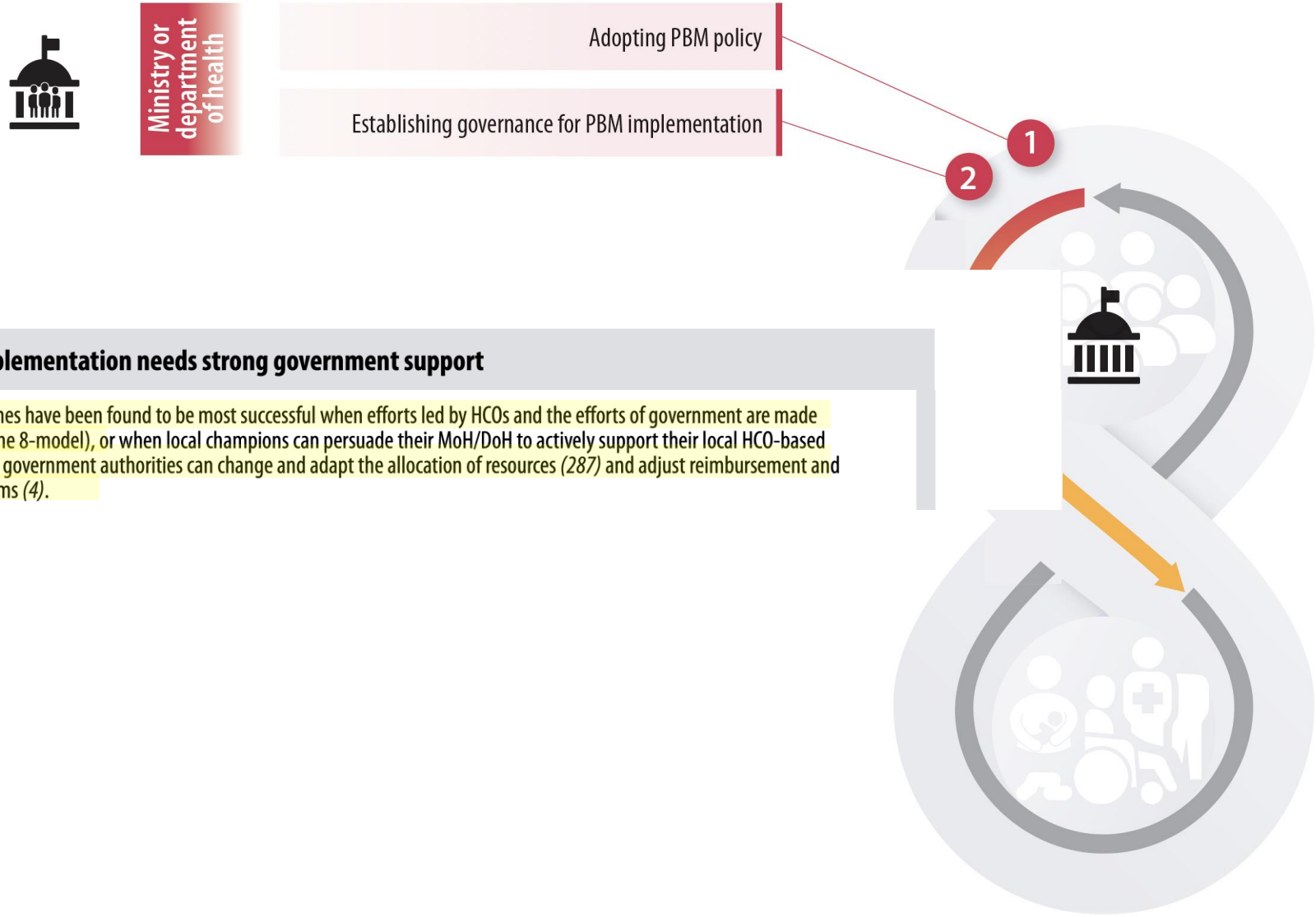






3 phases, 19 steps, 50 sub-steps outlining consecutive implementation steps from initiation to full completion.

Fig. 4. Phase A of the 8-model – Preparing the national/jurisdictional health care system for PBM



Box 13

Why PBM implementation needs strong government support

PBM programmes have been found to be most successful when efforts led by HCOs and the efforts of government are made concurrently (the 8-model), or when local champions can persuade their MoH/DoH to actively support their local HCO-based approach. Only government authorities can change and adapt the allocation of resources *(287)* and adjust reimbursement and incentive systems *(4)*.

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

A Phase A
Preparing the national/ jurisdictional health care system for PBM

Phase A of the guidance is a "how-to" manual for the responsible authorities within the public health sector, describing what decisions and steps must be taken to prepare for the full national/jurisdictional implementation of PBM.

Fig. 4. Phase A of the 8-model – Preparing the national/jurisdictional health care system for PBM

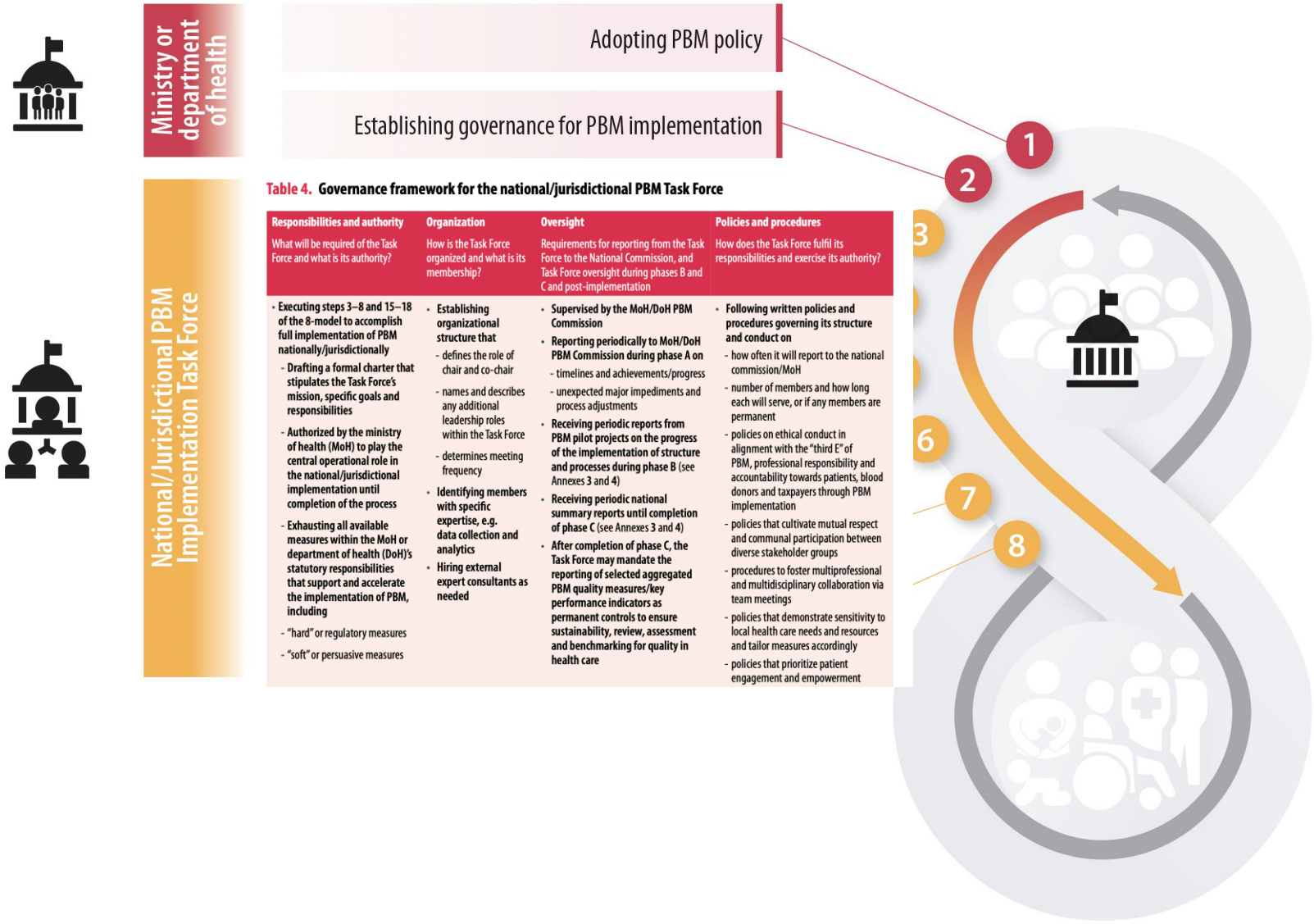
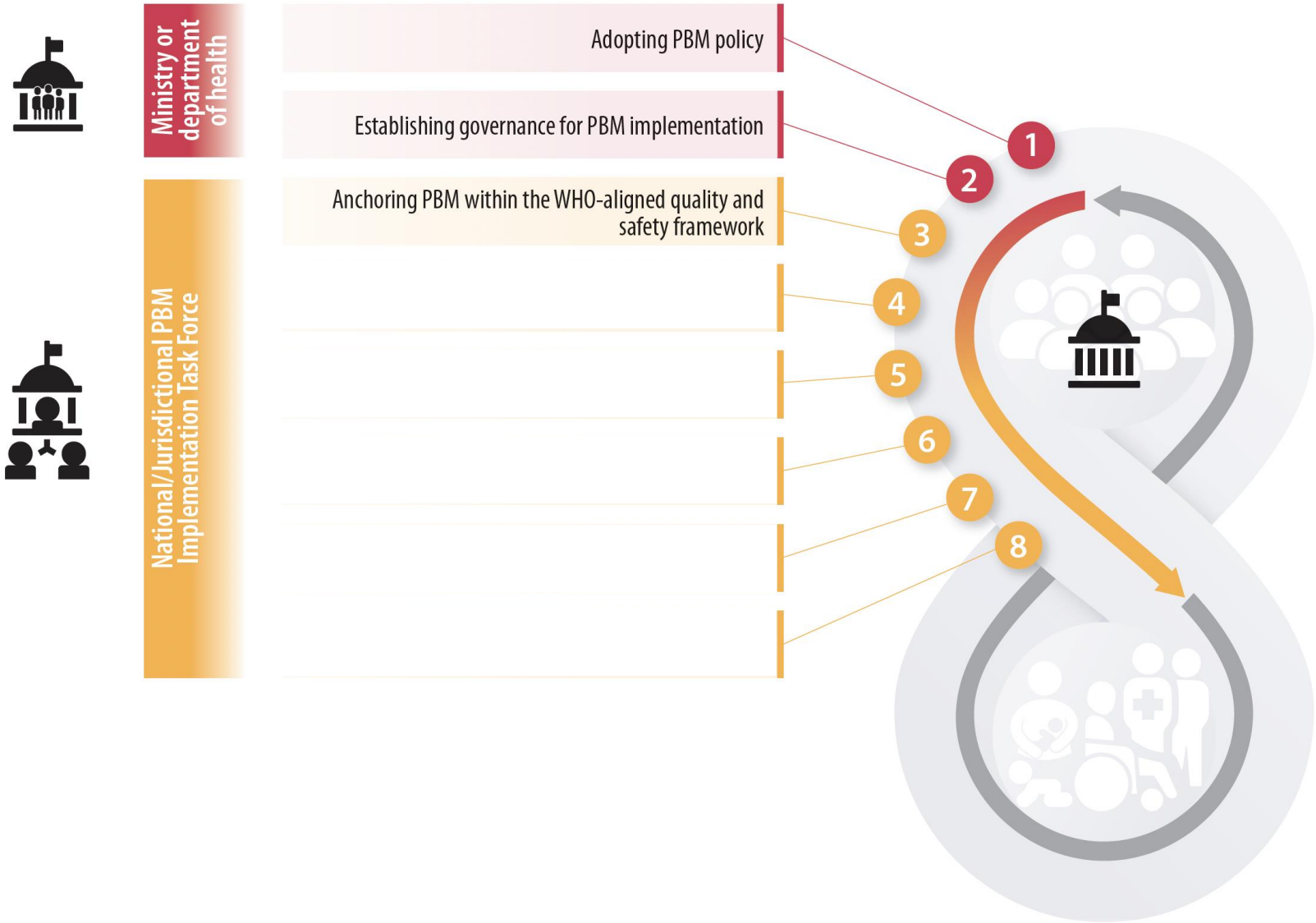


Table 4. Governance framework for the national/jurisdictional PBM Task Force

Responsibilities and authority What will be required of the Task Force and what is its authority?	Organization How is the Task Force organized and what is its membership?	Oversight Requirements for reporting from the Task Force to the National Commission, and Task Force oversight during phases B and C and post-implementation	Policies and procedures How does the Task Force fulfil its responsibilities and exercise its authority?
• **Executing steps 3–8 and 15–18 of the 8-model to accomplish full implementation of PBM nationally/jurisdictionally** - **Drafting a formal charter that stipulates the Task Force's mission, specific goals and responsibilities** - **Authorized by the ministry of health (MoH) to play the central operational role in the national/jurisdictional implementation until completion of the process** - **Exhausting all available measures within the MoH or department of health (DoH)'s statutory responsibilities that support and accelerate the implementation of PBM, including** - "hard" or regulatory measures - "soft" or persuasive measures	• **Establishing organizational structure that** - defines the role of chair and co-chair - names and describes any additional leadership roles within the Task Force - determines meeting frequency • **Identifying members with specific expertise, e.g. data collection and analytics** • **Hiring external expert consultants as needed**	• **Supervised by the MoH/DoH PBM Commission** • **Reporting periodically to MoH/DoH PBM Commission during phase A on** - timelines and achievements/progress - unexpected major impediments and process adjustments • **Receiving periodic reports from PBM pilot projects on the progress of the implementation of structure and processes during phase B** (see Annexes 3 and 4) • **Receiving periodic national summary reports until completion of phase C** (see Annexes 3 and 4) • **After completion of phase C, the Task Force may mandate the reporting of selected aggregated PBM quality measures/key performance indicators as permanent controls to ensure sustainability, review, assessment and benchmarking for quality in health care**	• **Following written policies and procedures governing its structure and conduct on** - how often it will report to the national commission/MoH - number of members and how long each will serve, or if any members are permanent - policies on ethical conduct in alignment with the "third E" of PBM, professional responsibility and accountability towards patients, blood donors and taxpayers through PBM implementation - policies that cultivate mutual respect and communal participation between diverse stakeholder groups - procedures to foster multiprofessional and multidisciplinary collaboration via team meetings - policies that demonstrate sensitivity to local health care needs and resources and tailor measures accordingly - policies that prioritize patient engagement and empowerment

Fig. 4. Phase A of the 8-model – Preparing the national/jurisdictional health care system for PBM



THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

Phase A
Preparing the national/ jurisdictional health care system for PBM

Phase A of the guidance is a "how-to" manual for the responsible authorities within the public health sector, describing what decisions and steps must be taken to prepare for the full national/jurisdictional implementation of PBM.

Annex 5.
Patient blood management (PBM) and PBM-related guidelines, guidance, consensus statements and recommendations by specialty and/or clinical settings

1. Peri-operative	Patient blood management guidelines: module 2 – Perioperative. Natio Management of severe perioperative bleeding: Guidelines from the Eur EACTS/EACTA Guidelines on patient blood management for adult cardia STS/SCA/AmSECT/SABM Update to the clinical practice guidelines on pa 2022 ESC Guidelines on cardiovascular assessment and management of Recommendations from the International Consensus Conference on Ane Centre for Perioperative Care, 2022 *(8)* Identification and management of preoperative anaemia in adults: A Br Management of peri-surgical anemia in elective surgery. Conclusions ar
2. Medical	Patient blood management guidelines: module 3 – Medical. National Management of anaemia and iron deficiency in patients with cancer: E Guidance for the gastrointestinal evaluation and management of iron Practical clinical consensus guidelines for the management of cancer a British Society of Gastroenterology guidelines for the management of
3. Intensive care/ critical care	Patient blood management guidelines: module 4 – critical care. Natio
4. Obstetrics and gynaecology	Patient blood management guidelines: module 5 – obstetrics. Nationa A roadmap to combat postpartum haemorrhage between 2023 and 20 Patient blood management in obstetrics: management of anaemia an Patient blood management in obstetrics: prevention and treatment of UK guidelines on the management of iron deficiency in pregnancy, 202 Accelerating anaemia reduction: a comprehensive framework for actio SABM administrative and clinical standards for patient blood manager

Annex 5. *continued*

5. Neonatology and paediatrics	Patient blood management guidelines: module 6 – neonatal and paediatrics. National Blood Authority, 2017 (24) Patient blood management for neonates and children undergoing cardiac surgery: 2019 NATA Guidelines *(25)* Society for the advancement of blood management administrative and clinical standards for patient blood management programmes (pediatric version). 2019 *(26)* Management of severe peri-operative bleeding: Guidelines from the E Accelerating anaemia reduction: a comprehensive framework for actio
6. Massive haemorrhage	The European guideline on management of major bleeding and coagu Management of severe perioperative bleeding: Guidelines from the Eu
7. Hospital PBM implementation	SABM administrative and clinical standards for patient blood manage Supporting patient blood management (PBM) in the EU – A practical
8. National/ jurisdictional PBM implementation	Building national programmes of patient blood management (PBM) i Accelerating anaemia reduction: a comprehensive framework for actio

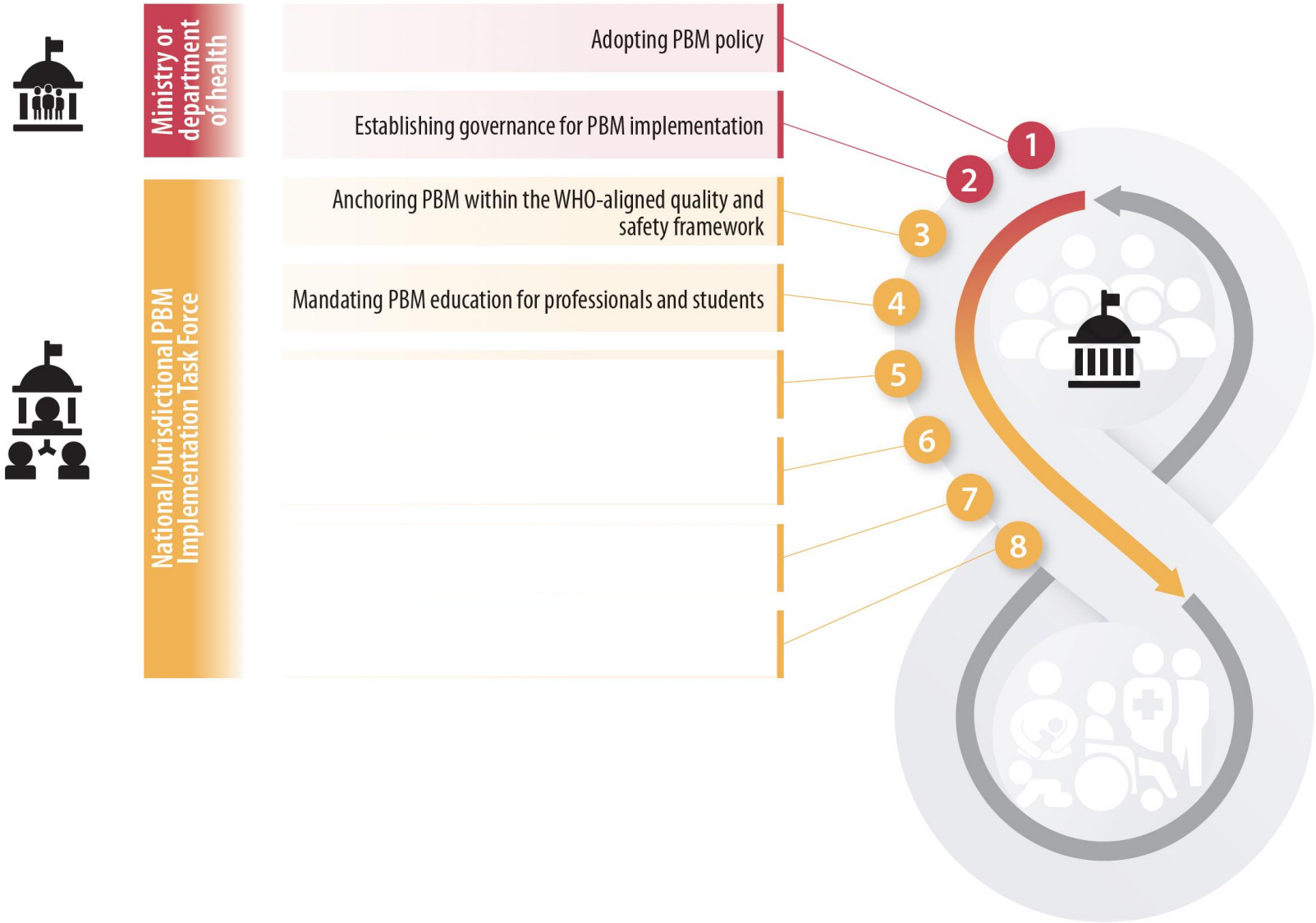
References

1. Patient Blood Management Guidelines: module 2 – perioperative. Canberra: National Blood A 2025).
2. Kietaibl S, Ahmed A, Afshari A, Albaladejo P, Aldecoa C, Barauskas G et al. Management of se Anaesthesiol. 2023;40:226-304. doi: 10.1097/EJA.0000000000001803.
3. Task Force on Patient Blood Management for Adult Cardiac Surgery of the European Associati blood management for adult cardiac surgery. J Cardiothorac Vasc Anesth. 2018. 32: 88–120.
4. Tibi P, McClure RS, Huang J, Baker RA, Fitzgerald D, Mazer CD et al. STS/SCA/AmSECT/SABM u athoracsur.2021.03.033.
5. Halvorsen S, Mehilli J, Cassese S, Hall TS, Abdelhamid M, Barbato E et al. 2022 ESC Guidelines 10.1093/eurheartj/ehac270.
6. Shander A, Corwin HL, Meier J, Auerbach M, Bisbe E, Blitz J et al. Recommendations from the 10.1097/SLA.0000000000005721.
7. The 2007 national blood collection and utilization survey report. Washington (DC): The Unite blood-collection-and-utilization-survey/index.html, accessed 04 February 2025).
8. Guideline for the management of anaemia in the perioperative pathway. London: Centre for February 2025.
9. Hands K, Daru J, Evans C, Kotze A, Lewis C, Narayan S et al. Identification and management o bjh.19440.
10. Moral V, Abad Motos A, Jericó C, Antelo Caamaño ML, Ripollés Melchor J, Bisbe Vives E et al. M Rev Esp Anestesiol Reanim (Engl Ed). 2024;71:454–65. doi: 10.1016/j.redare.2024.04.015.

Annex 5. *continued*

11. Patient blood management guidelines: module 3 – medical. Canberra: National Blood Authority; 2012 (https://www.blood.gov.au/module-3-medical-patient-blood-management-guidelines, accessed 04 February 2025).
12. Aapro M, Beguin Y, Bokemeyer C, Dicato M, Gascon P, Glaspy J et al. Management of anaemia and iron deficiency in patients with cancer: ESMO clinical practice guidelines. Ann Oncol. 2018;29(Suppl 4):iv96–iv110doi: 10.1093/annonc/mdx758.
13. Simmonds WM, Awuku Y, Barrett C, Brand M, Davidson K, Epstein D et al. Guidance for the gastrointestinal evaluation and management of iron deficiency in Sub-Saharan Africa. S Afr Med J. 2024;114:e711. doi: 10.7196/SAMJ.2024.v114i1b.711.
14. Parikh PM, Aggarwal S, Biswas G, Gulia S, Agarwala V, Basade M et al. Practical clinical consensus guidelines for the management of cancer associated anemia in low- and middle-income countries. South Asian J Cancer. 2023;12:93–9. doi: 10.1055/s-0043-1771445.
15. Snook J, Bhala N, Beales ILP, Cannings D, Kightley C, Logan RP et al. British Society of Gastroenterology guidelines for the management of iron deficiency anaemia in adults. Gut. 2021;70:2030–51. doi: 10.1136/gutjnl-2021-325210.
16. Patient blood management guidelines: module 4 – critical care. Canberra: National Blood Authority; 2012. (https://www.blood.gov.au/module-4-critical-care-patient-blood-management-guidelines, accessed 04 February 2025).
17. Patient blood management guidelines: Module 5 - Obstetrics. Canberra, Australia: National Blood Authority; 2015 (https://www.blood.gov.au/module-5-obstetrics-and-maternity-patient-blood-management-guidelines, accessed 04 February 2025).
18. A roadmap to combat postpartum haemorrhage between 2023 and 2030. Geneva: World Health Organization; 2023 (https://cdn.who.int/media/docs/default-source/reproductive-health/maternal-health/pph-roadmap.pdf?sfvrsn=db36b511_, accessed 04 February 2025)
19. Muñoz M, Pena-Rosas JP, Robinson S, Milman N, Holzgreve W, Breymann C et al. Patient blood management in obstetrics: management of anaemia and haematinic deficiencies in pregnancy and in the post-partum period: NATA consensus statement. Transfus Med. 2018;28:22–39. doi: 10.1111/tme.12443.
20. Muñoz M, Stensballe J, Ducloy-Bouthors AS, Bonnet MP, De Robertis E, Fornet I et al. Patient blood management in obstetrics: prevention and treatment of postpartum haemorrhage. A NATA consensus statement. Blood Transfus. 2019;17:112–36. doi: 10.2450/2019.0245-18.
21. Pavord S, Daru J, Prasannan N, Robinson S, Stanworth S, Girling J et al. UK guidelines on the management of iron deficiency in pregnancy. Br J Haematol. 2020;188:819–30. doi: 10.1111/bjh.16221.
22. WHO. Accelerating anaemia reduction: a comprehensive framework for action. Geneva: World Health Organization; 2023 (https://www.who.int/publications/i/item/9789240074033, accessed February 22, 2024).
23. SABM administrative and clinical standards for patient blood management programs, 4th edition. Mt Royal (NJ): Society for the Advancement of Blood Management; 2017 (https://www.sabm.org/publications/, accessed 15 September 2018).
24. Patient blood management guidelines: module 6 – neonatal and paediatrics. Canberra: National Blood Authority; 2017.(https://www.blood.gov.au/module-6-neonatal-and-paediatrics-patient-blood-management-guidelines, accessed 04 February 2025).
25. Faraoni D, Meier J, New HV, Van der Linden PJ, Hunt BJ. Patient blood management for neonates and children undergoing cardiac surgery: 2019 NATA Guidelines. J Cardiothorac Vasc Anesth. 2019;33:3249–63. doi: 10.1053/j.jvca.2019.03.036.
26. Goobie SM, Gallagher T, Gross I, Shander A. Society for the advancement of blood management administrative and clinical standards for patient blood management programs. 4th edition (pediatric version). Paediatr Anaesth. 2019;29:231–6. doi: 10.1111/pan.13574.
27. Kietaibl S, Ahmed A, Afshari A, Albaladejo P, Aldecoa C, Barauskas G et al. Management of severe peri-operative bleeding: Guidelines from the European Society of Anaesthesiology and Intensive Care: second update 2022. Eur J Anaesthesiol. 2023;40:226-304. doi: 10.1097/EJA.0000000000001803.
28. Rossaint R, Afshari A, Bouillon B, Cerny V, Cimpoesu D, Curry N et al. The European guideline on management of major bleeding and coagulopathy following trauma: sixth edition. Crit Care. 2023;27:80. doi: 10.1186/s13054-023-04327-7.
29. Gombotz H, Hofmann A, Nørgaard A, Kastner P. Supporting patient blood management (PBM) in the EU – a practical implementation guide for hospitals. Luxembourg: European Commission – Directorate-General for Health and Food Safety; 2017. (https://op.europa.eu/en/publication-detail/-/publication/93e1bbbf-1a8b-11e7-808e-01aa75ed71a1/language-en, accessed 04 February 2025).
30. Hofmann A, Nørgaard A, Kurz J, Choorapoikayil S, Meybohm P, Zacharowski K et al. Building national programmes of patient blood management (PBM) in the EU – A Guide for Health Authorities. Luxembourg: European Commission – Directorate-General for Health and Food Safety; 2017. (https://op.europa.eu/en/publication-detail/-/publication/5ec54745-1a8c-11e7-808e-01aa75ed71a1/language-en, accessed 04 February 2025).

Fig. 4. Phase A of the 8-model – Preparing the national/jurisdictional health care system for PBM

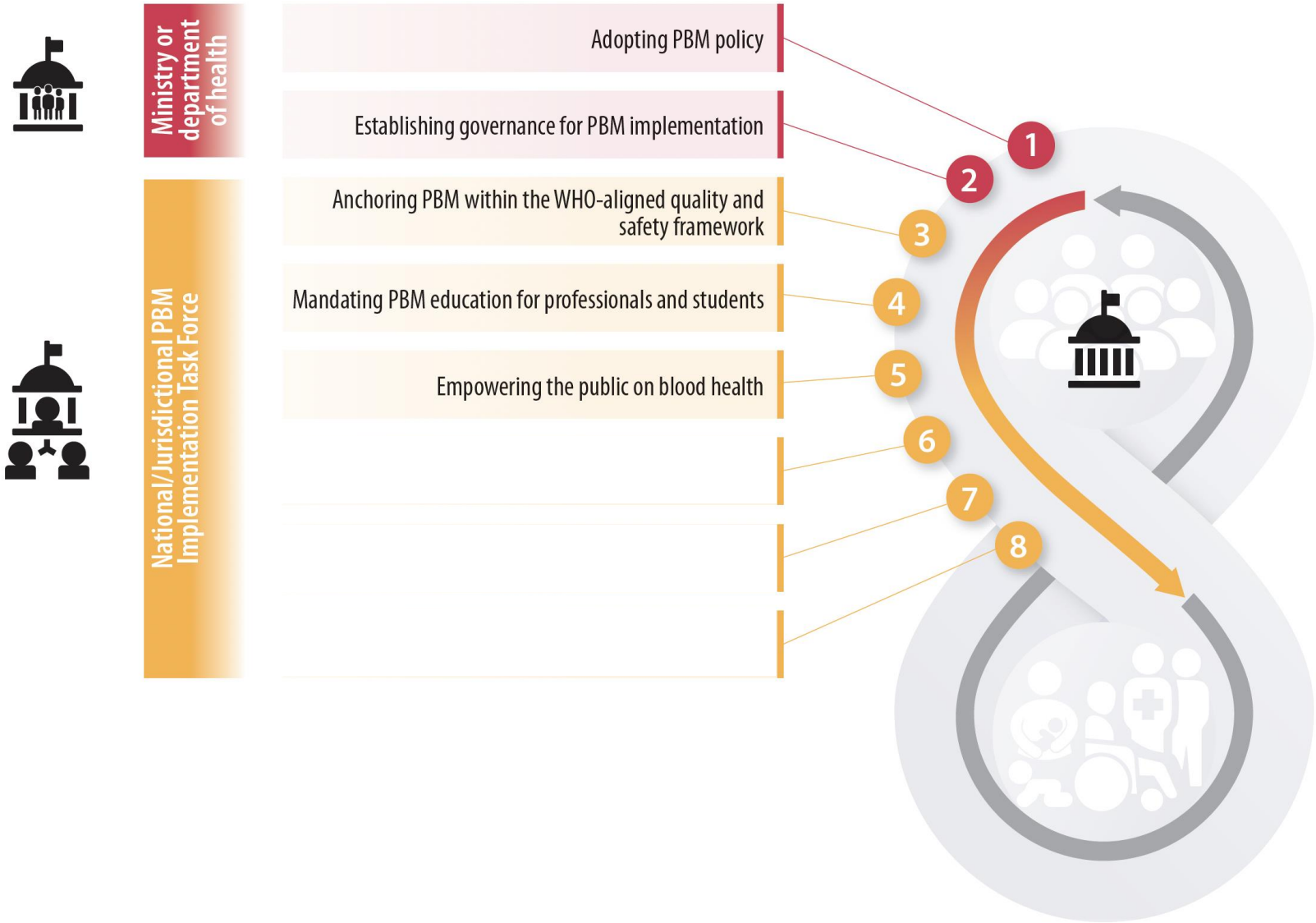


THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

Phase A
Preparing the national/ jurisdictional health care system for PBM

Phase A of the guidance is a "how-to" manual for the responsible authorities within the public health sector, describing what decisions and steps must be taken to prepare for the full national/jurisdictional implementation of PBM.

Fig. 4. Phase A of the 8-model – Preparing the national/jurisdictional health care system for PBM

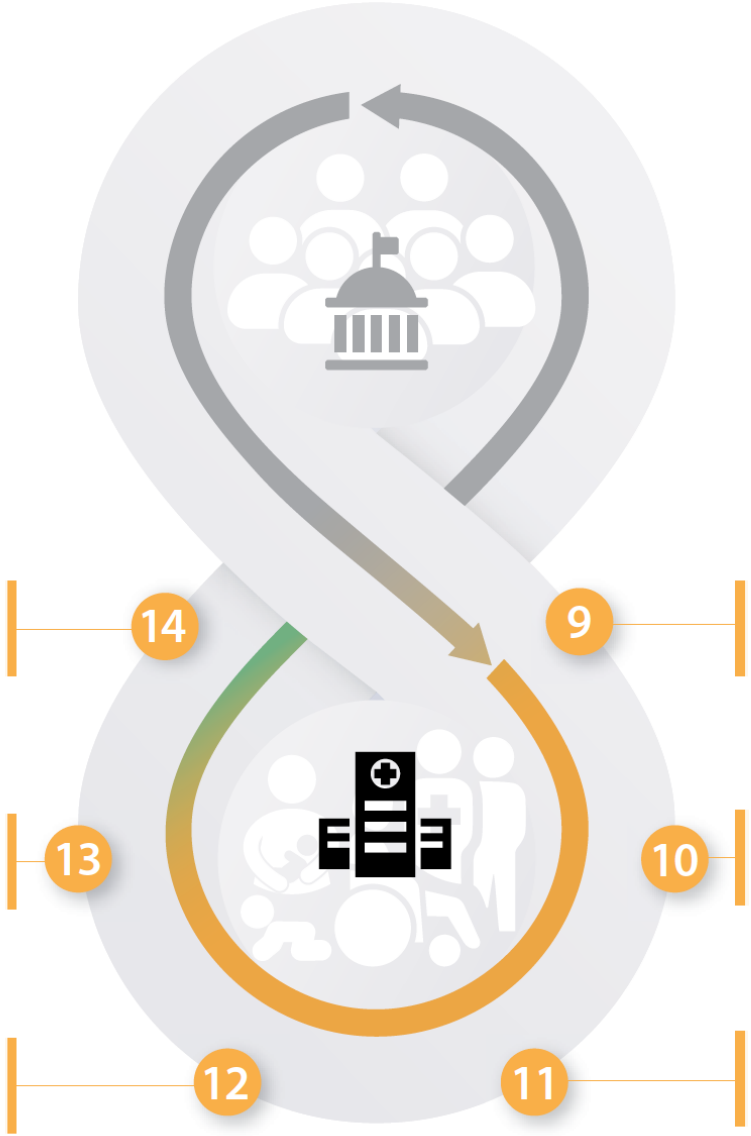


THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

A Phase A
Preparing the national/ jurisdictional health care system for PBM

Phase A of the guidance is a "how-to" manual for the responsible authorities within the public health sector, describing what decisions and steps must be taken to prepare for the full national/jurisdictional implementation of PBM.

Fig. 5. Phase B of the 8-model – Conducting patient blood management pilot project(s)



THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

B Phase B
Conducting PBM pilot project(s)

Phase B of the guidance document is a "how-to" manual for local champions to initiate, prepare and conduct demonstrational PBM projects at an HCO level, and to qualify as national PBM reference centres. These reference centres would then serve as resources to accelerate full national/jurisdictional PBM implementation.

The role of champions

"Clinical champions are individuals who are dedicated to supporting, advocating for, and spearheading an implementation initiative, and who overcome resistance that may occur at the organizational level. They have an intrinsic interest to implement change and use their position to motivate others. . . . [Their] strong communication and mentorship skills include collaborating with others, advocating for change, the ability to negotiate as well as educate and facilitate learning. Strong communication and mentorship skills can facilitate buy-in by conveying their conviction and positive perceptions about the initiative to their peers. Champions can also effectively tailor messages to different audiences to maximize engagement and buy-in" *(589)*.

These attitudes and capabilities could also apply to nonclinical professionals, such as public health representatives, hospital administrators or other health care-related professionals *(287)*.

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

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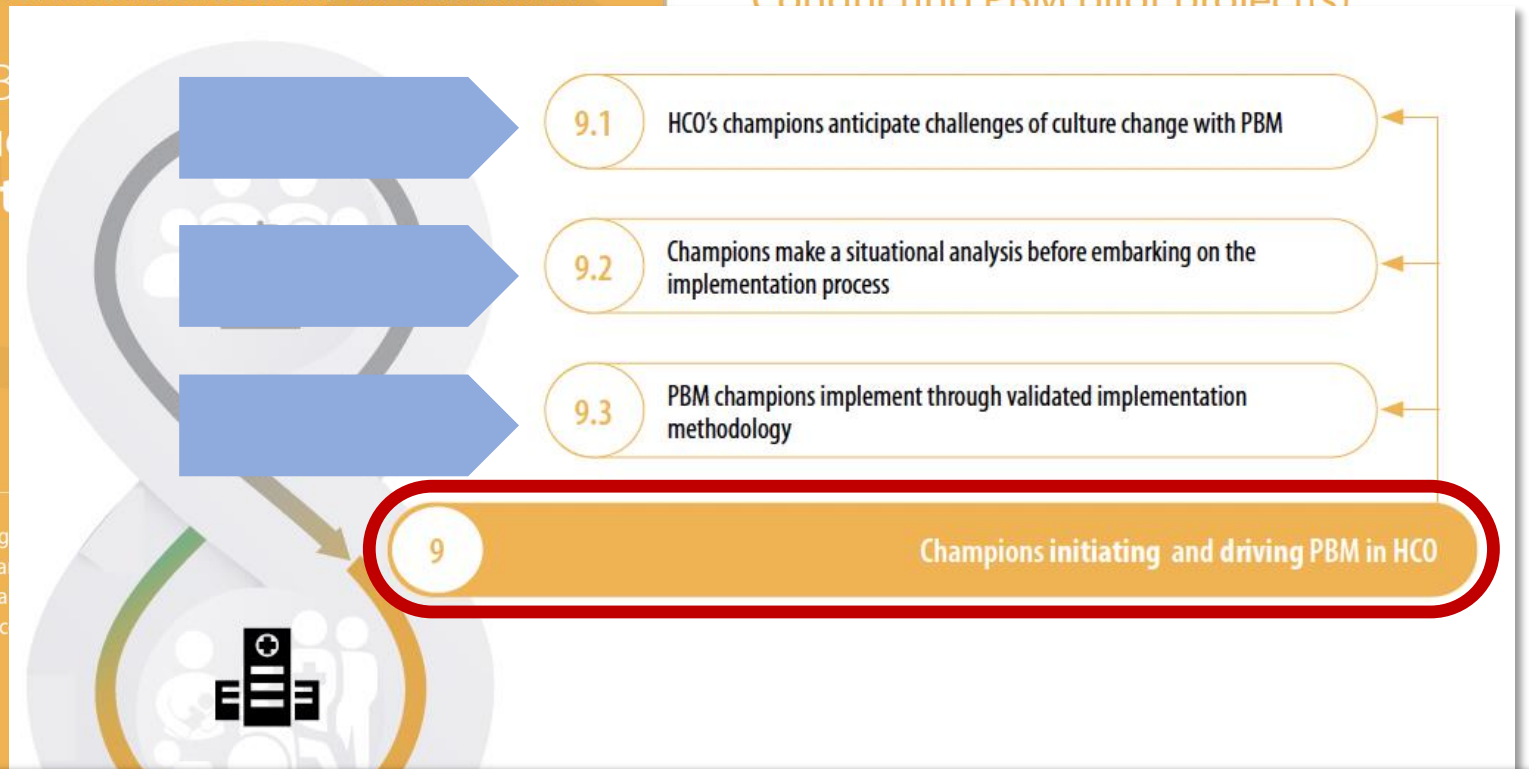


9.3 Implementing through validated methodology

As highlighted in the WHO PBM Policy Brief, applying a proven implementation methodology is pivotal for successful PBM implementation. **Annex 2** of this guidance document lists and briefly describes several implementation methodologies. In the world's largest PBM implementation programme to date, the Kotter model for change management was applied.

Fig

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

Phase B support
Changing HCO's culture methodologically

Using implementation methodology to change culture

To increase the chances of success of local or institutional pilot projects, it is recommended that champions use a validated implementation methodology *(1, 37, 600)*. As stated in the WHO PBM Policy Brief, this is **even more important when the implementation requires culture change**.

The Kotter model for change has been successfully used to implement PBM programmes within HCOs and on a state level *(22)*. The model, with its eight-stage framework, provides a structured approach to facilitate successful organizational change and to overcome complacency, resistance and deeply ingrained culture.

Annex 1.
Donabedian model

Fig. A1.1: Donabedian quality framework in the context of establishing PBM as a standard of care

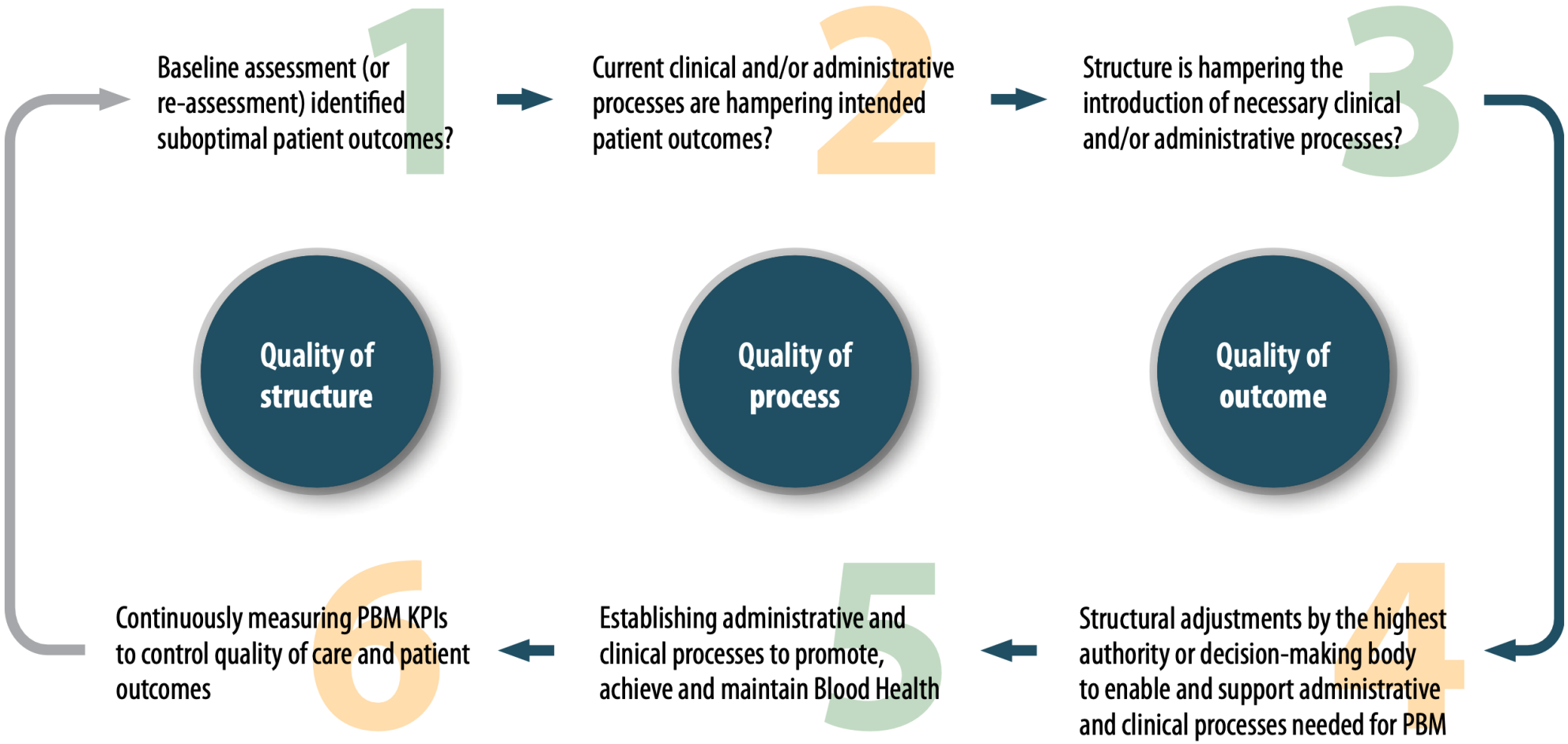


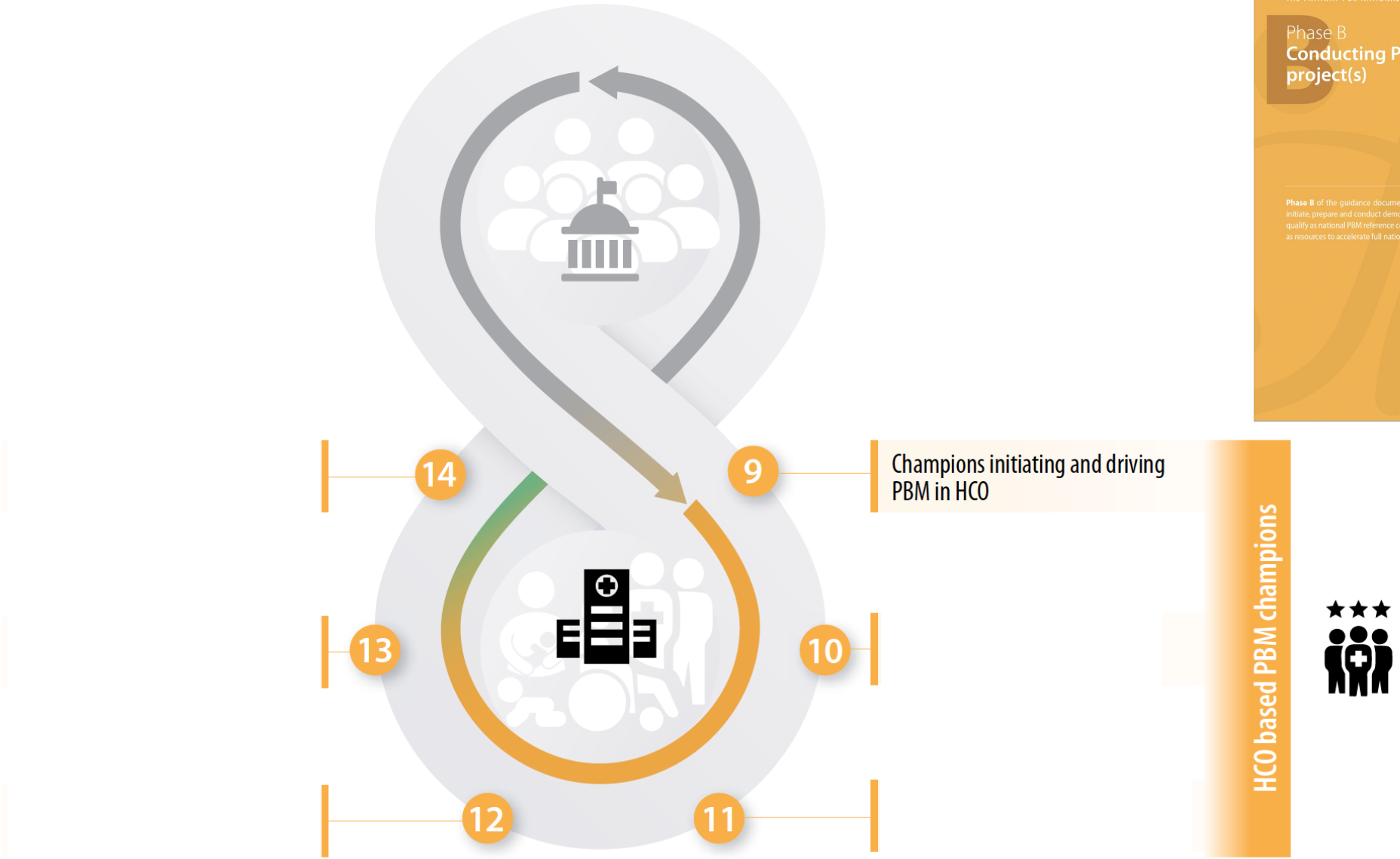
Table 2. Structure of the Patient Blood Management Implementation and Assessment Tool (PIAT) Using a Modified Donabedian Model

Structure	Weight 30%
Governance	
Awareness	
Information systems	
Patient autonomy and patient empowerment	
Process	Weight 35%
Pillar 1—detection, diagnosis, and management of anemia and iron deficiency	
Pillar 2—minimization of blood loss and optimization of coagulation	
Pillar 3—leveraging and optimizing the patient-specific physiological tolerance of anemia	
Patient empowerment	
Outcomes Reporting	Weight 35%

Abbreviation: PIAT, Program Implementation and Assessment Tool.

Farmer SL, Ellis C, Hamdorf JM, Falconer D, Symons K, McNally C, et al. Patient Blood Management Program Implementation and Assessment Tool: Measuring Compliance With Guidelines and World Health Organization 2021 Policy Brief. Anesth Analg. 2025:10.1213/ANE.0000000000007364.

Fig. 5. Phase B of the 8-model – Conducting patient blood management pilot project(s)



THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

B Phase B
Conducting PBM pilot project(s)

Phase B of the guidance document is a "how-to" manual for local champions to initiate, prepare and conduct demonstrational PBM projects at an HCO level, and to qualify as national PBM reference centres. These reference centres would then serve as resources to accelerate full national/jurisdictional PBM implementation.

Fig. 5. Phase B of the 8-model – Conducting patient blood management pilot project(s)

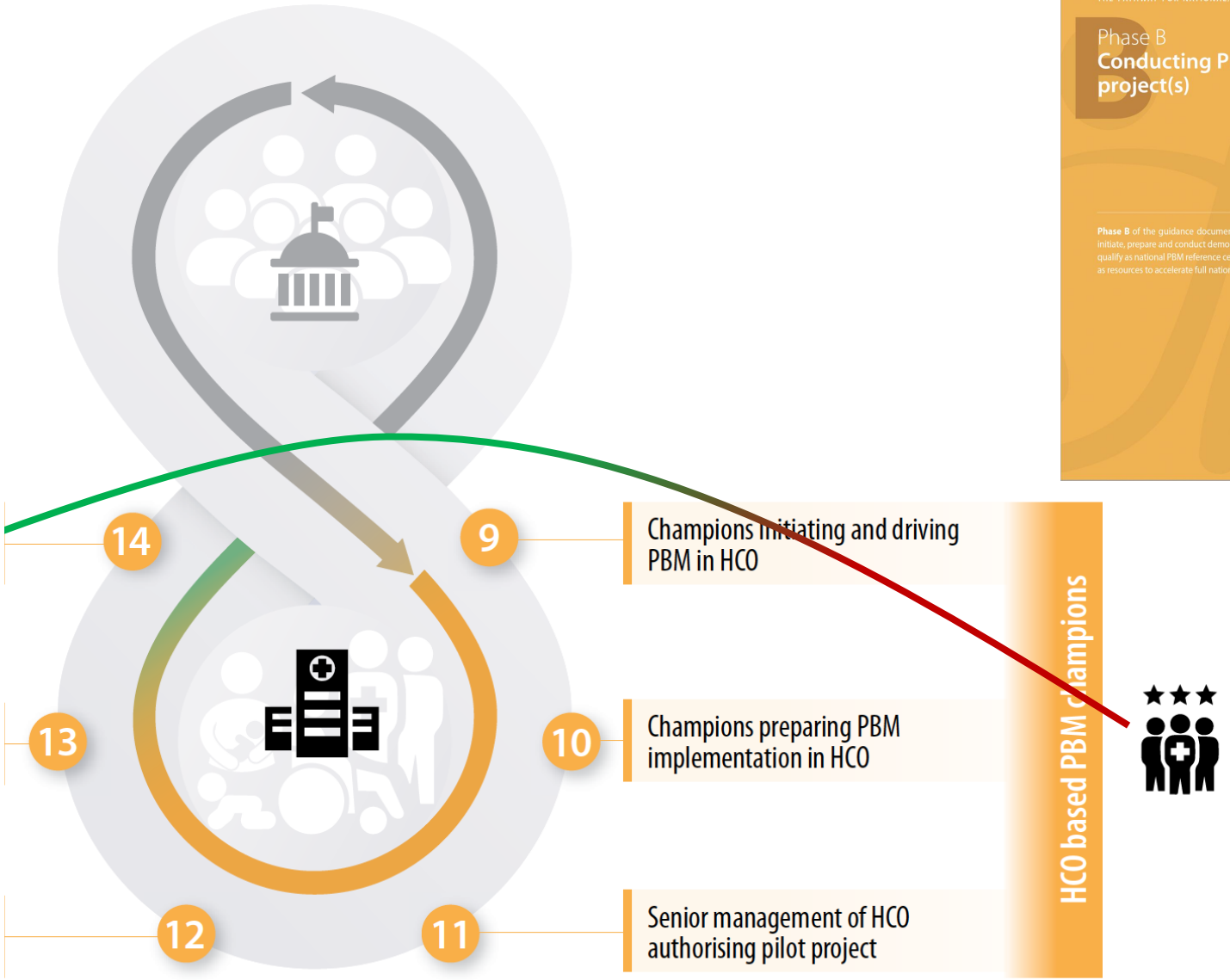


Table 6. Governance framework for the HCO PBM Task Force

Responsibilities and authority What will be required of the Task Force and what is its authority?	Organization How is the **Implementation Task Force** organized?	Oversight Reporting requirements from the Task Force to the national commission, and Task Force oversight during phases B and C and post-implementation	Policies and procedures How does the Task Force fulfil its responsibilities and exercise its authority?
• Managing/executing steps 12–14 of the 8-model to accomplish full implementation of PBM in the health care organization (HCO) • Drafting a formal charter that stipulates the Task Force's mission, specific goals and responsibilities • Coordinating necessary workstreams and interaction between all departments/ units • Authorized by the HCO's senior management to fully implement PBM as a standard of care, based on the "3Es" of PBM • HCO's senior management obliges all clinical and nonclinical departments to support the HCO Task Force where necessary to accomplish PBM implementation • Seeking support from the National PBM Task Force when deemed necessary	• Establishing organizational structure with individual task assignment, i.e. with defined roles and responsibilities for managing the four workstreams that are required to execute steps 12–14 of the 8-model - data - education - communication - processes • Identifying and recruiting members with specific expertise, e.g. data collection and analytics • Leading PBM implementation with a methodology (using the Kotter model or another validated model) • Post-implementation, HCO Task Force - evolves into the HCO PBM department - coordinates the HCO's activities as a national PBM reference centre	• Supervised by the HCO's senior leadership, e.g. board of directors, chief executive, operations and finance officers, medical executive committee, or similar committees • Reporting periodically to the HCO's senior leadership on - timelines and achievements/progress - unexpected major impediments and process adjustments - budget reports including planned versus actual costs and savings • Periodic reporting to the national task force on key performance indicators (KPIs) that are specific to the progress of structure and process implementation during phase B (see Annex 4) • Periodic reporting to the national task force of selected KPIs during phase C of the national/jurisdictional roll-out of PBM (see Annex 4) • After implementation of PBM, the newly formed PBM department will continue to report to HCO senior leadership and to report to the national task force on selected PBM KPIs • The HCO may choose optional reporting of selected KPIs to the community/public	• Following written policies and procedures governing its structure and conduct on - policies on ethical conduct, professional responsibility and accountability towards patients, blood donors and taxpayers through PBM implementation - policies that cultivate mutual respect and communal participation between diverse stakeholder groups - policies that demonstrate sensitivity to local health care needs and resources and tailor measures accordingly - policies and procedures that define where and how frequently the Task Force will meet, how often it will report to leadership, the length of time workstream leaders will serve, etc. - policies that establish a clearly defined quality management system - policies and procedures that will govern clinical protocols, care pathways, patient education and empowerment, informed consent/choice - policies on how to interact with other clinical departments

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

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- 12.1 Establishing governance framework for PBM implementation
- 12.2 Creating PBM awareness through continuing medical education across all clinical and non-clinical departments
- 12.3 Selecting metrics and KPIs and developing PBM data collection and reporting system
- 12.4 Developing communication strategy to empower the public and patients on blood health

Creating HCO specific PBM STRUCTURE 12

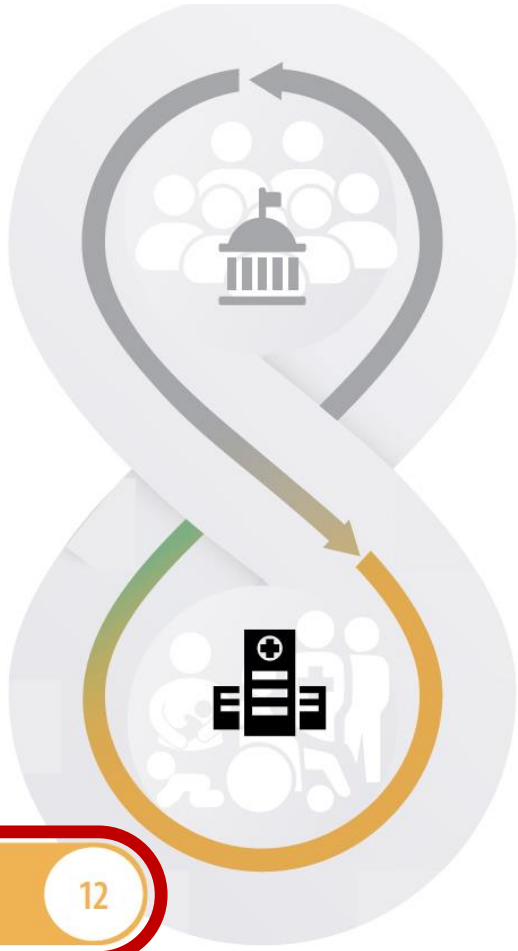
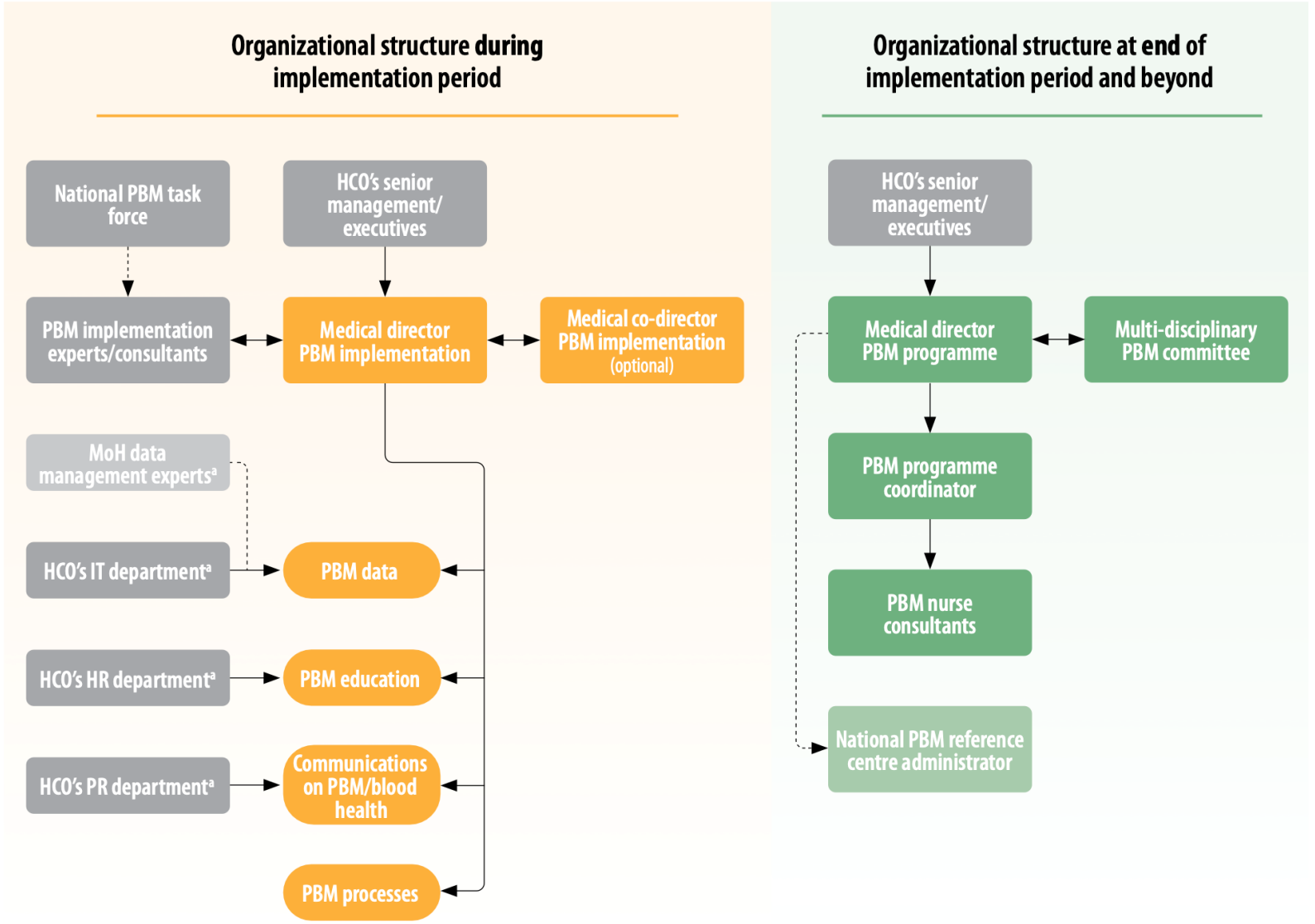


Fig. 14. Evolution from HCO Implementation Task Force to an HCO PBM department



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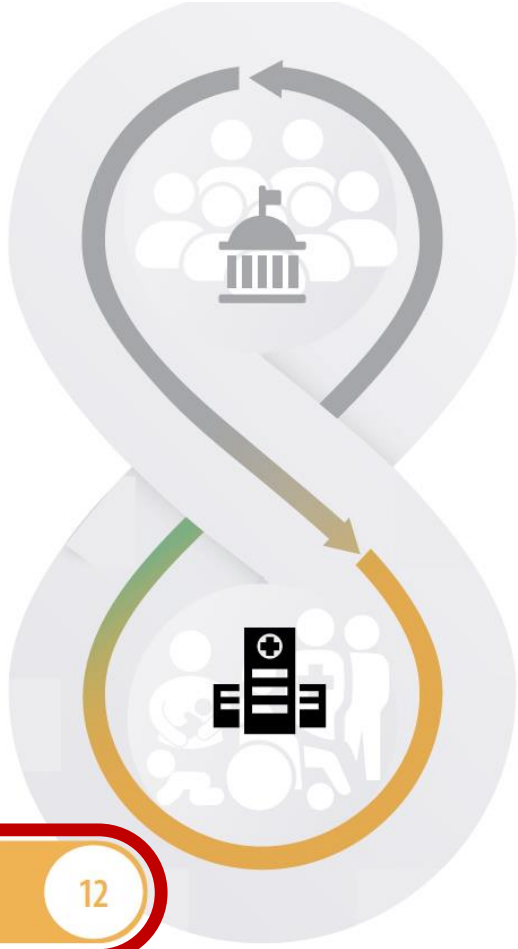

Annex 4.

Patient blood management (PBM) metrics for health care organization implementation and post-implementation periods

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Notes
Structure/process metrics						
Guidelines to treat iron deficiency anaemia (IDA)						
Pre-admission and discharge collaboration with primary health care providers						
Identify, manage and minimize bleeding and blood loss						
Evidence-based transfusion guidelines						
Reporting on outcomes associated with ID or anaemia						
Reporting the blood transfused						
Percentage of hospitalized patients with iron studies performed prior to discharge						
Percentage of patients who were treated for anaemia during hospitalization						
Percentage of pregnant women screened for ferritin prior to delivery						

Annex 4. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Notes
Maturity assessment model in patient blood management (MAPBM): percentage of patients with a haemoglobin determination 21–90 days before surgery						
MAPBM: percentage of patients with an iron status determination 21–90 days before surgery						
Outcome metrics						
Percentage of patients transfused with red blood cells in key elective surgery groups						
Units of red blood cells transfused per 1000 patient-days						
Units of red cells transfused per 1000 admissions						
Percentage of all transfused patients with Hb ≥ 80 g/L at time of transfusion						
Percentage of all transfused patients transfused with Hb ≤ 70 g/L						
Percentage of transfusions ordered as single units						

Annex 4. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Notes
Mean pre-platelet transfusion threshold by patient population						
Percentage of all transfused patients transfused plasma with international normalized ratio (International Normalized Ratios) < 2 (bigger is worse)						
Percentage of patients with haemoglobin level less than "x" g/L on admission						
Percentage of patients with haemoglobin level less than "x" g/L at discharge						
Average nadir haemoglobin level (without transfusion) for hospitalized patients						
Average nadir haemoglobin (without transfusion) in patient with postpartum haemorrhage (PPH)						
Percentage of women with PPH treated with some form of iron						
Percentage of women discharged on iron therapy afte delivery						
Percentage of women receiving some form of iron supplementation prenatally						

Annex 4. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Notes
Percentage of patients with anaemia at discharge						
Metrics from the MAPBM project						
Percentage of patients with anaemia prior to surgery						
Percentage of patients treated with intravenous iron during hospital stay						
Percentage of patients given preoperative transfusion						
Percentage of patients under spinal anaesthesia						
Percentage of patients treated with antifibrinolytics perioperatively						
Percentage of patients with blood recovery systems perioperatively						
Mean haemoglobin level prior to transfusion for hospitalized patients						

Annex 4. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Notes
Mean haemoglobin level post-transfusion for hospitalized patients	Evidence-based guidelines recommend restrictive haemoglobin thresholds for red blood cell transfusions	Numerator: sum of post red blood cell transfusion haemoglobin values. Denominator: sum of transfusion orders in hospitalized patients with a haemoglobin value post-red blood cell transfusion	Hospital case mix data, transfusion database, laboratory information system	Outcome	Ongoing	Lower is better

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

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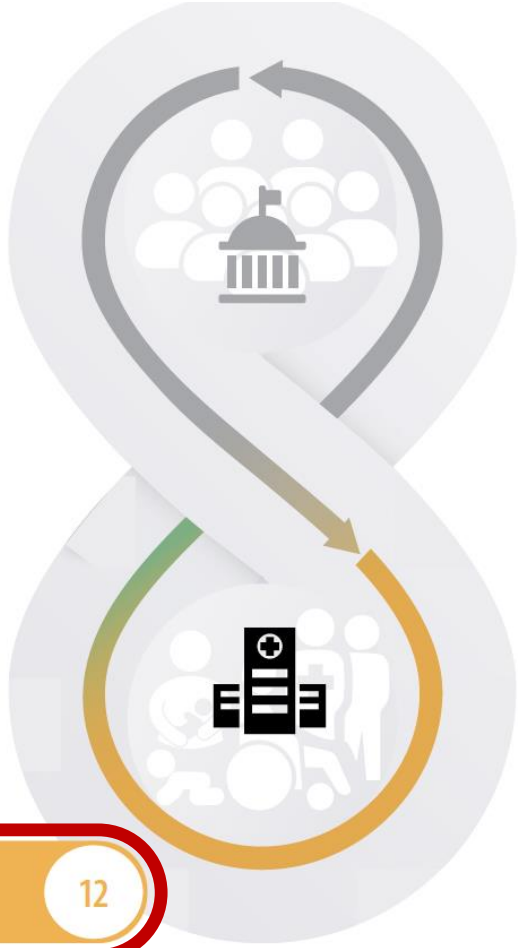

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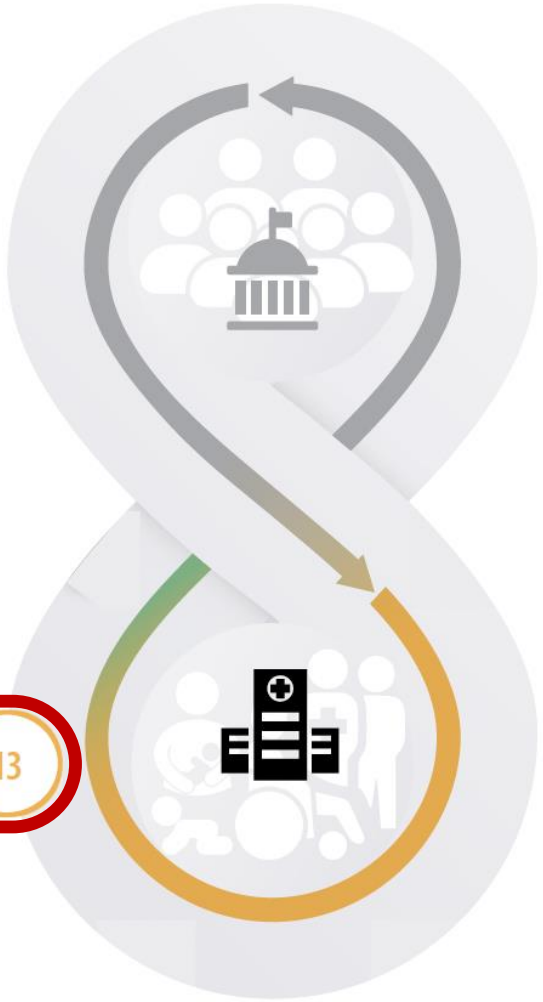
- 13.1 Implementing clinical processes
- 13.2 Implementing patient empowerment processes
- 13.3 Creating continua of care for specific patient populations or disease groups

Implementing HCO specific PBM processes 13



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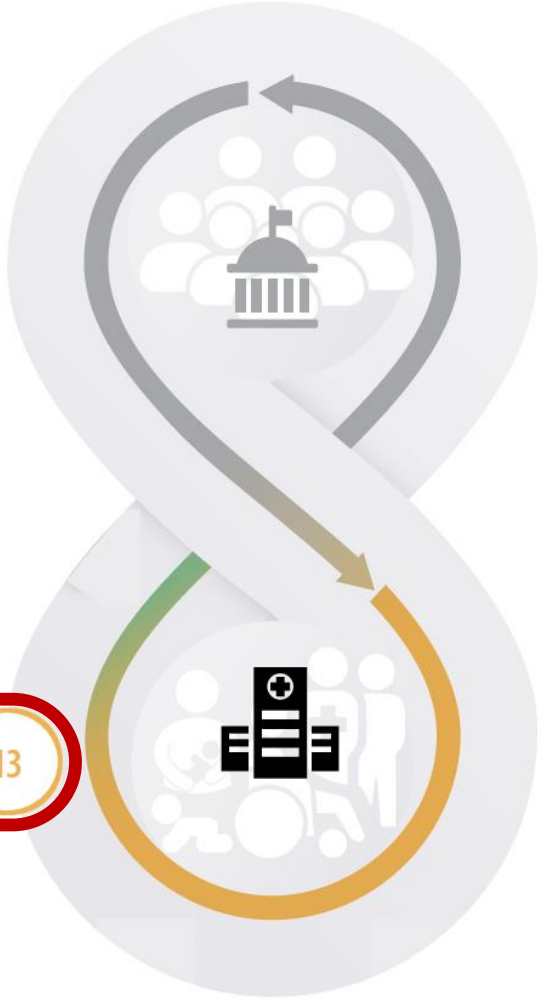
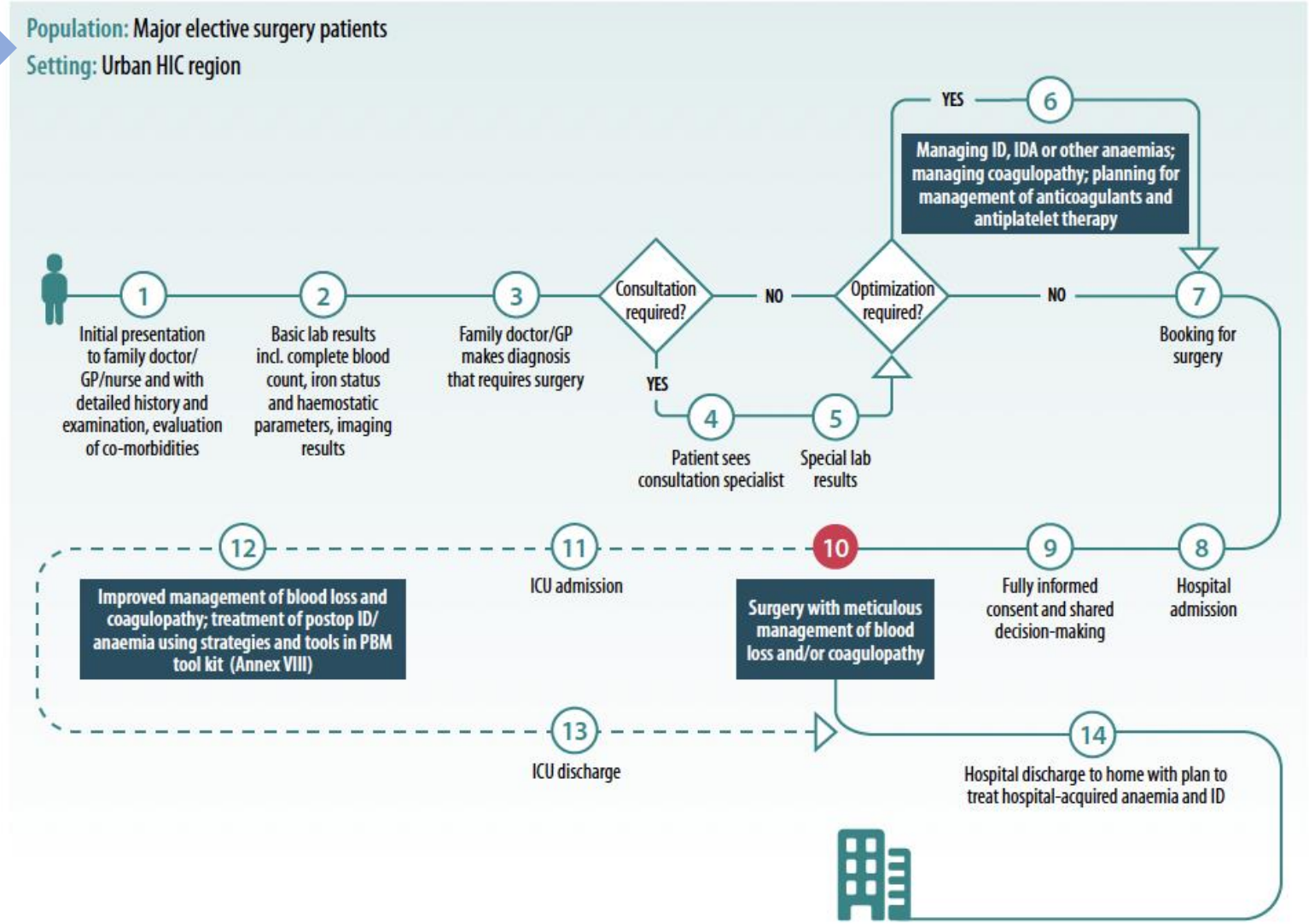


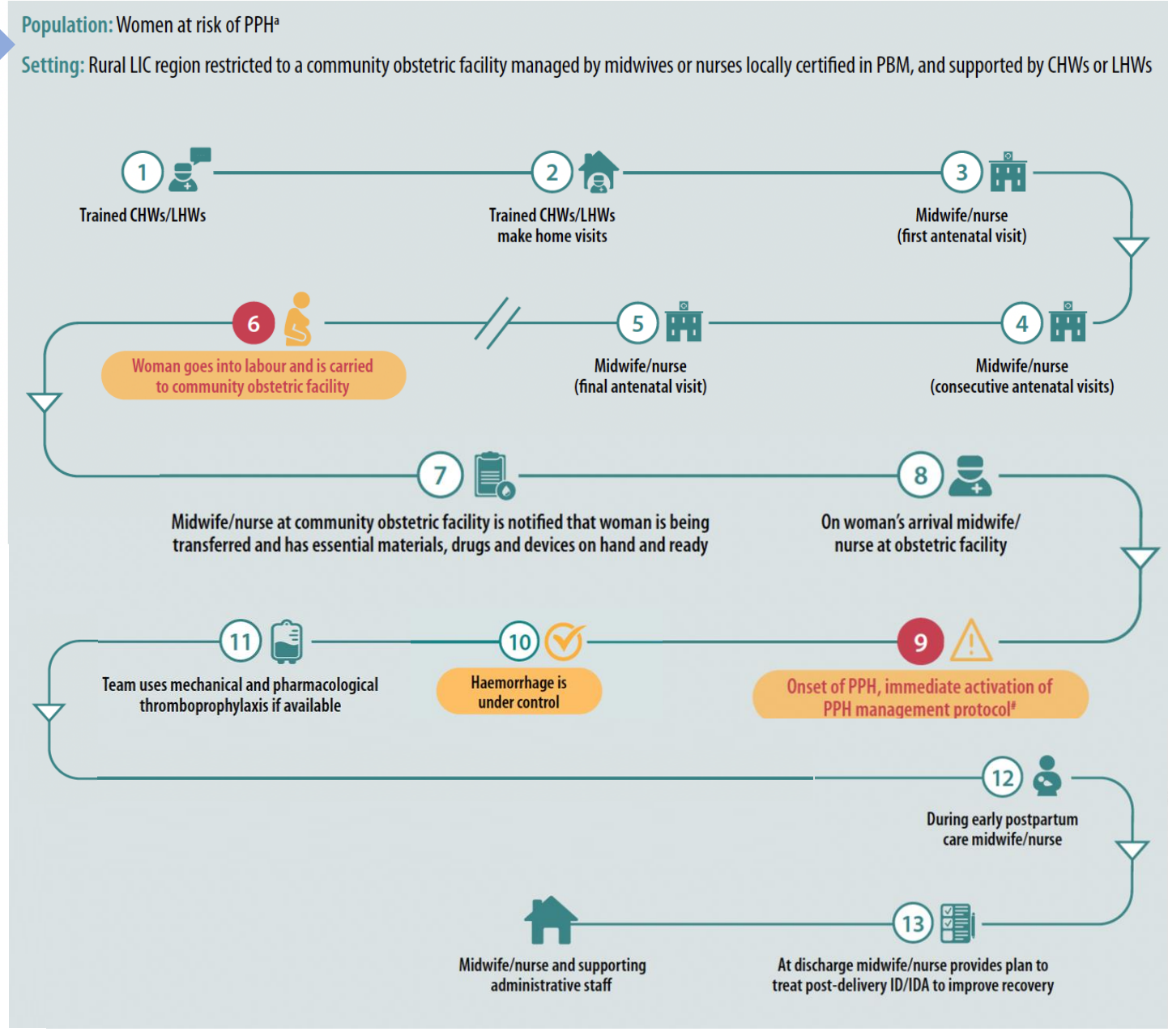
Fig. 15. Continuum of care aiming for improved blood health in major elective surgery



This diagram depicts a simplified continuum of care for major elective surgery patients in an urban setting in an HIC. There is an expectation that all relevant tools and strategies of PBM are utilized in the seamless management of the patient from initial presentation to the family doctor through a post-discharge plan to manage acquired anaemia. **Annexes 5** and **8** serve as resources to further adapt and fine tune the care path for different surgical populations or specialties.

HIC, high-income country; ID, iron deficiency; IDA, iron deficiency anaemia; GP, general practitioner; ICU, intensive care unit.

Fig. 16. Continuum of care aiming for improved blood health in women at risk for postpartum haemorrhage (PPH).



1. Trained CHWs/LHWs

- conduct outreach and education programmes s to promote prenatal and postnatal care
- educate on the benefits of facility-based births with experienced obstetric care
- educate on necessity for prenatal iron deficiency and anaemia management

2. Trained CHWs/LHWs make home visits

- use questionnaire to collect medical and obstetric history from pregnant women and identify high-risk pregnancies and risk factors for PPH
  - multiple pregnancies/high parity
  - women under 18 or over 35 years
  - previous instances of PPH
  - polyhydramnios
  - Instrumented al deliveries+
  - uterine abnormalities, e.g. leiomyomata or adenomyosis
  - placental issues, e.g. previa, accreta
  - large-for-gestational-age babies
  - ID, IDA, hereditary anaemia
  - pre-eclampsia/eclampsia
  - gestational diabetes
- educate on protein-rich food, e.g. eggs, soybeans, iron-rich and fortified food, and iron supplementation
- educate on drugs/vitamins/nutrition/supplements/ beverages that may
  - impair absorption of iron
  - Increase bleeding
- encourage scheduled antenatal visits at community obstetric facility

3. Midwife/nurse (first antenatal visit)

- provides sufficient patient education on
  - PPH risks
  - ID/anaemia risks for mother and baby
  - risks and benefits of treatment modalities
  - when to seek additional medical help
- establishes informed consent
- Involves family members in care and decision-making

Trained CHWs/LHWs use mobile technology (mHealth) to send health messages, reminders for appointments, and education about pregnancy and childbirth

4. Midwife/nurse (consecutive antenatal visits)

- screens for anaemia (colorimetric method when haemoglobinometers not available)
- screens for helminthic infections contributing to anaemia where endemic, and provides deworming tablets
- screens for HIV and treats with antiviral therapy
- treats ID/IDA with oral iron
- optimizes haematinic status (folate, vitamin B12)
- adminsters vitamin K in case of malnutrition
- monitors and manages where needed
  - pre-eclampsia/eclampsia
  - gestational diabetes
- in endemic areas: administers malaria prophylaxis and provides insecticide-treated bed net

5. Midwife/nurse (final antenatal visit)

- educate families on recognizing danger signs and the importance of timely intervention.
- provide emergency contact coordinates and transportation plan
- allocates CHWs/LHWs to facilitate transportation to community obstetric facility as needed

6. Woman goes into labour and is carried to community obstetric facility

7. Midwife/nurse at community obstetric facility is notified that woman is being transferred and has essential materials, drugs and devices on hand and ready

- blood collection drape
- uterotonics (oxytocin, heat-stable sublingual oxytocin, carbetocin, methylergonovine, ergometrine, carboprost, and misoprostol according to local protocol and availability)
- tranexamic acid
- intravenous fluids
- antihypertensives, anticonvulsants (e.g. magnesium sulfate), and antibiotics
- haemoglobinometer if available
- thermal blankets
- Bakri balloon or sterile gauze if available, otherwise condom-catheter balloon
- manual vacuum aspirator
- blood pressure monitor
- low-cost transvaginal uterine artery clamp
- low-technology red blood cell collection and reinfusion set
- oxygen if available
- non-pneumatic anti-shock garment if available, otherwise bicycle tubes and sheets for improvised use

8. On woman's arrival midwife/nurse at obstetric facility

- determines haemoglobin concentration when woman arrives
- considers establishing intravenous access
- ensures bladder is empty
- positions mother for proper access to uterus
- controls cord traction to deliver placenta
- rapidly identifies atony by manual palpation
- massages uterus after delivery of placenta
- ensures placenta is complete and intact to avoid undiagnosed tissue retention, and evacuate clots
- tracks haemoglobin status with haemoglobinometer
- monitors pulse rate, blood pressure, urine output and mental state
- monitors amount of blood loss by use of blood collection drape

9. Onset of PPH, immediate activation of PPH management protocol#

Midwife/nurse follows protocol based on published guidelines (see Annex 5). However, guidelines are adapted/expanded in response to local conditions:

- lack of anaesthesia services (skills and/or equipment, pharmaceuticals)
- lack of surgical skills, thus caesarean sections cannot be performed
- interrupted or no access to electricity, thus limited cold chain (cold storage required for oxytocin)
- no or limited access to oxygen
- no or limited supply of blood components/products
- no escalation/further referral possible
- no or limited access to pulse oximetry, ultrasound machines, fetal monitors

The adapted/expanded PPH management protocol relies on

- immediacy of intervention
- timing and dosing of uterotonics
- timing and dosing of tranexamic acid
- patient positioning
- trained emergency skills (team-applied bimanual compression, external aortic compression as temporizing measure)
- skilled/careful placenta removal with smooth curettage if retained product
- umbilical vein injection of oxytocin for the treatment of retained placenta
- trained manual dexterity for repairing/suturing of perineal/vaginal/cervical lacerations (task shifting/training in suturing techniques supported online by surgeons/obstetricians)
- maintaining normothermia
- rehydration/fluid management
- skilled use of low-technology uterine tamponade modalities where applicable
- skilled use of low-technology red blood cell collection and reinfusion set where applicable
- skilled use of low-technology anti-shock devices to where applicable (hypovolaemic shock)
- telemedicine support where available

10. Haemorrhage is under control

11. Team uses mechanical and pharmacological thromboprophylaxis if available

12. During early postpartum care midwife/nurse

- promotes early breastfeeding or manual nipple stimulation to encourage uterine contraction
- monitoring vital signs and blood loss closely for at least 24 hours post-delivery
- provide oral rehydration solutions or intravenous fluids to manage hypovolaemia
- avoid infections or treat infections promptly consider prophylactic use of antibiotics (if available) with severe PPH

13. At discharge midwife/nurse provides plan to treat post-delivery ID/IDA to improve recovery

Midwife/nurse and supporting administrative staff

- debrief after each PPH event to evaluate opportunities for improvements
- maintain accurate and up-to-date records of all PPH events including identified risk factors
- use mobile health applications for efficient data collection to improve continuum of care
- report findings to local health authorities to help in planning and resource allocation

This diagram depicts a continuum of care for women at risk for PPH in a rural LIC region where pregnancy management takes place in a community obstetric facility by midwives or nurses locally certified in PBM and supported by community and/or lay health workers. This care path is presented in detail to demonstrate the many modalities that can be implemented even in limited resource situations. **Annexes 5** and **10** provide additional resources to further develop the continuum of care for women at risk of PPH.

CHW, community health worker; ID, iron deficiency; IDA, iron deficiency anaemia; LIC, low-income country; LHW, lay health worker.

Box 2

Definition of toolkit

In medicine, a "toolkit" refers to a collection of resources, guidelines, strategies and interventions designed to address specific health issues, improve patient care or enhance health care professionals' knowledge and skills. The toolkits in Annexes 6 to 11 cover a wide range of topics and are intended to provide PBM champions and clinicians with practical tools and information to implement PBM as the standard of care. They are designed to reduce the difficulty of PBM implementation, increase the opportunity for understanding and engagement for both patients and health care workers, and improve health outcomes.

6 Toolkits

Annex 6.

General patient blood management (PBM) toolkit for national/ jurisdictional and health care organization (HCO) PBM task forces and health care professionals in low-income countries (LICs)[a]

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 7.

General patient blood management (PBM) toolkit for national/ jurisdictional and health care organization PBM task forces and health care professionals in lower middle-income countries (LMICs) and upper middle- income countries (UMICs)[a]

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 8.

General patient blood management (PBM) toolkit for national/ jurisdictional and health care organization PBM task forces and health care professionals in high-income countries

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 9.
Patient blood management (PBM) toolkit in neonatology and paediatrics for national/jurisdictional and health care organization PBM task forces and health care professionals[a]

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 10.
Patient blood management (PBM) toolkit in obstetrics for national/jurisdictional and health care organization PBM task forces and health care professionals[a]

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 11.
Patient blood management (PBM) toolkit in trauma for national/jurisdictional and health care organization PBM task forces and health care professionals[a]

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy

Annex 9.

Patient blood management (PBM) toolkit in neonatology and paediatrics for national/jurisdictional and health care organization PBM task forces and health care professionals[a]

Annex 9. *continued*

Tools	Anaemia a
Strategies to enable infrastructure changes and adaptation, and to provide specific clinical knowledge and skills to create continua of care	• Develop a anaemia, i nutritiona health. • Educate fr without a many othe • Involve pa screening, • Recognize lead to ina populatio is no consi • Publish an moderate • Teach that associated to sympto myalgias, • Teach that intensive of attentio disorder, p • Teach that more than infection, • Involve pa (3-5)

Annex 9. *continued*

Tools	Anaemia
Strategies to enable infrastructure changes and adaptation, and to provide specific clinical knowledge and skills to create continua of care *(continued)*	• Use ever visits) as • Open a p a multid anaesth pharma • Screen a (especia etiology • Postpon • If surger • Educate laborato - anaen - IDA - ID wit - cancer - anaen - hospit - haem - vitam - protei - sickle - malar • Establish haemat if availab remote f

Annex 9. *continued*

Tools	Anaemia and iron
Strategies to enable infrastructure changes and adaptation, and to provide specific clinical knowledge and skills to create continua of care *(continued)*	• Evaluate, diagnose underlying cause(s and anaemia *(6, 8,* • Be aware of the dr example, drug-ind • Be aware of condit malabsorption syn • Focus on children v heart failure) *(11,* infants), if there ar • Establish anaemia discharge patients. • Develop algorithm oral and intraveno appropriate manag • Consider high FIO_2 • After optimizing ox status, and if blood informed consent f blood component t cells should not be patient's clinical sig risk of haemorrhag weight-based red b non-actively bleed other measures) (2 • **Note:** Cross-match have been prepare (return to blood ba setting, avoiding a accepting that the circumstances. A tr a cost to the health • Identify patient gr • Conduct multidisci and/or preoperativ • Consider postponin benefits of delay a post-discharge ana

Annex 9. *continued*

Tools	Anaemia
Vigilance regarding nutritional and pharmacological interactions (knowledge required)	Identify a • can cont • can incr • can imp beverag acid (un
Knowledge and skills to ensure patient empowerment	• Educate • Develop • Develop
Diagnostic devices to be considered (knowledge, equipment and skills required)	• Validate • Smaller- • Protocol • Avoid ro
Treatment devices to be considered (knowledge, equipment and skills required)	• Emerge blood tr

Annex 9. *continued*

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy
Medicines (access to medicines as well as knowledge of their uses and interactions required)	• Oral/intravenous iron *(8, 75-77)* • Folic acid *(78)* • Vitamin B12 *(78, 79)* • High-dose vitamin D *(80)* • Diet counselling: protein-rich (for example, eggs, soya beans), iron-rich and fortified foods • Rituximab (haemolytic anaemias) • Hydroxyurea (sickle cell disease) • Erythropoiesis-stimulating agents *(8, 76, 77)* • Hypoxia-inducible factor prolyl hydroxylase inhibitors (HIF-PHIs) for anaemia in patients with chronic kidney disease	• Antifibrinolytics (tranexamic acid, aminocaproic acid) *(35, 81-83)* • Topical haemostatic agents *(84)* • Local vasoconstrictive agents • Consider high FIO_2 (1.0) in patients with life-threatening anaemia • Platelet-stimulating agents where appropriate	• Fibrinogen replacement therapy *(85)* • Prothrombin complex concentrates (PCC) *(86)* • Other clotting factors (for example, FEIBA, rFVIIa, FXIII) • Vitamin K intravenously

[a] All tools may not be available in all countries, hospitals, regions or communities. This toolkit can serve as a picklist or checklist that can be adapted and used to develop local guidance and protocols.
[b] For guidance on clinically indicated blood component therapy see *WHO Educational modules on clinical use of blood* (https://iris.who.int/handle/10665/350246).
[c] For example, see an extensive list at: https://med.stanford.edu/content/dam/sm/ohns/documents/Sinus%20Center/Stanford_Medication_and_Herbs.pdf

References

1. Goobie SM, Faraoni D, Zurakowski D, DiNardo JA. Association of preoperative anemia with postoperative mortality in neonates. JAMA Pediatr. 2016;170:855–62. doi: 10.1001/jamapediatrics.2016.1032.
2. Faraoni D, DiNardo JA, Goobie SM. Relationship between preoperative anemia and in-hospital mortality in children undergoing noncardiac surgery. Anesth Analg. 2016;123:1582–7. doi: 10.1213/ANE.0000000000001499.
3. Isbister JP, Pearse BL, Delaforce AS, Farmer SL. Patients' choice, consent, and ethics in patient blood management. Anesth Analg. 2022;135:489–500. doi: 10.1213/ANE.0000000000006105.
4. Crighton GL, New HV, Liley HG, Stanworth SJ. Patient blood management, what does this actually mean for neonates and infants? Transfus Med. 2018;28:117–31. doi: 10.1111/tme.12525.
5. Griffin T, Celenza J. Family-centered care for the newborn : the delivery room and beyond. New York: Springer; 2014.
6. Shander A, Corwin HL, Meier J, Auerbach M, Bisbe E, Blitz J et al. Recommendations from the International Consensus Conference on Anemia Management in Surgical Patients (ICCAMS). Ann Surg. 2022. 2022;277:581–90. doi: 10.1097/SLA.0000000000005721
7. Goobie SM, Gallagher T, Gross I, Shander A. Society for the advancement of blood management administrative and clinical standards for patient blood management programs. 4th edition (pediatric version). Paediatr Anaesth. 2019;29:231–6. doi: 10.1111/pan.13574.
8. Warner MA, Shore-Lesserson L, Shander A, Patel SY, Perelman SI, Guinn NR. Perioperative anemia: prevention, diagnosis, and management throughout the spectrum of perioperative care. Anesth Analg. 2020;130:1364–80. doi: 10.1213/ANE.0000000000004727.
9. Beris P, Munoz M, Garcia-Erce JA, Thomas D, Maniatis A, Van der Linden P. Perioperative anaemia management: consensus statement on the role of intravenous iron. BJA. 2008;100:599–04. doi: 10.1093/bja/aen054.
10. Shander A, Javidroozi M, Ashton ME. Drug-induced anemia and other red cell disorders: a guide in the age of polypharmacy. Curr Clin Pharmacol. 2011;6:295–303. doi: 10.2174/157488411798375895.
11. Mikhail A, Brown C, Williams JA, Mathrani V, Shrivastava R, Evans J et al. Renal association clinical practice guideline on anaemia of chronic kidney disease. BMC Nephrol. 2017;18:345. doi: 10.1186/s12882-017-0688-1.
12. Macdougall IC, Canaud B, de Francisco AL, Filippatos G, Ponikowski P, Silverberg D et al. Beyond the cardiorenal anaemia syndrome: recognizing the role of iron deficiency. Eur J Heart Fail. 2012;14:882–6. doi: 10.1093/eurjhf/hfs056.

Annex 8.
General patient blood management (PBM) toolkit for national/ jurisdictional and health care organization PBM task forces and health care professionals in high-income countries

Tools	Anaemia and iron deficiency	Blood loss and bleeding	Coagulopathy
Strategies to enable infrastructure changes and adaptation, and to provide specific clinical knowledge and skills to create continua of care	• Develop and implement public health initiatives to identify, evaluate and manage anaemia, iron deficiency (ID) and nutritional deficiencies so the population is in a better state of blood health *(1–11)* • Involve patients and family or patients' trusted individuals in care and decision-making as a collaborative effort *(12)* • Use every patient encounter with the health system as an opportunity to screen for and diagnose anaemia and ID • Open a preoperative anaemia and surgical planning clinic – ideally a multidisciplinary team with inputs from anaesthesiology, surgery, haematology, nursing, pharmacy and others • Screen all patients for anaemia as early as possible prior to surgery and initiate investigation into etiology and treatment as early as possible *(3)* • For patients undergoing urgent surgery, begin anaemia treatment as soon as possible *(3)* • Educate physicians on the recognition and diagnosis – including interpretation of laboratory tests – of anaemia from all causes, including: - anaemia of inflammation - Iron deficiency anaemia (IDA) - ID without anaemia - cancer-related anaemia - anaemia from blood loss - hospital-acquired anaemia (HAA) - haemolytic anaemia - vitamin B12 and folate deficiency - nutritional deficiency including protein deficiency - sickle cell disease, thalassaemia and other haemoglobinopathies - malaria and other infectious diseases	• Practise meticulous surgical haemostasis - Utilize surgical haemostatic devices - Consider tourniquet - Utilize staging and packing - Utilize mechanical pressure - Consider local vasoconstrictive agents - Consider topical haemostatic agents • Utilize minimally invasive surgical techniques • Intervene **early** for bleeding • Position patient appropriately during surgery • Consider autologous cell salvage options (see device section) • Utilize local vasoconstrictive agents • Utilize topical haemostatic agents • Utilize systemic haemostatic agents • Utilize interventional radiological embolization (for example, surgery for hypervascular tumours, liver resection/transplantation, uterine fibroids, postpartum haemorrhage, oesophageal variceal bleeding, haemorrhoids, etc.) • Practise appropriate blood pressure and fluid management • Practise controlled intraoperative hypotension when indicated • In bleeding patients, practise restrictive fluid administration and permissive hypotension until bleeding is controlled, then aim to restore normal circulating blood volume (euvolaemia) • Maintain euvolaemia in stable anaemic patients • Prevent or correct hypothermia *(27)*, hypoperfusion and acidosis • Utilize autologous blood options • Utilize intra- and postoperative cell salvage	• Conduct preoperative assessment of bleeding risk (history, laboratory investigations) *(34)* • Use a questionnaire to determine bleeding risk • Develop a clear plan or algorithm for management of bleeding during or after surgery • Address clinically significant coagulopathy early by identifying the source and/or coagulation defect • Educate physicians and nurses to ensure their knowledge and understanding of the contribution of blood vessels, platelets, coagulation factors, acid–base balance, temperature, degree of anaemia, perfusion and volume to haemostasis and how to address each of these in a bleeding patient • Educate physicians and nurses about procoagulants and their administration • Educate physicians and nurses on anticoagulants, antiplatelet agents, and/or supplements (herbal, etc.), and when to discontinue and restart them in the peri-operative period

Fig. 7. Phase C of the 8-model – Rolling out patient blood management on a national/jurisdictional scale

THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

C Phase C
Rolling out PBM on a national/jurisdictional scale

Phase C of the Guidance is a "how-to" manual for the responsible authorities within the public health sector explaining what decisions and steps must be taken to fully roll out the national/jurisdictional PBM implementation.

Annex 3.
Patient blood management (PBM) metrics for national/ jurisdictional implementation and post-implementation periods

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Collected by the World Health Organization (WHO) and/or Institute for Health Metrics and Evaluation (IHME)
Structure/process metrics						
Implementation of a struct national/jurisdictional mini department of health (or e PBM stewardship						
Implementation of a PBM e and communication strateg national/jurisdictional mini or department of health						
National/jurisdictional data quality improvement practi						
Identifying and managing i (ID) and anaemia in the con						
Reporting the units of bloo transfused at the national/j level						
Availability of formal PBM e training courses at the follo						
(i) undergraduate						
(ii) postgraduate						
(iii) continuing education						
Hospital accreditation for P						

Annex 3. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/	Timing	Collected by the World Health Organization (WHO)
Health care provider ce						
Strategies for national l and protection measur health						
Availability and access t essential to PBM						
Outcome metrics						
Number of women aged with anaemia, by pregn (thousands)						
Prevalence of anaemia 15–49 years, by pregna						
Mean haemoglobin leve 15–49 years, by pregna						
Number of pregnant wo years, with anaemia (th						

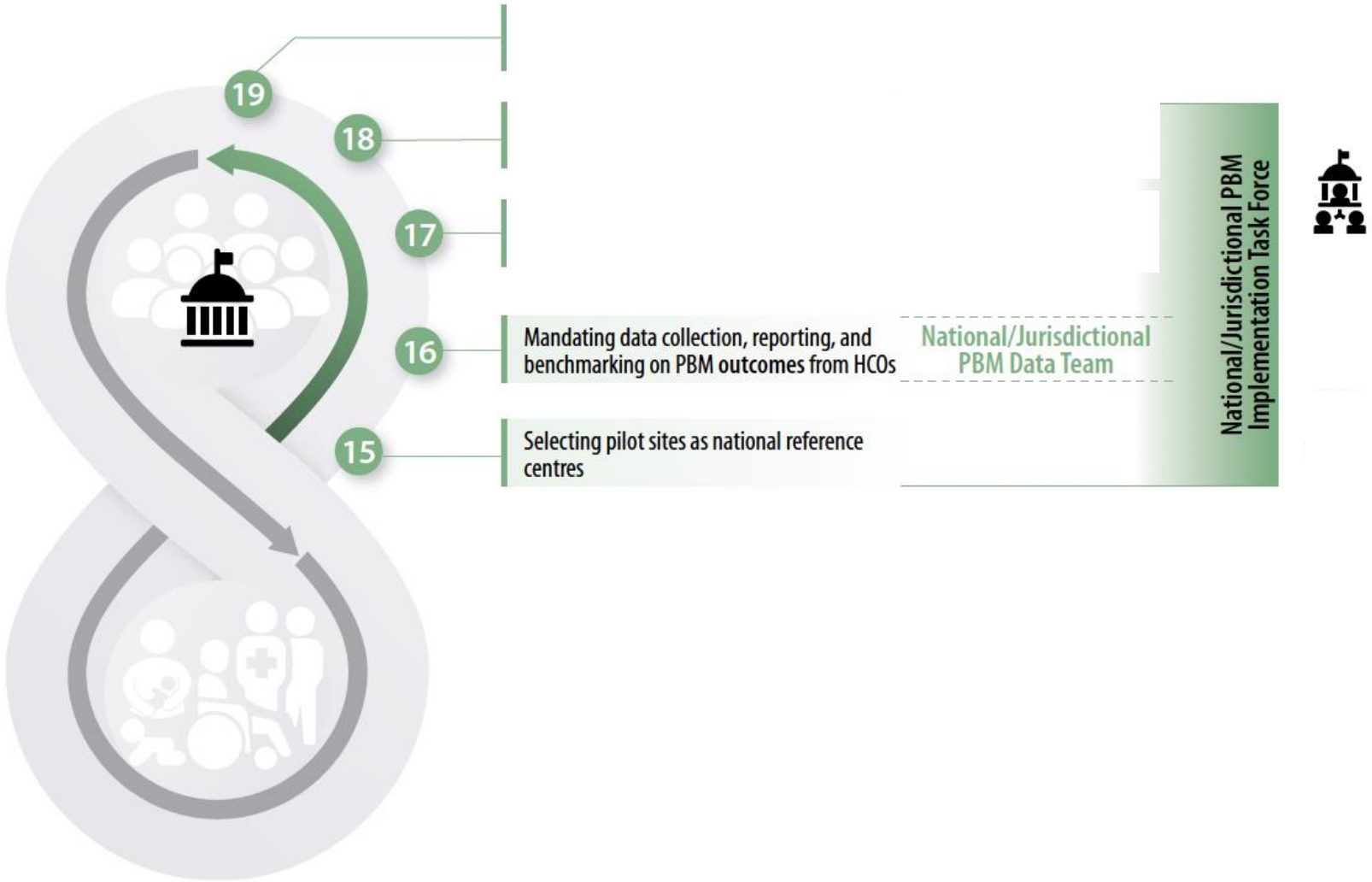
Annex 3. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/	Timing	Collected by the World Health Organization (WHO)
Prevalence of anaem women aged 15–49 y						
Mean haemoglobin l women aged 15–49 y						
Number of non-pregn 15–49 years, with an						
Prevalence of anaem women aged 15–49 y						
Mean haemoglobin l women aged 15–49 y						

Annex 3. *continued*

Metric name	Rationale	Proposed indicator definition	Primary source	Structure/ process/ outcome	Timing	Collected by the World Health Organization (WHO) and/or Institute for Health Metrics and Evaluation (IHME)
Mean haemoglobin level of children aged 6–59 months (g/L)	Anaemia in children is associated with undesirable outcomes	Mean haemoglobin concentration in children aged 6–59 months	Survey data	Outcome	Ongoing	https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mean-hemoglobin-level-of-children-aged-6-59-months
Prevalence of anaemia in those aged 60 years or over by sex (%)	Anaemia in those aged 60 years or over is associated with undesirable outcomes	Percentage of those aged 60 years or over with a haemoglobin concentration less than 130 g/L	Survey data	Outcome	Ongoing	–
Units of red blood cells issued per population	Great variability exists in the rate or frequency of red blood cell transfusion. Red blood cell transfusions are associated with a range of undesirable patient outcomes	Total number of units issued per 100,000 population	Survey data	Outcome	Ongoing	https://www.who.int/publications/i/item/9789240051683
Mean haemoglobin level (various populations) (g/L)	Anaemia is common and associated with undesirable outcomes	Mean haemoglobin concentration in patients admitted for inpatient surgery	Survey data	Outcome	Ongoing	https://www.who.int/teams/nutrition-and-food-safety/databases/vitamin-and-

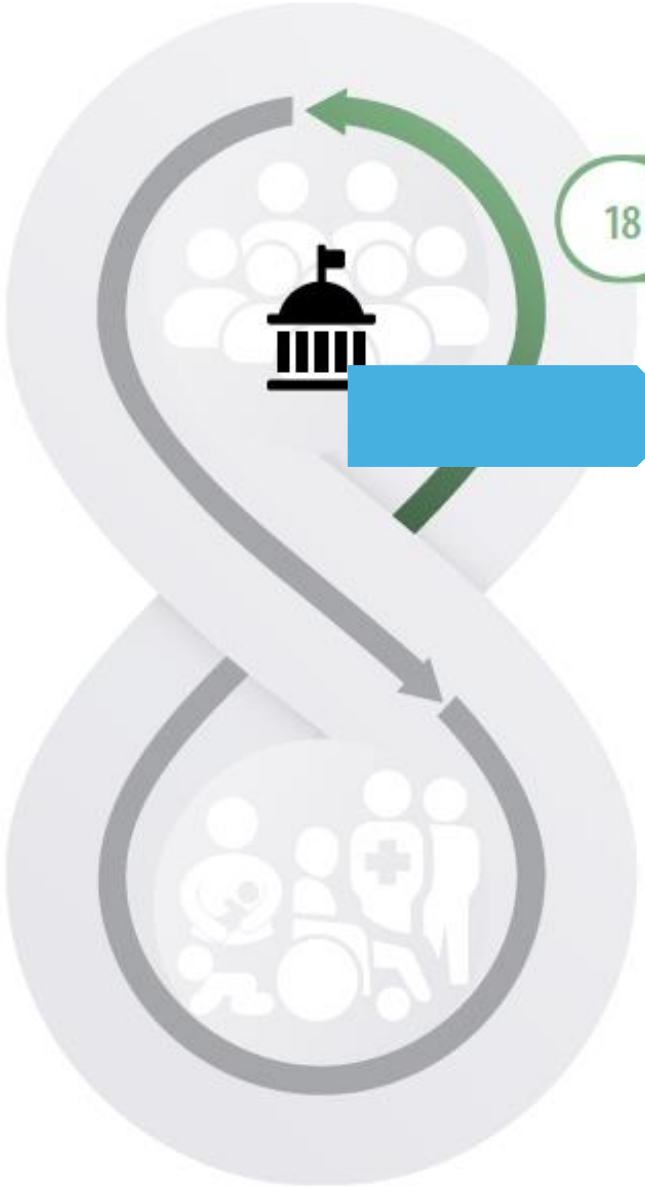
Fig. 7. Phase C of the 8-model – Rolling out patient blood management on a national/jurisdictional scale



THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

Phase C
Rolling out PBM on a national/jurisdictional scale

Phase C of the Guidance is a "how-to" manual for the responsible authorities within the public health sector explaining what decisions and steps must be taken to fully roll out the national/jurisdictional PBM implementation.



18 Fostering accreditation and auditing of HCOs' PBM programs

18.1 Mandating national PBM standards and recommending institutional PBM accreditation and periodical PBM auditing

18.2 Appointing appropriate body for PBM accreditation

PBM standards for the accreditation of health care organizations (HCOs)[a]	Qualitative indicators
Structure	
Standard 1: Governance system is in place to ensure optimal and sustainable clinical and administrative PBM in all of the HCO's facilities	Documented through formal commitment governance framework
Standard 2: PBM is integrated into the **quality** management system and patient **safety**[b] framework	Integration into the quality policy and/or i patient safety policy is documented
Standard 3: PBM is governed by a **multiprofessional/ multidisciplinary** team through strict adherence to evidence-based clinical **PBM guidelines** and their periodic updates	Team members are officially assigned. Selection is based on the size, complexity a represented in the organization
Standard 4: Clinical and administrative **PBM leadership** structure, roles and responsibilities are clearly defined	Documented through organizational chart, of qualified individuals and role descriptior
Standard 5: Continuous and periodically updated PBM staff **education** and **training** is provided	PBM staff education and training follows a and training plan or programme. The annu is posted on the Intranet PBM knowledge and competence of staff is kept up to date
Standard 6: Resource (re-)allocation[c] is ensured to sustain the structure necessary for PBM (staff, stuff, space and systems)	Budget items Periodic evaluation of the necessary resour

Table 7. *continued*

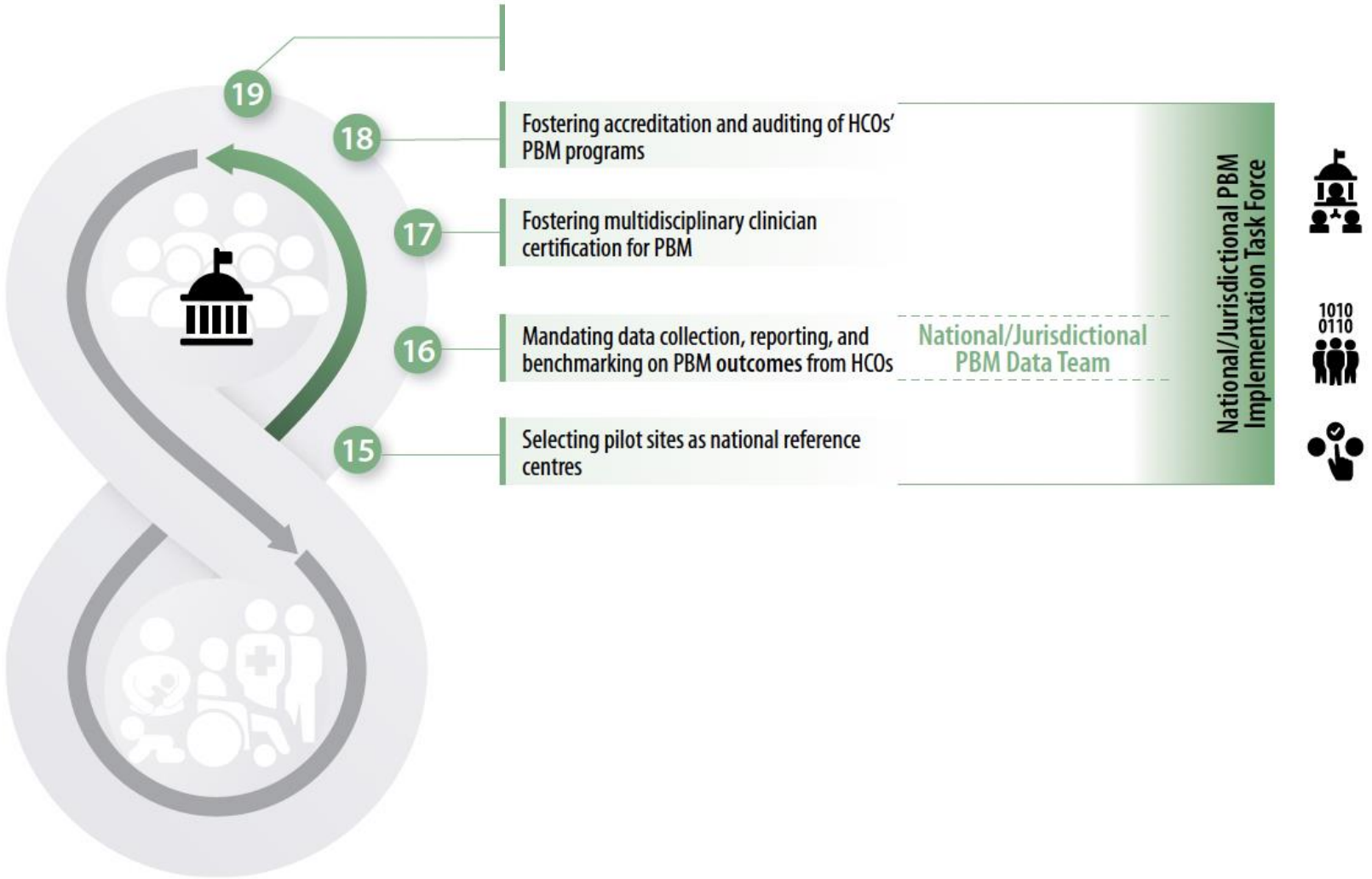
PBM standards for the accreditation of health care organizations (HCOs)[a]	Qualitative indicators	Quantitative indicators
Processes		
Standard 7: PBM processes are reflected across **all specialties** and within **primary, community, emergency** and **acute health care settings.** These processes are particularly reflected in populations at increased risk for anaemia, blood loss and/or coagulopathy with bleeding, including:	Processes are evidence-based and documer	
1. age- and weight-appropriate PBM processes for neonates, infants, children and adolescents	PBM process for neonates and children is in date and quality-assured	
2. women of reproductive age (WRA)	PBM process for WRA is in place, up to date assured	
3. patients 65 years and older	PBM process for patients 65 years and older up to date and quality-assured	
Standard 8: Processes are in place to **manage the patient's own blood**, i.e. to	Processes are evidence-based and documer	
1. identify, evaluate and manage preoperative/ preprocedural iron deficiency (ID) and anaemia	PBM process to identify, evaluate and mana preoperative/preprocedural ID and anaemia up to date and quality-assured	
2. identify, evaluate and manage postoperative/ postprocedural anaemia	PBM process to identify, evaluate and mana postoperative/postprocedural anaemia is in date and quality-assured	
3. identify, evaluate and manage anaemia in all other patients	PBM process to identify, evaluate and manag in all other patients is in place, up to date and assured	
Standard 9: Processes are in place to **preserve the patient's own blood**, i.e. to	Processes are evidence-based and documer	
1. reduce iatrogenic blood loss	PBM process to reduce iatrogenic blood loss up to date and quality-assured	
2. reduce and avoid disease-related bleeding and blood loss	PBM process to reduce and avoid disease-re bleeding and blood loss is in place, up to da quality-assured	
3. reduce and avoid surgical and trauma-related bleeding and blood loss	PBM process to reduce and avoid trauma-re bleeding and blood loss is in place, up to da quality-assured	
4. reduce and avoid bleeding and blood loss from congenital and acquired coagulopathy or conditions, and manage perioprocedural reversal of anticoagulants	PBM process to reduce and avoid bleeding and blood loss from congenital and acquired coagulopathy or conditions, and manage reversal of anticoagulants and	Percentage of patients treated according to this process

Table 7. *continued*

PBM standards for the accreditation of health care organizations (HCOs)[a]	Qualitative indicators	Quantitative indicators
2. optimize fluid management based on patient-specific physiological needs	PBM process to optimize fluid management based on the physiological needs of the individual patient is in place, up to date and quality-assured	Percentage of patients treated according to this process
3. prevent and promptly control infection	PBM process to prevent and promptly control infection is in place, up to date and quality-assured	Percentage of patients treated according to this process
Standard 11: Patients are empowered through proactive education and engagement, and patient choices, values and preferences are reflected in PBM-related clinical decision-making	Information material for patients is available and the content is evidence-based, easy to understand and available; consultation appointments with PBM staff are available	n.a.
Standard 12: Continuous efforts are made to improve community/public understanding of blood health	Continuous external communication of PBM-relevant topics	n.a.
Outcomes reporting		
Standard 13: Function and quality of PBM practice are continuously and regularly evaluated, internally reported and benchmarked	PBM is part of the management review or of performance reports per facility, department and clinician	PBM key indicators are part of the performance report per facility department, and clinician
1. PBM-related quality improvement and patient safety	System to collect and report PBM-related quality and patient safety data is available	Indicators for quality improvement and patient safety with PBM are established
2. PBM-related patient-level outcome data	System to collect and report PBM-related patient-level outcome data is available	Patient-level outcome data are reported per facility, department and clinician
Standard 14: Relevant data/selected indicators are shared with government, regulatory and quality control entities	The relevant data/selected indicators are used for benchmarking	Periodic benchmarking reports are available
Standard 15: Regular auditing processes are in place to ensure high-quality PBM and contribute to benchmarking data	Internal and external audit systems are in place to evaluate PBM and ensure continuous improvement	Hours of PBM-related audits per year
Research and development		
Standard 16: Projects related to PBM activity/ development are fostered and published	Resources for PBM projects are available	Number of research and development projects related to PBM per year

Table 7. A set of PBM standards and the respective qualitative and/or quantitative indicators as an example of a comprehensive evaluation of PBM structure, processes and outcomes

Fig. 7. Phase C of the 8-model – Rolling out patient blood management on a national/jurisdictional scale



THE PATHWAY FOR NATIONAL/JURISDICTIONAL PBM IMPLEMENTATION

C Phase C
Rolling out PBM on a national/jurisdictional scale

Phase C of the Guidance is a "how-to" manual for the responsible authorities within the public health sector explaining what decisions and steps must be taken to fully roll out the national/jurisdictional PBM implementation.

Summary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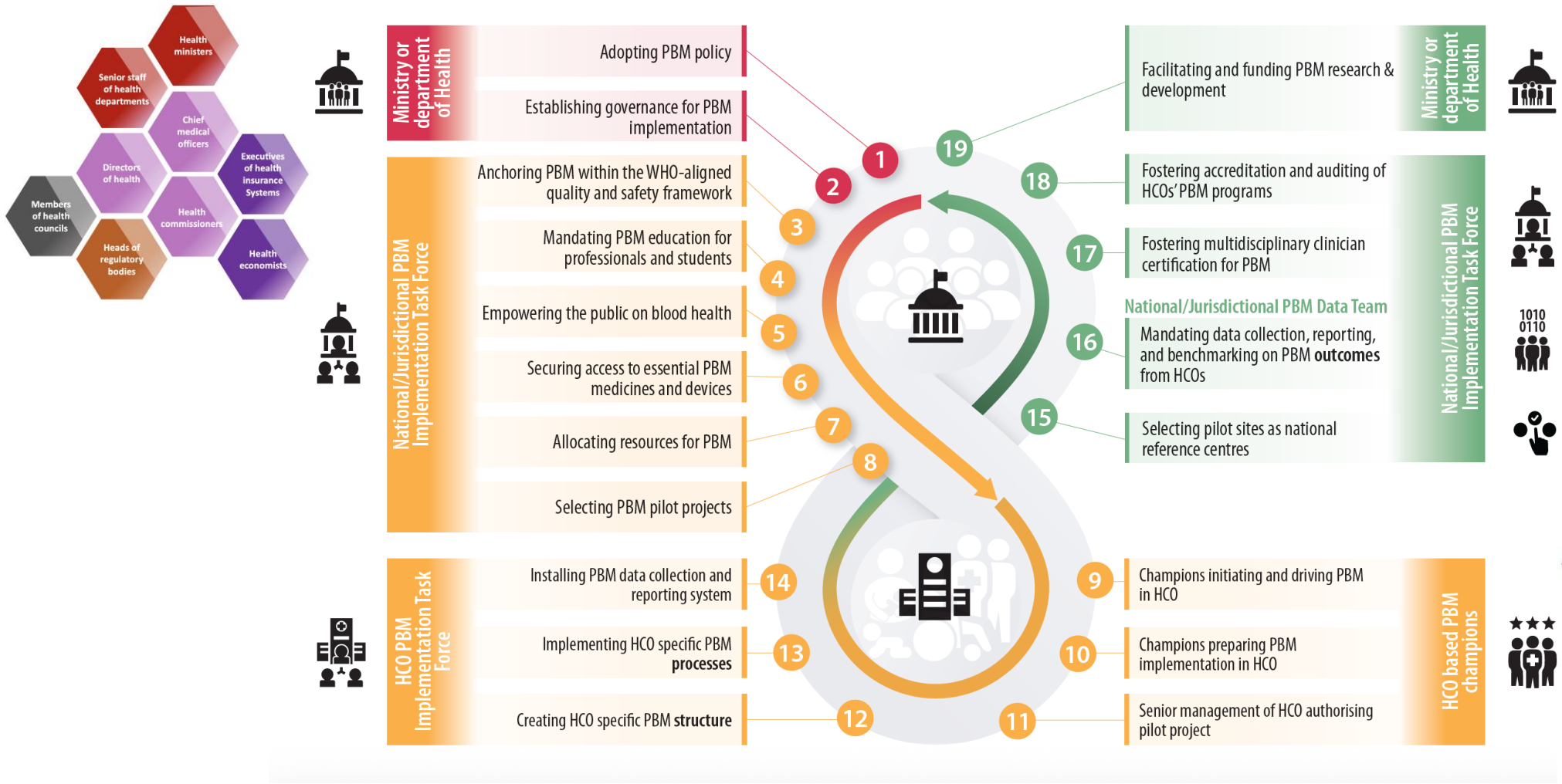
Health ministers
Senior staff of health departments
Chief medical officers
Directors of health
Executives of health insurance Systems
Members of health councils
Health commissioners
Heads of regulatory bodies
Health economists
Ministry or department of Health
Adopting PBM policy
Establishing governance for PBM implementation
National/Jurisdictional PBM Implementation Task Force
Anchoring PBM within the WHO-aligned quality and safety framework
Mandating PBM education for professionals and students
Empowering the public on blood health
Securing access to essential PBM medicines and devices
Allocating resources for PBM
Selecting PBM pilot projects
HCO PBM Implementation Task Force
Installing PBM data collection and reporting system
Implementing HCO specific PBM processes
Creating HCO specific PBM structure
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Facilitating and funding PBM research & development
Ministry or department of Health
Fostering accreditation and auditing of HCOs' PBM programs
Fostering multidisciplinary clinician certification for PBM
National/Jurisdictional PBM Data Team
Mandating data collection, reporting, and benchmarking on PBM outcomes from HCOs
Selecting pilot sites as national reference centres
National/Jurisdictional PBM Implementation Task Force
1010 0110
Champions initiating and driving PBM in HCO
Champions preparing PBM implementation in HCO
Senior management of HCO authorising pilot project
HCO based PBM champions
Quality & safety managers
Data collection benchmarking & reporting experts
Hospital administrators
Haematologists
Critical care specialists
Transplant surgeons
Nurses
Oncologists
Neonatologists Paediatricians
General practitioners
Cardiac surgeons
Cardiologists
Women's health specialists
Nephrologists
Non-cardiac surgeons
Anaesthesiologists
Patient representatives
Gastro-enterologists
Ethicists
Medicolegal experts
Perfusionists
Nutritionists
Transfusion medicine specialists
Clinical pharmacists
Laboratory medicine specialists

Foreword

In a continuing effort to reduce the massive global burden of iron deficiency and anaemia, blood loss and coagulopathy with bleeding, the World Health Organization has developed this practical guidance on how to implement patient blood management (PBM). PBM is a concept to address these challenges by comprehensively managing and preserving the patient's own blood.

This document is the result of extensive collaboration among multiprofessional and multidisciplinary international experts dedicated to improving patient outcomes, patient safety and quality of care. Public health experts, chief medical officers, physicians, nurses, pharmacists, hospital adminstrators, implementation experts, medico-legal experts, quality managers, blood bank managers, information technology and clinical data management experts, and patient advocates have all contributed to this document.

Incorporating expertise from peers working in countries where health care faces extreme resource constraints, attention is paid to how PBM processes and structures can be embedded in the system. The aim is to reduce maternal mortality

With this implementation guidance, PBM should now become part of the public health agenda for all Member States, ensuring that hundreds of millions of individuals can benefit from this detailed, yet practical approach to improving their blood health status. This initiative is also central to tackling health care inequities by reducing the overall burden of disease and of costly transfusion dependency, which allows the reallocation of limited funds to where they are most needed.

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Dr Yukiko Nakatani
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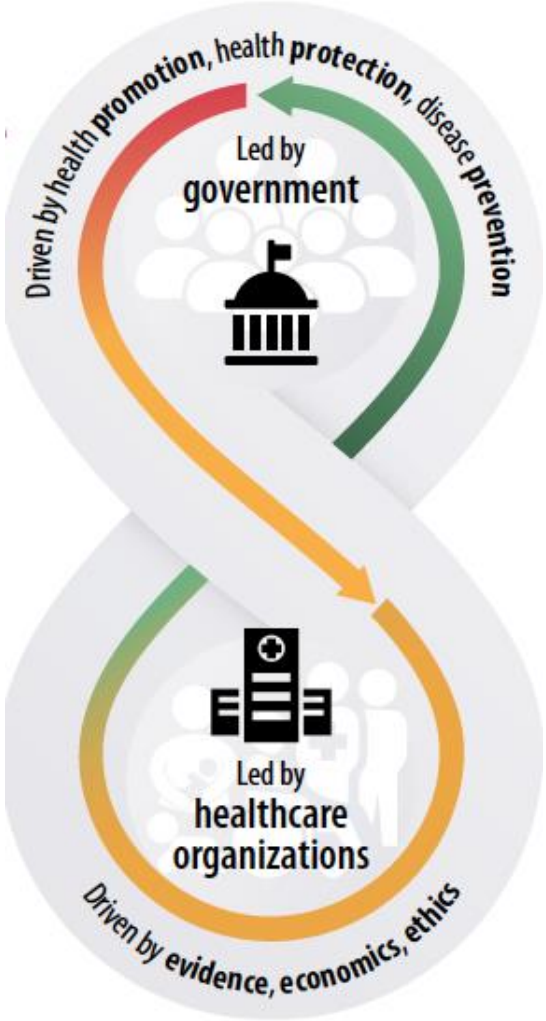
World Health Organization



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