Bank. Civilian/Community Walking Blood Banks

Research Team: Priyansh Nathani, Sidra Inam, Marisa DelSignore, Saksham Gupta
Radcliffe Delegates: Dr. Gilchrist Lokoel, Dr. Joy Mammen, Ms. Caroline Wesonga, Dr. Linda Barnes, Dr. Andre Cap

OVERVIEW

Walking blood banks (WBBs) are a subsistence method to provide blood transfusion capabilities to areas without blood banks. They rely on obtaining blood from a person at the time the patient needs a transfusion. In the most advanced form, a WBB includes a community of pre-screened, cataloged potential donors who are called upon to provide a blood transfusion to a matched recipient in need of blood. Versions of this WBB process have been used for decades in austere environments like the military, and have also been employed in natural disasters, mass shootings and settings with extremely low blood availability or with no blood banks in vicinity [(Garcia Hejl et al. 2015; Martinaud et al. 2021)]. For example, during the COVID-19 pandemic, the downtrend in blood collection led to shortages, leading to the use of WBB as back-ups for transfusion needs (Ngo et al. 2020; Stanworth et al. 2020) .

Walking blood banks bring their own logistical and medical challenges, including the need for a platform to activate WBB donors, accurate rapid diagnostic testing (RDT), and safe management of immediately procured blood. There are variations in the structure and implementation of WBBs, but all utilize some pool of potential donors (e.g. healthcare workers, community members, soldiers) to provide rapid transfusion when banked and tested blood is unavailable (Raykar et al. 2021). Notably, WBBs are not designed to supplant traditional blood banking systems, but instead serve as a system-level contingency strategy to ensure availability of safe blood products during periods of blood shortages or in the absence of a blood bank.

Through a WBB, blood is typically transfused as warm fresh whole blood (WFWB), which is recognized as an effective treatment for hemorrhagic shock and coagulopathy, or separated into components as needed and if capacity exists (Holcomb et al. 2021; Gurney et al. 2022; Katsura et al. 2020)cite]. There is growing evidence for the benefits of using WFWB in hemorrhagic shock, which include improved survival in hemorrhagic shock and not specifically the focus of this manuscript.

There are some concerns around the implementation of a WBB, related to the use of RDTs for transfusion transmissible infection (TTI) screening of blood units. These concerns are heightened when the prevalence of TTI is a concern and RDT test sensitivity, as well as the logistics of RDT usage such as supply and hemovigilance.

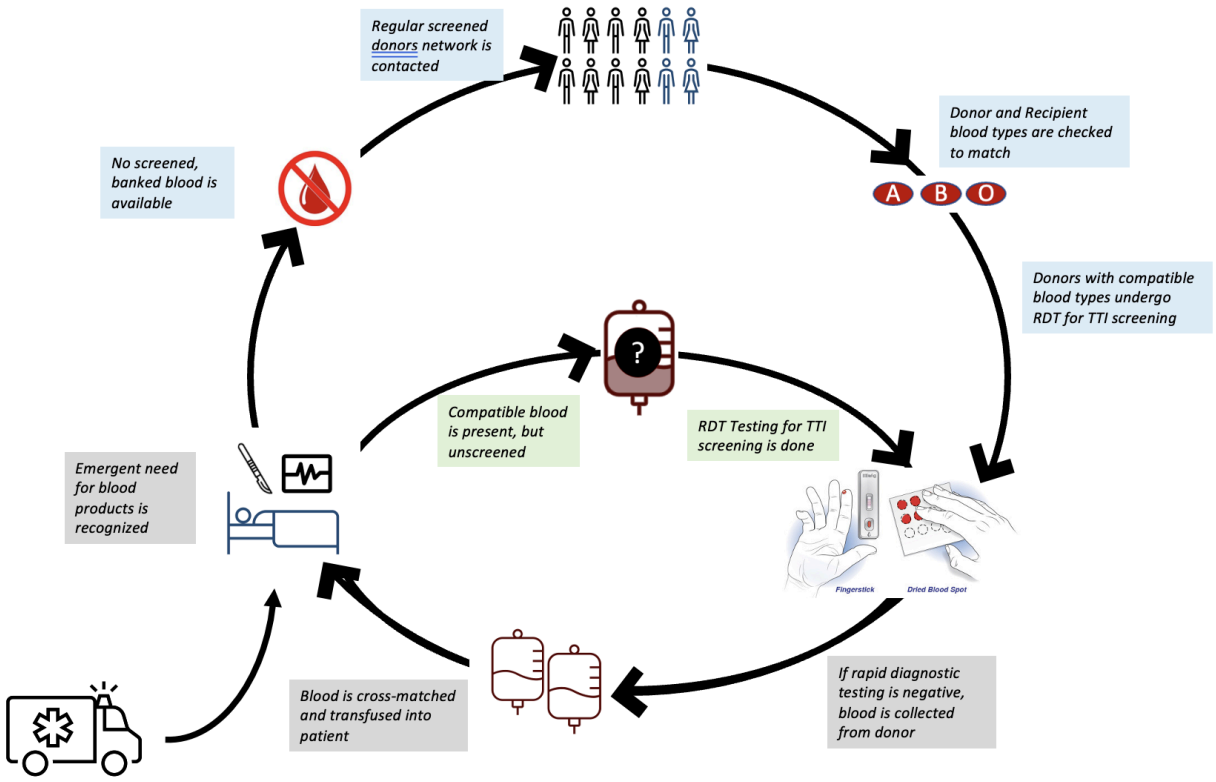

Figure 1. Depiction of a Civilian Walking Blood Bank. Patient arrives at the ED with an emergent need for blood products. In Setting A (green), there is compatible blood present in the blood bank, but it is awaiting screening results. Given the immediate need for blood, the unit is screened with an RDT for TTIs, before being cross-matched and transfused into the patient. In Setting B (blue), there is no compatible banked, screened blood available. A network of compatible, healthy, regular donors is contacted. The available donor is checked for blood type compatibility and screened for TTI with an RDT before blood is collected. This blood is then cross-matched and transfused to the recipient.

CURRENT STATE

WBB programmes have been implemented in multiple countries, and the following section provides an overview of different implementation strategies **(Table 1)**. These cases were identified through a combination of literature review and interviews with local experts.

United States

Since the 1910s, the United States has implemented a military WBB, evolving into a standardized program over the years. The most updated version, in use since the early 2000s, soldiers are recruited to be donors and are screened prior to deployment for TTIs (HIV-1 NAT, HBV NAT, HCV NAT, anti-HIV1/2, anti-Hbc, HbsAg, anti-HCV, Zika NAT, babesia NAT, syphilis, anti-HTLV1/2, anti-T.cruzi and anti-A/anti-B for type O donors) every year (cite). The senior medical officer in the unit makes the decision to activate the WBB based on the existing supply of FDA licensed blood products. Type-specific donors are preferred, or low-titer Type O blood donors, who are screened regularly for the presence of antibodies. Compatibility is confirmed by Eldon card or saline tube testing. TTI screening is done on donor and recipient before transfusion using RDT. Donors and recipient blood samples are also taken for testing at a later

date; all FDA required testing is done except ABO/Rh. Blood is collected in bags and can be stored for up to one month; in the field it is used either on-site or transferred immediately to the front line. Over 10,000 units of blood WB has been collected through WBB as of 31st August 2020.
In civilian settings, an initiative started in south Texas by the South Texas Blood and Tissue Blood Center titled the Heroes in Arms project started in 2018. Donors with low-titer antibody O-positive are pre-screened for blood type and antibody count, and donate whole blood in the usual patterns. Emergency teams in south Texas stock and carry O-positive whole blood for transfusion to the site of an accident, on medical helicopters, or in the emergency room.
US-based cruise lines have also implemented WBB systems, using a volunteer-based system and rapid screening at the time of transfusion.

United Kingdom
Since the 1990s, the UK military has employed a WBB system. Enrolled donors are typed and tested every 7 months for HIV, HCV, HbsAg and syphilis, as well as allo-antibodies, Anti A and Anti B titers. In settings of emergency, donors are called and undergo point-of-care (POC) testing for cross-match, as well as RDT use for TTI screening. Blood is collected and filtered using an in-line leukodepletion filter, and can be stored for 24 hours at room temperature or for up to 28 days at 4°C. Post-transfusion haemovigilance is managed through an online reporting system managed by the Center of Defence Pathology, and all participating healthcare professionals must undergo a five-day training program (Martinaud et al. 2021).

Israel (1997):
Since 1997, Israel has had an operational military WBB that is coordinated by military surgeons. Donors are pre-screened and selected by National Blood Services phlebotomists and military surgeons. Pre-screening includes ABO, Rh typing, RBC antibody screening and TTI screening for HIV, HBV, HCV and HTLV seasonal WNV. Only low titer O blood is used. No POC testing (Compatibility testing or TTI screening) is performed during emergency transfusion. There is no haemovigilance reporting system. The program is exercised in rare incidents when special forces need to transfuse a massively bleeding patient in a remote or austere location and have no cold stored LTOWB or blood components. (Martinaud et al. 2021)

India (Raykar et al. 2021)
Up until 1998, India had utilized versions of civilian WBBs in rural settings, but regulatory changes affirmed that only licensed blood banks can collect, store, and transfuse blood from 1998 onwards. There are reports that physicians are penalized for utilizing aspects of a WBB. There is anecdotal evidence of the ongoing use of WBBs in conjunction with RDT for safety in rural settings based on clinical judgment of risk versus benefit, especially in situations where death or disability is imminent without transfusion.

There are technologies implemented to create a WBB-like process, including civilian donor mobilization technologies (Smart Blood Query in India), which leverage mobile phones to recruit donors and manage health information related to donor eligibility.(“Smart Blood Query: A Novel Mobile Phone Based Privacy-Aware Blood Donor Recruitment and Management System for Developing Regions” n.d.) The Smart Blood Query project builds on this concept and uses RapidSMS, an open source short message service (SMS) in South-East Asia to connect a database of pre-screened donors to increase blood donation during disasters and otherwise, allowing both donors and recipients to access the platform in times of crisis. (“Smart Blood Query: A Novel Mobile Phone Based Privacy-Aware Blood Donor Recruitment and Management System for Developing Regions” n.d.)

Mali
Since 2000, a civilian WBB has been operated by the Center National de Transfusion Sanguine (CNTS) in Bamako, Mali. It is activated for war-related trauma, disasters, malaria epidemics, and traffic accidents. Potential WBB donors receive regular hemoglobin level checks, but are not required to undergo regular TTI screening . Hemoglobin levels are mandatory before donation. POC testing includes cross-matching and TTI (anti-HIV, HbsAg, Anti-HCV and syphilis) Donor/recipient samples are collected for testing blood group antigens. WB can also be stored at 2-6°C for a month. 55,935 donations have been collected since 2000. There is no haemovigilance reporting system. CNTS is responsible for training to implement the WBB programme. Nurses and technicians are trained by doctors and pharmacists specialized in blood transfusion.

France
Since 2006, the France military WBB program has been administered by the French Armed Forces Health Service under the leadership of the Centre de Transfusion Sanguine des Armees. Donors undergo pre-screening for blood-typing, hemolysins, anti-erythrocytes irregular antibodies, antibodies against HIV1/2, HCV, HBc, HTLV1/2, syphilis, HBs antigen and nucleic acid testing for HIV1/2, HBV, HCV, and HEV. This screening is valid for up to 12 months. It's activated for life threatening emergencies when the blood bank is overwhelmed or lacking necessary units. Iso-type warm fresh whole blood is transfused at POC. Donor and recipient blood also undergo screening for TTI using RDTs. ((Martinaud et al. 2021)

Norway(Apelseth, Arsenovic, and Strandenes 2022)
Since 2009, Norway has had a military WBB and has also developed two civilian programs in 2015 (on oil installations) and 2017 (at Haukeland University Hospital in Bergen). The WBB programs are run by collaborative efforts of trained blood bankers and the clinical and military personnel through both the Norway Regional Health Authority and Norwegian Armed Forces, through the Blood Preparedness Project. Potential donors are pre-screened for ABO type, titer anti-A and anti-B and Virus (HIV and hepatitis) before operations. Only low titer group O blood is used for donation and compatibility is confirmed by POC test using Eldon cards. No additional POC tests are performed on the recipient. No repeat TTI tests are performed on donors at time of donation. Whole blood can be stored at 2-6°C for 35 days. The Norwegian Hemovigilance Network - Norwegian Health Directorate - is responsible for haemovigilance reporting. Norwegian Armed Forces Medical Services and the Department of Immunology and Transfusion Medicine at Haukeland University Hospital, Bergen, Norway are responsible for training of personnel involved in WBBs.(Martinaud et al. 2021) (Apelseth, Arsenovic, and Strandenes 2022)

Poland
Since 2011, the Polish Ministry of Defense has organized its military WBB. Potential donors are pre-screened for HCV, HBV, HIV and syphilis using ELISA testing. Approximately 100 units have been collected and about 70 have been transfused in combat settings. (Martinaud et al. 2021)

Canada
Since 2015, Canada has utilized a military WBB. Soldiers, identified as potential donors, are screened with laboratory testing every 3 months for blood type, syphilis, hepatitis B, hepatitis C, HIV, HTLV 1/2 and West Nile virus, and Anti-A and anti-B titers for Type O donors. The WBB is activated by senior medical professionals when blood stocks are depleted. Blood typing of donor and recipient is done using POC testing with compatibility confirmed through Eldon card

or gel card. Both recipients' and donors' blood are screened for hepatitis B, C, HIV, syphilis and malaria with rapid diagnostic testing. Blood is collected and must be transfused within 24 hours of collection. While blood samples are collected for laboratory testing at a later date, there is no haemovigilance reporting structure in place. This programme is regulated by the federal regulatory authority Health Canada. (Martinaud et al. 2021)

Czech Republic (2015):
Since 2015, a military WBB program has functioned in the Czech Republic. Potential donors are pre-screened for blood type, blood borne infections HBV, HCV, syphilis, anti-erythrocyte antibodies, titer anti-A/B IgM. When donors are called, a POC Rapid ABO test is performed but TTI screening is optional in this situation. Blood is collected and can either be transfused immediately or stored for up to 2-3 weeks. There is no known haemovigilance reporting system. (Martinaud et al. 2021)

Pakistan
Since approximately 2017, medical student volunteers have organized grassroots WBBs in areas of need. These societies include the FMU Blood Donating Society (Faisalabad), Patient Care and Welfare Society (Sargodha), Students' Patient Welfare Society (Lahore), and Ghazians Blood Donation Society (Ghazi Khan) amongst many others. Donors include community members and medical student volunteers. Donors self-report their blood type and are not pre-screened for TTIs. When a WBB is activated, the donor donates blood at their regional blood center. If the physician indicates that this is an emergent need for blood, the donor is screened for TTI (HCV, HBV, HIV and Syphilis) and malaria using an RDT. However, if the physician does not indicate emergency on the blood request form, the donor is screened using a more sensitive standard of care chemiluminescence immunoassay test, which takes longer to result. In either case, prior to transfusion, blood is cross-matched. For haemovigilance, adverse reactions are reported back to regional blood centers. Most of these WBBs still rely on local hospitals to facilitate the transfusion and storage process, and very low funding is required given these are managed by student volunteers.

Sweden
Since 2019, the Swedish armed forces have managed a Military WBB. Potential donors are pre-screened on a monthly basis for blood type, erythrocyte antibody screening, HbsAg, anti-HIV, anti-HCV, -HTLV, HBV, HCV, HIV and titer anti-A/B in blood type O donors. Blood group O donors with low titer anti-A/B are preferred. The WBB is activated by the senior medical officer only when blood component therapy is unavailable for the deployed forces. Donors are tested prior to blood collection for ABO typing with the Eldon card and for HBsAG, anti-HIV, HCV and HBc, if the tests were not performed in the last month. Blood is collected and either immediately transfused or can be stored in the fridge at 2-6°C for up to 35 days. To date, no patient has been transfused with a unit from this WBB. (Martinaud et al. 2021)

Angola
Since 2022, a remote missionary clinic in Angola has developed a civilian WBB that utilizes rapid testing with the Bloodpak's HemaPak tools for use in remote areas to supplement existing blood supply systems or create new ones where they do not exist. There have been 12 successful transfusions in 12 patients, including 10 pediatric cases of severe anemia, 1 ectopic pregnancy, and 1 kidney mass, in this clinic. Complications include 3 cases of clotting in the bag, 1 transfusion reaction, and 1 test kit reagent desiccation

HemaPak's process of donor selection, testing, and transfusion takes only 45-90 minutes. If found suitable, family members are the most frequent donors, however most clinical staff have been pre-typed and regularly donate for patients in need. The rate of use in 2022 was about twice to five times per week and fluctuated with the height of malaria season (personal communication, 24 March 2023).

Vietnam:
A civilian WBB in Hanoi, Vietnam, has been reported, where people with rare blood groups are encouraged to enroll in "Family Medical Practice Hanoi." Enrollees are called when an emergent blood transfusion is needed. Donors donate blood at local blood transfusion hospitals. Blood is screened for TTIs (cite).

Kenya
In the civilian settings, WBBs have been used in rural Kenya given severe shortages of banked and screened blood. These are often coordinated by nonphysician blood bank staff, who maintain a ledger of potential donors who regularly undergo laboratory testing for TTIs. When a physician activates the WBB process, blood bank staff coordinate the identification, testing (with RDTs), and cross-match of a potential donor-recipient pair. The legal implications of this practice are unclear, as the current regulations require that blood is tested by the national blood transfusion service.

Afghanistan
From 2010 to 2014 in Afghanistan, the French military provided medical services at a facility based in the Kabul International Airport. Blood products were stocked by the French Military Blood Institute. Due to constraints in blood supply, fresh whole blood was transfused in mass casualty situations, massive transfusion needs, platelet transfusion needs and severe coagulopathy. Volunteer French blood donors were recruited beforehand, or in the immediate situation depending on need. Rapid screening was performed for HIV and HCV; all donors were required to have been vaccinated for HBV. Patient as also tested for ABO and Rh blood grouping. Samples were also collected for conventional screening of HTLV, HIV, syphilis, HBV and HCV. Blood could be collected and stored at room temperature for up to 6 hours. Medical personnel underwent an e-training module. From June 2011 to October 2011, 93 blood bags were collected. (Garcia Hejl et al. 2015)

Table 1. Implementation strategies for WBBs

Inception Year	Country	WBB Type	RDT Testing	Pre-screening of Donors?
2000s	United States	Military	Yes	Yes
2000s	United States	Civilian	Yes	Yes
1900's	United Kingdom	Military	Yes	Yes
1997	Israel	Military	Yes	Yes
	India	Civilian	Yes	No
2000	Mali	Civilian	No	For Hb predonation only

2006	France	Military	Yes	Yes
2009	Norway	Joint Civilian & Military	No	Yes
2011	Poland	Military		Yes
2015	Canada	Military	Yes	Yes
2015	Czech Republic	Military	Yes	Yes
2017	Pakistan	Civilian	Yes	No
2019	Sweden	Military	No	Yes
2022	Angola	Civilian	Yes	No
	Kenya	Civilian	Yes	Yes
	Afghanistan	Military	Yes	Yes

Implementation Considerations

Community

The community is a critical stakeholder in the success of CWBB. Community perceptions of blood donation can influence donation rates and donor retention. Understanding community attitudes, beliefs, and behaviors towards blood donation is important to develop targeted interventions to increase donation rates. Effective community engagement strategies, including developing culturally appropriate messages and using community leaders as advocates, can help build trust and support for the implementation of a CWBB. Moreover, the community must be engaged to develop comprehensive consent practices for recipients, and encourage acceptance of blood products in these settings.

Donor(s)

The donor may be identified individually or from a defined pool of prospectively identified donors. The identification of TTIs within the donor is a major concern in blood transfusion. Effective recruitment and tracking of donors who have been previously screened can help reduce the risk of transfusion infections. Methods for alerting donors, such as text message reminders, donor apps or social media calls, can also improve response times in urgent cases and donor retention to support participation.

Supplies

In order to implement a sustainable WBB, multiple supplies are needed. Donor registries, and haemovigilance protocols are crucial functions for the WBB process. Platforms for contacting and coordinating with donors, such as phone or web applications, are necessary to ensure smooth communications. As WBB should act as a supplant to existing blood banking structures many of the supplies needed for blood collection and testing may be present. For donor testing, TTI testing kits, type-testing and blood sample collection supplies are needed. Further, blood bags and a blood collection kit is critical. Finally, cross-match testing and transfusion supplies are needed to ensure safe and effective supply of blood. Cold storage may be useful in certain settings, depending on the blood demand and the local capacity for blood banking.

Haemovigilance

Haemovigilance is the surveillance of adverse events associated with blood transfusion. Effective procurement of supplies, tracking of transfusion needs, and post-transfusion monitoring are essential components of haemovigilance. Tracking transfusion needs can help ensure an adequate supply of blood components and prevent wastage. Post-transfusion monitoring can help identify adverse events and inform corrective measures to improve the safety of the blood supply.

Multilevel Coordination

Multilevel coordination among all stakeholders is essential for the success of CWBB (Holcomb et al. 2021). Coordination among policymakers, hospital administrators, clinicians, nurses, and blood bank staff is critical for ensuring an effective and efficient blood transfusion system. Patient consent and community buy-in are also key components of multilevel coordination.
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Hospital Policy:

Hospital-specific policy around activation criteria is important to ensure that blood is used appropriately and efficiently. Protocols around activation criteria, such as distance from the blood bank, clinical need, and blood supply, can help ensure that blood is available when and where it is needed. Finally, the hospital must establish protocols on ethical use of this process, ensuring comprehensive consent including risks and benefits and appropriate activation/deactivation practices.

Policy:

Policy plays a critical role in shaping the blood transfusion system. Policy around testing of blood, including the use of RDTs, can help improve the safety of the blood supply. Policy about whole blood collection, including the use of apheresis and the collection of specific blood components, can help ensure an adequate and efficient blood supply. International policy, including the World Health Organization's guidelines on blood transfusion, can also provide a framework for improving the safety and effectiveness of the blood supply on a global scale.

Barriers to Implementation

Experience with civilian and military WBBs have demonstrated predictable barriers to implementation, including negative stakeholder perceptions, an unfavorable regulatory environment, lack of multisectoral coordination, insufficient capital, and technology limitations.

Stakeholder Perceptions

Stakeholder perceptions are driven by context-dependent features such as national policy, socioeconomic and cultural factors, and awareness. Attitudes and beliefs surrounding the safety and scalability of WBBs may influence buy-in among key stakeholders such as government officials, media, healthcare workers, donors, and recipients. Public perceptions surrounding blood donations can factor into individuals' willingness to donate to or receive transfusions from an active WBB. Negative press or word-of-mouth experiences surrounding blood systems can mar the community's trust in healthcare institutions. As maintenance of pre-screened donor pools in a WBB model requires frequent monitoring of TTI status among registry participants, individuals may also face unintended pressures to report a desired health status or experience stigma or retaliation from the community in response to a change in status

Legal/Regulatory Barriers

Legality represents one of the largest challenges to WBB implementation. Regulatory agencies and healthcare workers can be risk-averse and require substantive evidence to support proposed changes to health policy. Unfortunately, there is a paucity of evidence surrounding the efficacy of civilian WBBs to guide these agencies. Moreover, previous initiatives to introduce elements of the WBB model to health systems have been met with resistance to use blood that has not gone through standard screening using the local standard of care methods for testing of TTIs. Expert consensus, testimony, and advocacy are required to drive the conversation and conceptualization forward.

Multisectoral Coordination

The successful implementation of a Civilian WBB depends on multisector interoperability, which requires coordination across healthcare authorities, medical providers, laboratory technicians, regional blood banks, and community agents. This coordination involves several operational functions, such as activating or deactivating functionality with nearby functioning blood banks, activating and mobilizing donors, and conducting internal and external quality control through reporting and auditing. However, this multi-agent process can introduce challenges and variability into concerted operations. Moreover, sites must have the capacity to regularly pre-screen emergency donor panels, which can be resource-intensive.

Fundraising and Capital Investment

The setup, training, donor education campaigns and recruitment/mobilization technologies, information technology system, recurring costs of collection supplies and processing fees by lab, staffing, and quality control are all capital investments required for WBB. Many of the existing WBB have been funded through military organizations, either for field applications, or for civilian-military collaborations as done in Norway. Other examples, such as the Hemapak are privately funded. Unfortunately, there is a lack of evidence on cost-benefit analysis for these investments, or concrete examples on the best funding processes.

Technical Limitations

When considering technical barriers, there are many related to the adoption and reliance on rapid diagnostic testing for TTIs. For widespread implementation, more research is needed to identify the best practices around RDT usage, as well as the most effective tests on the market. Further, the proceduralized implementation of this process requires data management platforms for donor registries, haemovigilance, and communications and outreach to the donors.

Knowledge Gaps

Current Use

While the use of WBB in military settings is relatively well described in the literature, it is still unclear how often this process is employed in civilian settings, and in what manner it is done. This includes the circumstances of activation/deactivation, the donor pre-screening and recruitment processes, and the testing performed at time of transfusion. Such information may help build a stronger understanding of the CWBB, and the best practices around its use.

RDT Safety

There are several knowledge gaps when it comes to implementing rapid diagnostic tests (RDTs) for blood transfusion safety. Firstly, there is a need for validation of RDTs in detecting transfusion-transmissible infections (TTIs) in populations with differing prevalence. This would help determine the accuracy and effectiveness of RDTs in different contexts and inform their appropriate use. Additionally, there is a need for a risk calculus to determine low-risk individuals who may not need to be tested using RDTs, as this would help optimize their use and reduce unnecessary testing.

TTI Risk Calculator

A simulation-based model was developed to describe the risk of TTIs in civilian WBBs. Prior to this, the risk of TTIs in WBBs had not been estimated given the challenges of integrating multiple sources of uncertainty in prevalence, testing characteristics, donor screening, and seroconversion. This model accounts for these uncertainties across the transfusion process by leveraging a discrete, event-based simulation approach. In this method, a theoretical population of donors is moved through a proposed WBB donation structure from pre-screening to testing to transfusion using literature-derived estimates of TTI prevalence, testing characteristics, donor screening efficacy, and seroconversion. Validation studies must be undertaken within the LMIC context to assess performance of the model, and its suitability to predict risk of transfusion infection through a CWBB approach in these settings.

Context-Specific Best Practices

Best practices for WBB development and implementation will be highly contextually dependent, and considerations should include where and when to create a WBB, how to involve multisectoral agents and community stakeholders, the role of the nearest hospital in the WBB, the utility of RDT in the population, and the funding source for the WBB. Prior to an attempt at a new WBB, there should be a thorough review of WBBs implemented in similar contexts and an on-the-ground needs assessment.

Way Forward

While there is a rich array of military WBB models, there are few civilian WBB models that have been carefully described and actively studied. This makes for a void of information about when and how civilian WBB are being deployed and how policies should be structured to safely integrate them. Further, the degree of blood shortages and the morbidity/mortality that causes is often poorly characterized and should be quantified to justify the creation of a civilian WBB in any context.

Research & Implementation

This involves conducting rigorous research and testing to inform the development and implementation of CWBB strategies. It includes RDT (Rapid Diagnostic Test) testing, TTI (Transfusion Transmissible Infections) risk modeling, hemovigilance strategies, and perceptions research to understand stakeholder perspectives, identify possible barriers and facilitators, and engage the community using best-practices. Pilot studies, needs assessments, and process modeling of different CWBB strategies are also crucial for effective implementation. Additionally, quantifying time-to-transfusion in CWBB and post-implementation optimization studies can help refine and improve the CWBB process. Cost-effectiveness studies are also essential to assess the feasibility of CWBB implementation.

Recommendations for Research & Implementation

1. Characterize the current landscape of civilian WBB that may not be published in the literature.
2. Conduct thorough research and implementation of RDT testing to improve diagnostic accuracy and speed.
3. Implement TTI risk modeling as a proactive measure to reduce the risk of transfusion-transmitted infections.
4. Develop and implement hemovigilance strategies to enhance the safety and quality of blood transfusions.
5. Conduct perception surveys to understand the perceptions of stakeholders towards blood transfusions.
6. Engage with stakeholders to understand their perspectives and identify potential barriers and facilitators for the implementation of new strategies.
7. Follow community engagement best practices to involve the community in the implementation process and increase their understanding of blood transfusions.
8. Conduct needs assessments to determine the specific needs of the target population and tailor interventions accordingly.
9. Conduct pilot studies to test the feasibility and effectiveness of different CWBB strategies before scaling up.
10. Develop process models for different CWBB strategies to enhance the efficiency and quality of blood transfusion processes.
11. Quantify the time-to-transfusion in CWBB to identify opportunities for improvement.
12. Conduct post-implementation optimization to continuously monitor and improve the implementation of CWBB strategies.
13. Conduct cost-effectiveness studies to determine the economic impact of different CWBB strategies.

<u>Policy & Advocacy</u>

Identifying key stakeholders, including government and clinical professionals, to gain buy-in is crucial for successful CWBB implementation. It is also important to ensure a safe professional clinical environment for providers and minimal legal exposure. Advocacy efforts may include lobbying policymakers and creating awareness about the benefits of CWBB. By engaging in policy and advocacy efforts, CWBB can be integrated into national health systems and sustainable funding models established.

Recommendations for Advocacy and Policy

1. Identify key stakeholders to garner government and clinical buy-in for blood transfusion policies.
2. Ensure that policies and regulations are in place to create a safe and legally compliant environment for providers.
3. Minimize legal exposure and create a safe professional clinical environment for providers.

Recommendation Matrix

	Academic Institutions	Private Industry	Regional and National Governments	Civil Society	
Research					
Implementation					
Policy					

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